Main Spindle Bearings

9. Angular Contact Ball Bearings for Radial Loads CONTENTS

9. Angular Contact Ball Bearings for Radial Loads

Angular contact ball bearings for radial loads used in machine tools are bearings which inner and outer rings cannot be separated. This series of bearing includes 78, 79U, 70U, 72, HSE9, HSE0, BNS9, BNS0, BNT9, BNT0 and BNT2 types. For angular contact ball bearings, an imaginary straight line connecting the contact points between the balls and inner and outer rings forms an angle with the radial axis. The optimal contact angle can be selected to meet functional requirements such as high speed or high rigidity. The available contact angles are 15° (contact angle symbol "C"), 20° (no symbol), 25° ("AD"), and 30° (no symbol) (see **Fig. 9.1**).

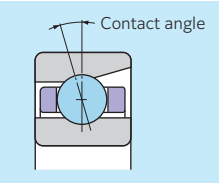

Fig. 9.1 Contact angle

9.1 Types and features

Open bearings

■ **Standard angular contact ball bearings (78, 79, 70 and 72 Types)**

Standard angular contact ball bearings are available in four types: 78, 79, 70 and 72. Types 79 and 70 include the 79U and 70U ULTAGE series, which accommodate high speed and low temperature rise with optimized specifications of the internal design. For these types, three contact angles are available: 15° (contact angle symbol "C"), 25° ("AD"), and 30° (no symbol). The contact angle of 25°, however, is also available with 79U and 70U types. This bearing series has an accuracy of JIS Class 5 or better. The features include high speed, high rigidity, and high load capacity. Some models incorporate ceramic balls.

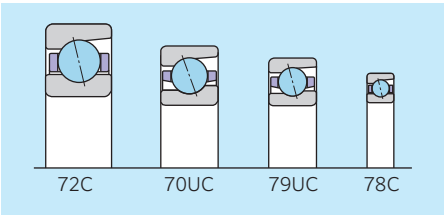

Fig. 9.2 Standard angular contact ball bearings

■ **High speed angular contact ball bearings (HSE type)**

High speed angular contact bearings are available in two types: HSE9 and HSE0. The boundary dimensions of this bearing series are determined according to the JIS dimension series (9, 0), and three types of contact angles are available: 15° (contact angle symbol "C"), 20° (no symbol), and 25° ("D"). The accuracy of this ball bearing series is JIS Class 5 or better, and the ball diameter is smaller than that of the standard angular contact ball bearing in order to accommodate high speeds. The outer surface of the inner ring and the bore of the outer ring are relieved on one side, and this bearing series employs an air-oil lubrication system to ensure smooth oil flow. In addition, it employs special materials, and its surface is modified to protect the bearing from wear and seizure more positively. The HSE type bearing is available with either steel balls or ceramic balls.

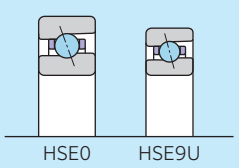

Fig. 9.3 High speed angular contact ball bearings

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■ **Ultra high speed angular contact ball bearings with ceramic balls (HSF type)**

The HSF0 type ultra high speed angular contact ceramic ball bearing employs smaller balls than the HSE0C type to ensure rigidity and prevent temperature rise. In addition, it employs a contact angle of 25° to accommodate the reduction in contact angle caused by centrifugal force during operation.

These characteristics with air-oil lubrication support bearings with a $d_m n$ value ≤ 2.6×10^6.

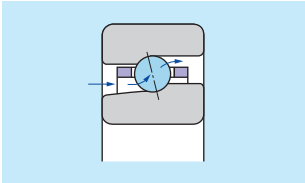

Fig. 9.4 Ultra high speed angular contact ball bearings

■ **Eco-friendly air-oil lubricated angular contact ball bearings (HSL and HSFL types)**

For eco-friendly air-oil lubricated angular contact ball bearings (HSL and HSFL types), the angle of the inner ring outer surface (counterbore area) is optimized compared with that of HSE and HSF types. In addition, these angular contact ball bearings are dedicated to air-oil lubrication by adopting a circumferential groove and an eco-friendly nozzle. They accommodate the same high speed as HSE and HSF types while being more eco-friendly. They generate less noise and conserve energy since they consume less air and oil. The accuracies of these bearing types are JIS Class 5 or better. For the HSL type, two contact angles 20° (no symbol), and 25° ("AD") are available. For the HSFL type, contact angle 25° ("AD") is available. The HSFL type utilizes a specially designed eco-friendly nozzle.

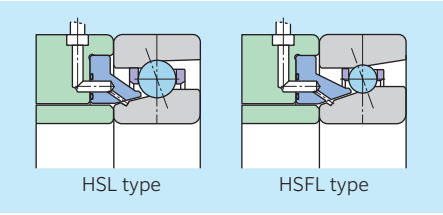

Fig. 9.5 Eco-friendly angular contact ball bearings

■ **Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (HSEW type)**

HSEW type is designed based on HSE type as high speed angular contact ball bearing for air-oil lubrication with lubrication hole on outer ring.

Spacers next to these bearings don't need length for nozzle to be mounted, and can be short. These short spacers have an effect on compact design and rigidity of spindle as a result of shortened distance between bearing and tool.

In addition, direct air-oil supply through the hole on outer ring achieves improved lubricating reliability with low air flow rate and small oil consumption.

JIS Class 5 or higher bearing accuracy is applied on this type. Two kind of contact angles are available, 20° (no symbol) and 25° ("AD").

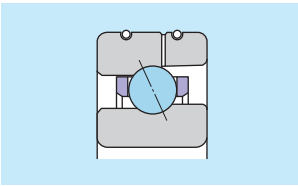

Fig. 9.6 Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring

■ High speed angular contact ball bearings for grinding machines/motors (BNT type)

The boundary dimensions of high speed angular contact ball bearings for grinding machines/motors (BNT type) are determined according to the JIS dimension series (9, 0, 2). For this bearing type, only one contact angle (15°, no symbol) is available, and the bearing accuracies are JIS Class 5 or better. This bearing uses mainly air-oil lubrication and oil mist lubrication. The features of this bearing are high speed capability and high load capacity. This type of bearing is available with either steel balls or ceramic balls.

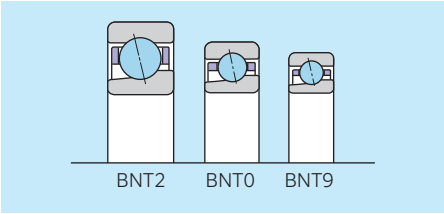

Fig. 9.7 High speed angular contact ball bearings for grinding machines/motors

Sealed bearings

■ Grease-lubricated sealed standard angular contact ball bearings (79LLB/70LLB types)

The grease-lubricated sealed standard angular contact ball bearings are available in 79 and 70 series. Non-contact rubber seals are mounted on both sides and special grease is used. As a result, these bearings accommodate high speed, offer prolonged service life, and help to maintain a comfortable working environment. These bearings are available in contact angles of 15° (contact angle symbol "CD") and 25° ("AD") and with a special accuracy of P42 (JIS Class 4 dimensional accuracy and JIS Class 2 running accuracy). Since they are prefilled with grease, these bearings require no cleaning before use and are therefore easy to handle. They are available with either steel balls or ceramic balls.

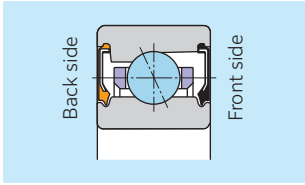

Fig. 9.8 Grease-lubricated sealed standard angular contact ball bearings

■ Grease-lubricated sealed high speed angular contact ball bearings (BNS LLB type)

Grease-lubricated sealed high speed angular contact ball bearings (BNS LLB type) are available with the boundary dimensions of HSE type. Non-contact rubber seals are incorporated on both sides and its inner structure is optimized. It is also prefilled with a special grease to achieve high speed capability, inhibit temperature rise, extend service life and create a comfortable working environment. This bearing type is available in contact angles of 15° (contact angle symbol "CD"), 20° (no symbol), and 25° ("AD"). Bearing accuracy is JIS Class 4 or better. The bearing ring is made of a special material, and the surface is modified to protect the bearing from wear and seizure. Since this type is prefilled with grease, it requires no cleaning before use and is therefore easy to handle. It is available with either steel balls or ceramic balls.

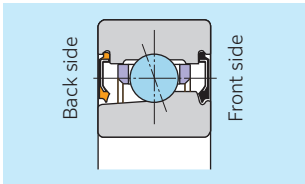

Fig. 9.9 Grease-lubricated sealed high speed angular contact ball bearings

Angular Contact Ball Bearings for Radial Loads NTN

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9.2 Standard cage types

Table 9.1 Standard cage of angular contact ball bearings for radial loads

Bearing type	Polyamide resin cage	Machined phenol resin cage	Machined high tensile brass cage
78C	—	7805C to 7824C	7826C to 7834C
79U (15°, 25°, 30°), 79C	7900U to 7926U	—	7928C to 7934C
70U (15°, 25°, 30°), 70C	7000U to 7028U	—	7030C to 7040C
72C	7200C to 7220C	7221C to 7228C	—
HSE9U (15°, 20°, 25°)	—	HSE910U to HSE934U	—
HSE0 (15°, 20°, 25°)	—	HSE010 to HSE034	—
HSF0	—	HSF010 to HSF020	—
HSL9U (20°, 25°)	—	HSL910U to HSL926U	—
HSL0 (20°, 25°)	—	HSL010 to HSL026	—
HSFL0	—	HSFL010 to HSFL020	—
HSEW9U (20°, 25°)	—	HSEW910U to HSEW920U	—
HSEW0 (20°, 25°)	—	HSEW010 to HSEW020	—
79 LLB (15°, 25°)	7900 LLB to 7910 LLB	—	—
70 LLB (15°, 25°)	7000 LLB to 7010 LLB	—	—
BNS9 LLB (15°, 20°, 25°)	—	BNS910 LLB to BNS920 LLB	—
BNS0 LLB (15°, 20°, 25°)	—	BNS010 LLB to BNS020 LLB	—
BNT9	—	BNT900 to BNT913	—
BNT0	—	BNT000 to BNT014	—
BNT2	—	BNT200 to BNT216	—

Note 1) Cage design is subject to change without notice. For detailed information, contact **NTN** Engineering.
2) The polyamide resin cage can be used up to the following rotating speeds depending on the material of the rolling element. The $d_m n$ value 0.9×10^6 for bearing steel and $d_m n$ value 1.0×10^6 for ceramics. Machined phenol resin cages must be used if the allowable speed listed in the dimension tables exceeds the figures above. For detailed information, contact **NTN** Engineering.

9.3 Bearing designations

78, 79, 70 and 72 types

5S- 7 0 20 U C T1 DB /GL P4

- **Precision class**
  P5: JIS Class 5, P4: JIS Class 4, P2: JIS Class 2
- **Internal clearance code**
  GL: Light preload, GN: Normal preload, GM: Medium preload,
  Gxx: Special preload, CSxx: Special clearance
- **Matching code**
  DB: Back-to-back (double-row)
  DT: Tandem (double-row)
  DTBT: Tandem back-to-back (quad-row)
  G: Flush ground (single-row)
- **Cage code**
  T1: Machined phenol resin cage
  L1: Machined high tensile brass cage
  No code: Standard cage
- **Contact angle code**
  C: 15°, AD: 25°, No symbol: 30°
- **Bearing series (ULTAGE series)**
- **Bore diameter code (See dimension table)**
- **Dimension series code**
- **Bearing type**
- **Material code**
  5S: Ceramic rolling elements
  No code: Steel rolling elements

HSE type

5S- 2LA-HSE 0 20 AD T2 DB /GL P4

- **Cage code**
  T2: Polyamide resin cage
  No code: Machined phenol resin cage
- **Contact angle code**
  C: 15°, AD: 25°, No symbol: 20°
- **Bore diameter code (See dimension table)**
- **Dimension series code**
- **Bearing type**
- **2LA: Special material with improved surface treatment**

HSL type

5S- 2LA-HSL 0 20 DB +xx Dn /GL P4 +TKZ

- **Spacer code**
  (Located beside bearings)
- **Spacer code**
  (Located between bearings)
- **Spacer width dimension**
- **Bearing type**

(notes) HSL: Bearing series code
xxDn, +TKZ: Spacer with Eco- friendly nozzle

HSEW type

5S- 2LA-HSEW 0 20 DB /GL P4

- **Bearing type**

79LLB/ 70LLB types

5S- 7006 CD LLB DB /GL P42 /L749

- **Accuracy class**
  P42: Dimensional accuracy = JIS Class 4,
  running accuracy = JIS Class 2
- **Contact angle code**
  CD: 15°
  AD: 25°

BNS LLB type

5S- 2LA-BNS 0 20 LLB DB /GL P4 /L749

- **Grease code**
  /L448: Special grease (MP-1)
  /L749: Special grease (SE-1)
- **Seal code**
  LLB: Non-contact rubber seal on both sides
- **Bearing type**

BNT type

5S- BNT 0 00 /GN P2

- **Bore diameter code (See dimension table)**
- **Dimension series code**
- **Bearing type**

9.4 Bearing accuracy

Table 9.2 Inner rings

Unit: μm

Nominal bore diameter d mm over	incl.	Deviation of mean bore diameter in a single plane Δ_{dmp} Class 5 high	low	Class 4 [1] high	low	Class 2 [1] high	low	Variation of bore diameter in a single plane V_{dsp} Diameter series 9 Class 5 max	Class 4 max	Class 2 max	Diameter series 0, 2 Class 5 max	Class 4 max	Class 2 max	Variation of mean bore diameter V_{dmp} Class 5 max	Class 4 max	Class 2 max	Radial runout of inner ring of assembled bearing K_{ia} Class 5 max	Class 4 max	Class 2 max
2.5	10	0	−5	0	−4	0	−2.5	5	4	2.5	4	3	2.5	3	2	1.5	4	2.5	1.5
10	18	0	−5	0	−4	0	−2.5	5	4	2.5	4	3	2.5	3	2	1.5	4	2.5	1.5
18	30	0	−6	0	−5	0	−2.5	6	5	2.5	5	4	2.5	3	2.5	1.5	4	3	2.5
30	50	0	−8	0	−6	0	−2.5	8	6	2.5	6	5	2.5	4	3	1.5	5	4	2.5
50	80	0	−9	0	−7	0	−4	9	7	4	7	5	4	5	3.5	2	5	4	2.5
80	120	0	−10	0	−8	0	−5	10	8	5	8	6	5	5	4	2.5	6	5	2.5
120	150	0	−13	0	−10	0	−7	13	10	7	10	8	7	7	5	3.5	8	6	2.5
150	180	0	−13	0	−10	0	−7	13	10	7	10	8	7	7	5	3.5	8	6	5
180	250	0	−15	0	−12	0	−8	15	12	8	12	9	8	8	6	4	10	8	5

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane. However, the dimensional difference is applied to diameter series 0 and 2 for Class 4, and also to all the diameter series for Class 2.

Unit: μm

Perpendicularity of inner ring face with respect to the bore S_d Class 5 max	Class 4 max	Class 2 max	Axial runout of inner ring of assembled bearing S_{ia} Class 5 max	Class 4 max	Class 2 max	Deviation of a single inner ring width Δ_{Bs} Single bearing Class 5 high	Class 4 high	Class 2 low	Duplex bearing [2] Class 5 high	Class 4 low	Variation of inner ring width V_{Bs} Class 5 max	Class 4 max	Class 2 max
7	3	1.5	7	3	1.5	0	−40		0	−250	5	2.5	1.5
7	3	1.5	7	3	1.5	0	−80		0	−250	5	2.5	1.5
8	4	1.5	8	4	2.5	0	−120		0	−250	5	2.5	1.5
8	4	1.5	8	4	2.5	0	−120		0	−250	5	3	1.5
8	5	1.5	8	5	2.5	0	−150		0	−250	6	4	1.5
9	5	2.5	9	5	2.5	0	−200		0	−380	7	4	2.5
10	6	2.5	10	7	2.5	0	−250		0	−380	8	5	2.5
10	6	4	10	7	5	0	−250		0	−380	8	5	4
11	7	5	13	8	5	0	−300		0	−500	10	6	5

2) Applies to individual raceway rings manufactured for combined bearing use.

Table 9.3 Outer rings

Unit: μm

Nominal outside diameter D mm over	incl.	Deviation of mean outside diameter in a single plane Δ_{Dmp} Class 5 high	low	Class 4 [3] high	low	Class 2 [3] high	low	Variation of outside diameter in a single plane V_{Dsp} Diameter series 9 Class 5 max	Class 4 max	Class 2 max	Diameter series 0, 2 Class 5 max	Class 4 max	Class 2 max	Variation of mean outside diameter V_{Dmp} Class 5 max	Class 4 max	Class 2 max	Radial runout of outer ring of assembled bearing K_{ea} Class 5 max	Class 4 max	Class 2 max
18	30	0	−6	0	−5	0	−4	6	5	4	5	4	4	3	2.5	2	6	4	2.5
30	50	0	−7	0	−6	0	−4	7	6	4	5	5	4	4	3	2	7	5	2.5
50	80	0	−9	0	−7	0	−4	9	7	4	7	5	4	5	3.5	2	8	5	4
80	120	0	−10	0	−8	0	−5	10	8	5	8	6	5	5	4	2.5	10	6	5
120	150	0	−11	0	−9	0	−5	11	9	5	8	7	5	6	5	2.5	11	7	5
150	180	0	−13	0	−10	0	−7	13	10	7	10	8	7	7	5	3.5	13	8	5
180	250	0	−15	0	−11	0	−8	15	11	8	11	8	8	8	6	4	15	10	7
250	315	0	−18	0	−13	0	−8	18	13	8	14	10	8	9	7	4	18	11	7

3) The dimensional difference Δ_{Ds} of the measured outside diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outside diameter within a plane. However, the dimensional difference is applied to diameter series 0 and 2 for Class 4, and also to all the diameter series for Class 2.

Unit: μm

Perpendicularity of outer ring outside surface with respect to the face S_D Class 5 max	Class 4 max	Class 2 max	Axial runout of outer ring of assembled bearing S_{ea} Class 5 max	Class 4 max	Class 2 max	Deviation of a single outer ring width Δ_{Cs} All classes	Variation of outer ring width V_{Cs} Class 5 max	Class 4 max	Class 2 max
8	4	1.5	8	5	2.5	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing	5	2.5	1.5
8	4	1.5	8	5	2.5		5	2.5	1.5
8	4	1.5	10	5	4		6	3	1.5
9	5	2.5	11	6	5		8	4	2.5
10	5	2.5	13	7	5		8	5	2.5
10	5	2.5	14	8	5		8	5	2.5
11	7	4	15	10	7		10	7	4
13	8	5	18	10	7		11	7	5

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Main Spindle Bearings

9.5 Internal clearance and standard preload of duplex angular contact ball bearings

The initial internal clearance or preload for duplex angular contact ball bearings is determined with consideration for two factors: temperature rise during operation and the rigidity and accuracy required after assembly or during operation.

The internal clearance of the bearing may be significantly affected during operation due to three factors: the reduction in clearance caused by fits, the temperature difference between the inner and outer rings during operation, and the effects of centrifugal force. Depending on the initial internal clearance, a significantly reduced clearance may result in extreme temperature rise, vibration, noise, and short service life. In addition, seizure may result in some cases. For this reason, it is important to determine the optimal initial internal clearance and initial preload required for operation. When using a duplex angular contact ball bearing on the main spindle of a machine tool, the preload is determined by considering the type, main spindle configuration, lubrication system, drive system, intended functions, and other factors. However, preload can also be generalized by the $d_m n$ value [(d_m: rolling element pith diameter (mm), n: speed (min^{-1})], as shown below:

$d_m n$ value $\leq 0.5 \times 10^6$
..... Normal preload (GN)
$0.5 \times 10^6 < d_m n$ value $\leq 0.65 \times 10^6$
..... Light preload (GL)
$d_m n$ value $> 0.65 \times 10^6$
..... 0 to positive clearance

For detailed information, contact **NTN** Engineering.

For duplex angular contact ball bearings, **NTN** recommends the initial radial clearances and standard preloads shown in **Table 9.4** through **Table 9.21**. Select the optimal radial internal clearance and initial preload for your application. When ordering a duplex angular contact ball bearing, please specify the desired preload and clearance. If these are not specified in the order, we will ship a bearing with standard clearance. However, some product types do not have a standard clearance. In this case, we will inform you of the available clearances.

Table 9.4 Radial internal clearance of duplex angular contact ball bearings

Unit: μm

Nominal bore diameter d (mm)		C1		C2		CN (normal)	
over	incl.	min	max	min	max	min	max
—	10	3	8	6	12	8	15
10	18	3	8	6	12	8	15
18	30	3	10	6	12	10	20
30	50	3	10	8	14	14	25
50	80	3	11	11	17	17	32
80	100	3	13	13	22	22	40
100	120	3	15	15	30	30	50
120	150	3	16	16	33	35	55
150	180	3	18	18	35	35	60
180	200	3	20	20	40	40	65

■ Standard preloads of angular contact ball bearings (DB and DF arrangements)

Table 9.5 Standard angular contact ball bearings (78C type)

Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°		
	78xxC		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
25	10	29	78
30	10	29	78
35	10	29	78
40	10	29	78
45	20	49	98
50	20	49	98
55	29	98	196
60	29	98	196
65	29	98	196
70	29	98	196
75	29	98	196
80	29	98	196
85	49	147	294
90	49	147	294
95	49	147	294
100	49	147	294
105	49	147	294
110	78	196	490
120	78	196	490
130	98	294	590
140	98	294	590
150	147	390	785
160	147	390	785
170	147	490	980

Table 9.6 Standard angular contact ball bearings (79 type)

Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°			Contact angle: 25°			Contact angle: 30°		
	79xxUC/5S-79xxUC			79xxUAD/5S-79xxUAD			79xxU/5S-79xxU		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	—	20	39	—	29	59	—	39	78
12	—	20	39	—	29	69	—	39	78
15	—	29	59	—	49	98	20	59	118
17	—	29	69	20	49	98	20	69	127
20	20	49	88	20	69	147	29	88	186
25	20	49	98	20	78	157	29	98	196
30	20	49	108	20	78	167	29	98	206
35	29	78	167	39	127	255	49	167	325
40	29	88	177	39	137	275	49	167	345
45	39	108	216	49	167	345	69	216	420
50	39	118	226	49	177	355	69	226	450
55	39	118	235	59	186	375	69	235	460
60	39	127	245	59	196	380	78	245	480
65	39	127	245	59	196	390	78	245	490
70	59	177	365	88	284	560	108	355	695
75	59	177	365	88	284	570	108	355	705
80	59	186	365	88	284	580	108	365	715
85	78	245	490	118	390	775	147	480	970
90	88	255	500	118	390	785	147	490	980
95	88	255	510	118	400	795	157	500	990
100	108	325	655	157	510	1 020	196	635	1 270
105	108	335	655	157	520	1 040	196	645	1 300
110	108	335	665	157	530	1 060	206	655	1 310
120	137	410	835	196	655	1 300	245	815	1 620
130	167	510	1 020	235	805	1 600	305	990	1 990
	79xxC								
140	196	490	980						
150	245	685	1 470						
160	245	685	1 470						
170	245	685	1 470						

Table 9.7 Standard angular contact ball bearings (70 type)

Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°			Contact angle: 25°			Contact angle: 30°		
	70xxUC/5S-70xxUC			70xxUAD/5S-70xxUAD			70xxU/5S-70xxU		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	—	29	59	20	49	108	20	69	127
12	—	39	69	20	59	108	20	69	137
15	—	39	78	20	59	127	29	78	157
17	20	49	98	20	78	157	29	98	196
20	20	69	137	29	108	216	39	137	265
25	29	78	147	39	118	235	49	147	294
30	29	98	186	49	147	305	59	186	375
35	39	118	235	59	186	380	69	235	480
40	39	127	255	59	206	400	78	255	510
45	49	147	305	69	245	480	88	305	600
50	49	157	325	78	255	510	98	325	635
55	69	216	420	98	335	665	127	420	845
60	69	216	430	108	345	685	127	430	855
65	78	226	460	108	365	725	137	450	900
70	98	294	580	137	460	920	177	580	1 150
75	98	294	600	137	470	940	177	590	1 180
80	118	365	725	177	580	1 150	216	715	1 430
85	127	375	745	177	590	1 180	226	735	1 470
90	147	440	890	206	705	1 400	265	875	1 750
95	157	460	910	216	715	1 430	275	900	1 790
100	157	460	930	226	735	1 470	284	920	1 830
105	186	550	1 090	255	865	1 720	335	1 070	2 140
110	206	630	1 250	294	990	1 980	380	1 230	2 460
120	216	635	1 270	305	1 010	2 020	380	1 260	2 510
130	265	805	1 600	380	1 270	2 530	480	1 570	3 150
140	275	815	1 640	380	1 280	2 570	490	1 610	3 200
	70xxC								
150	294	785	1 960						
160	490	980	2 450						
170	490	980	2 450						
180	490	980	2 450						
190	590	1 470	3 450						
200	590	1 470	3 450						

Table 9.8 Standard angular contact ball bearings (72C type)

Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°		
	72xxC		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	20	49	98
12	20	49	98
15	20	49	147
17	20	49	147
20	49	98	294
25	49	98	294
30	49	98	294
35	78	196	490
40	78	196	490
45	98	294	590
50	98	294	590
55	147	390	785
60	147	390	785
65	147	390	785
70	196	490	980
75	196	490	980
80	196	490	980
85	294	685	1 470
90	294	685	1 470
95	294	685	1 960
100	294	685	1 960
105	390	980	2 450
110	390	980	2 450
120	390	980	2 450
130	490	1 470	2 940

Table 9.9 High speed angular contact ball bearings (HSE9 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15° HSE9xxUC/5S-HSE9xxUC			Contact angle: 20° HSE9xxU/5S-HSE9xxU			Contact angle: 25° HSE9xxUAD/5S-HSE9xxUAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	34	88	177	39	127	255	39	177	345
55	44	108	216	49	157	345	49	216	440
60	44	118	226	49	167	345	54	226	440
65	44	118	226	49	167	345	54	226	440
70	69	167	345	74	245	490	78	345	685
75	69	177	345	74	255	490	83	345	685
80	69	177	345	74	255	540	83	345	685
85	98	235	490	98	345	685	108	490	930
90	98	245	490	108	345	735	118	490	980
95	98	255	490	108	345	735	118	490	980
100	118	294	590	127	440	835	137	590	1 180
105	118	294	590	127	440	885	137	590	1 180
110	118	294	590	127	440	885	137	590	1 180
120	157	390	785	167	540	1 080	177	785	1 570
130	186	490	930	196	685	1 370	226	930	1 860
140	186	490	930	206	685	1 370	226	930	1 860
150	255	635	1 270	275	930	1 860	294	1 270	2 550
160	255	635	1 270	275	930	1 860	294	1 270	2 550
170	255	635	1 270	275	930	1 860	294	1 270	2 550

Table 9.10 High speed angular contact ball bearings (HSE0 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15° HSE0xxC/5S-HSE0xxC			Contact angle: 20° HSE0xx/5S-HSE0xx			Contact angle: 25° HSE0xxAD/5S-HSE0xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	59	157	315	69	235	460	78	305	600
55	69	177	345	78	255	510	78	325	645
60	69	186	365	78	265	530	88	345	685
65	69	186	365	78	265	540	88	345	695
70	88	226	450	98	325	655	108	420	845
75	98	235	480	108	355	695	118	450	900
80	108	275	550	118	400	805	127	520	1 030
85	108	275	560	118	400	815	127	520	1 040
90	127	325	645	137	470	940	157	610	1 220
95	127	325	645	147	480	960	157	620	1 240
100	137	345	675	147	490	990	157	635	1 270
105	157	390	775	167	570	1 140	186	725	1 450
110	196	480	960	206	695	1 400	226	900	1 800
120	196	480	960	216	705	1 410	226	910	1 820
130	275	695	1 380	305	1 020	2 030	325	1 300	2 610
140	284	715	1 430	315	1 050	2 090	345	1 350	2 710
150	294	735	1 470	325	1 080	2 150	345	1 380	2 770
160	345	865	1 730	375	1 260	2 520	410	1 630	3 250
170	390	990	1 980	430	1 450	2 900	470	1 860	3 750

Table 9.11 Eco-friendly air-oil lubricated angular contact ball bearings (HSL9 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 20° 5S-HSL9xxU			Contact angle: 25° 5S-HSL9xxUAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	39	127	255	39	177	345
55	49	157	345	49	216	440
60	49	167	345	54	226	440
65	49	167	345	54	226	440
70	74	245	490	78	345	685
75	74	255	490	83	345	685
80	74	255	540	83	345	685
85	98	345	685	108	490	930
90	108	345	735	118	490	980
95	108	345	735	118	490	980
100	127	440	835	137	590	1 170
105	127	440	885	137	590	1 170
110	127	440	885	137	590	1 170
120	167	540	1 080	177	785	1 570
130	196	685	1 370	226	930	1 860

Table 9.12 Eco-friendly air-oil lubricated angular contact ball bearings (HSL0 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 20° 5S-HSL0xx			Contact angle: 25° 5S-HSL0xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	69	235	460	78	305	600
55	78	255	510	78	325	645
60	78	265	530	88	345	685
65	78	265	540	88	345	695
70	98	325	655	108	420	845
75	108	355	695	118	450	900
80	118	400	805	127	520	1 030
85	118	400	815	127	520	1 040
90	137	470	940	157	610	1 220
95	147	480	960	157	620	1 240
100	147	490	990	157	635	1 270
105	167	570	1 140	186	725	1 450
110	206	695	1 400	226	900	1 800
120	216	705	1 410	226	910	1 820
130	305	1 020	2 030	325	1 300	2 610

Table 9.13 Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (HSEW9U type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 20° 5S-HSEW9xxU			Contact angle: 25° 5S-HSEW9xxUAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	39	127	255	39	177	345
55	49	157	345	49	216	440
60	49	167	345	54	226	440
65	49	167	345	54	226	440
70	74	245	490	78	345	685
75	74	255	490	83	345	685
80	74	255	540	83	345	685
85	98	345	685	108	490	930
90	108	345	735	118	490	980
95	108	345	735	118	490	980
100	127	440	835	137	590	1 170

Table 9.14 Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (HSEW0 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 20°			Contact angle: 25°		
	5S-HSEW0xx			5S-HSEW0xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	69	235	460	78	305	600
55	78	255	510	78	325	645
60	78	265	530	88	345	685
65	78	265	540	88	345	695
70	98	325	655	108	420	845
75	108	355	695	118	450	900
80	118	400	805	127	520	1 030
85	118	400	815	127	520	1 040
90	137	470	940	157	610	1 220
95	147	480	960	157	620	1 240
100	147	490	990	157	635	1 270

Table 9.15 Grease-lubricated sealed standard angular contact ball bearings (79CD and AD types) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°			Contact angle: 25°		
	79xxCD/5S-79xxCD			79xxAD/5S-79xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	10	29	78	—	39	78
12	10	29	78	—	39	78
15	10	29	78	—	49	147
17	10	29	78	—	49	147
20	20	49	98	29	98	196
25	20	49	98	29	98	196
30	20	49	98	29	98	196
35	29	78	196	49	147	294
40	29	78	196	49	147	294
45	39	98	245	49	196	390
50	39	98	245	49	196	390

Table 9.16 Grease-lubricated sealed standard angular contact ball bearings (70CD and AD types) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°			Contact angle: 25°		
	70xxCD/5S-70xxCD			70xxAD/5S-70xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	20	29	98	29	78	147
12	20	29	98	29	78	147
15	20	29	98	29	78	147
17	20	29	98	29	78	147
20	29	78	147	49	147	294
25	29	78	147	49	147	294
30	29	78	147	49	147	294
35	49	147	294	78	294	590
40	49	147	294	78	294	590
45	49	147	294	78	294	590
50	49	147	294	78	294	590

Table 9.17 Grease-lubricated sealed high speed angular contact ball bearings (BNS9 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°			Contact angle: 20°			Contact angle: 25°		
	BNS9xxC/5S-BNS9xxC			BNS9xx/5S-BNS9xx			BNS9xxAD/5S-BNS9xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
50	29	78	167	39	118	235	39	157	305
55	39	108	206	49	147	305	49	196	390
60	39	108	216	49	157	315	49	196	400
65	39	108	216	49	157	315	49	206	410
70	59	137	275	59	196	400	69	255	520
75	59	137	284	59	206	410	69	265	530
80	59	147	294	59	216	420	69	275	550
85	69	177	345	78	255	510	78	325	655
90	69	177	355	78	265	520	88	335	665
95	69	186	365	78	265	540	88	345	685
100	98	255	510	108	375	755	118	480	970

Table 9.18 Grease-lubricated sealed high speed angular contact ball bearings (BNS0 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°			Contact angle: 20°			Contact angle: 25°		
	BNS0xxC/5S-BNS0xxC			BNS0xx/5S-BNS0xx			BNS0xxAD/5S-BNS0xxAD		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
45	49	118	235	49	177	345	59	226	450
50	59	157	315	69	235	460	78	305	600
55	69	177	345	78	255	510	78	325	645
60	69	186	365	78	265	530	88	345	685
65	69	186	365	78	265	540	88	345	695
70	88	226	450	98	325	655	108	420	845
75	98	235	480	108	355	695	118	450	900
80	108	275	550	118	400	805	127	520	1 030
85	108	275	560	118	400	815	127	520	1 040
90	127	325	645	137	470	940	157	610	1 220
95	127	325	645	147	480	960	157	620	1 240
100	137	345	675	147	490	990	157	635	1 270

Table 9.19 Angular contact ball bearings for grinding machines/motors (BNT9 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°		
	BNT9xx/5S-BNT9xx		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	10	29	78
12	10	29	78
15	10	29	78
17	10	29	78
20	20	49	98
25	20	49	98
30	20	49	98
35	29	78	196
40	29	78	196
45	39	98	245
50	39	98	245
55	49	118	294
60	49	118	294
65	49	118	294

Table 9.20 Angular contact ball bearings for grinding machines/motors (BNT0 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°		
	BNT0xx/5S-BNT0xx		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	20	29	98
12	20	29	98
15	20	29	98
17	20	29	98
20	29	78	147
25	29	78	147
30	29	78	147
35	49	147	294
40	49	147	294
45	49	147	294
50	49	147	294
55	98	196	490
60	98	196	490
65	98	196	490
70	98	294	685

Table 9.21 Angular contact ball bearings for grinding machines/motors (BNT2 type) Unit: N

Nominal bore diameter d (mm)	Contact angle: 15°		
	BNT2xx/5S-BNT2xx		
	Light preload (GL)	Normal preload (GN)	Medium preload (GM)
10	20	49	98
12	20	49	98
15	20	49	147
17	20	49	147
20	49	98	294
25	49	98	294
30	49	98	294
35	78	196	490
40	78	196	490
45	98	294	590
50	98	294	590
55	147	390	785
60	147	390	785
65	147	390	785
70	196	490	980
75	196	490	980
80	196	490	980

9.6 Recommended fits for angular contact ball bearings

If the $d_m n$ value is in the range of $d_m n \leq 0.75 \times 10^6$ [d_m: rolling element pith diameter (mm), n: speed (min^{-1})], the fit values shown in **Table 9.22** and **Table 9.23** are recommended to ensure high accuracies of precision bearings.

If the $d_m n$ value is in the range of $d_m n > 0.75 \times 10^6$, it is necessary to consider expansion of inner ring caused by centrifugal force. In this case, contact **NTN** Engineering for the recommended fits. As for the fit of the outer ring with the housing, consider the influence of the ambient temperature (such as heat buildup on a built-in motor or the cooling effect of jacket). For technical assistance, contact **NTN** Engineering.

Table 9.22 Shaft fits Unit: μm

Nominal bore diameter d (mm)		Fits of inner ring with shaft
Over	Incl.	
2.5	10	0–2T
10	18	0–2T
18	30	0–2T
30	50	0–3T
50	80	1T–4T
80	120	1T–5T
120	180	2T–7T
180	250	2T–8T

Notes: 1. The mean value should be the target value.
2. If the $d_m n$ value of the high speed machine is in the range of $d_m n > 0.75 \times 10^6$, it is necessary to increase the amount of interference In this case, contact **NTN** Engineering for technical assistance.
T: Tight (Interference) fit

Table 9.23 Housing fits Unit: μm

Nominal outside diameter D (mm)		Fits of outer ring with housing	
		Bearing on fixed side	Bearing on free side
Over	Incl.		
10	50	2L– 5L	6L–10L
50	80	3L– 7L	6L–12L
80	120	4L– 9L	8L–13L
120	150	5L–11L	10L–16L
150	180	6L–13L	11L–17L
180	250	7L–15L	13L–20L
250	315	8L–17L	15L–23L

Notes: 1. The mean value should be the target value.
2. If the $d_m n$ value is in the range of $d_m n > 1.0 \times 10^6$, spacer width and bearing arrangement, it is necessary to increase the amount of interference.
In this case, contact **NTN** Engineering for technical assistance.
L: Loose fit

9.7 Duplex angular contact ball bearings

Duplex angular contact ball bearings can be combined in rows of two, three or four bearings to accommodate required specifications.

The back-to-back duplex (DB) arrangement and the face-to-face duplex (DF) arrangement allow for the application of both radial loads and axial loads in both directions. The DB arrangement has a wide space between load points and can handle large moment loads. For this reason, this type of duplex arrangement is preferable for use on the main spindles of machine tools.

The DF arrangement cannot handle large moment loads, but its allowable inclination angle is greater than that of the DB arrangement. The tandem duplex (DT) arrangement can handle both a radial load and large axial load, but this bearing can take the axial load in one direction only. The 4-row duplex (type DTBT) arrangement ensures high rigidity in the radial and axial directions and accommodates high speed operation. For this reason, this type of duplex bearing is commonly used for the main spindles of machining centers.

Each duplex angular contact ball bearing is manufactured as a set to enable adjustment of the preload and clearance. For this reason, combine only duplex bearings of the same product number.

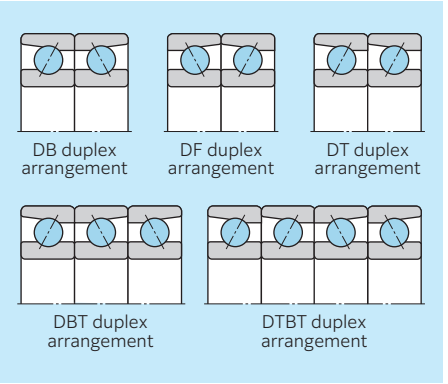


Fig. 9.10

9.8 Duplex arrangement codes of duplex angular contact ball bearings

Duplex angular contact ball bearings have a product number and duplex arrangement code on the side of the bearing (see **Fig. 9.11**). Duplex angular contact ball bearings of 3 rows or more have a "<" mark on the outside diameter surface of the bearing. Always ensure that the "<" mark is aligned when assembling them (see **Fig. 9.12**). Additionally, face-to-face duplex (DF) and back-to-back duplex (DB) angular contact ball bearings do not have the "<" mark, so use the duplex arrangement code to match them.

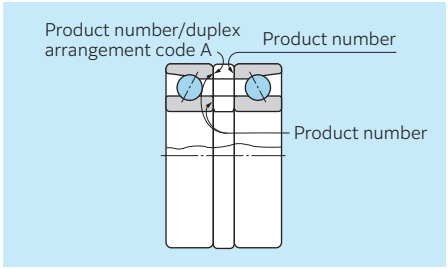


Fig. 9.11

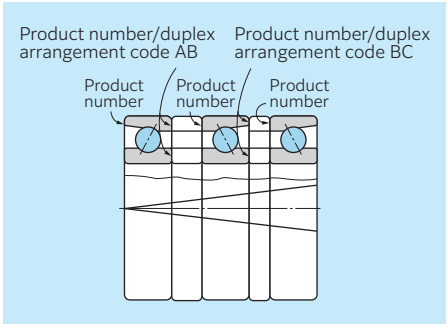


Fig. 9.12

9.9 Flush ground and universal matching

Angular contact ball bearings are often combined for a special purpose. Face-to-face duplex (DF) arrangement, back-to-back duplex (DB) arrangement and tandem duplex (DT) arrangement may be combined in rows of two or more. When combining many bearings, it is important to control the accuracies of the bearings and to align their face heights in a common plane.

■ Flush ground

"Flush ground" is a finishing technique in which the front and back faces of the inner and outer rings are aligned with each other to eliminate differences in face height (see **Fig. 9.13**). Such alignment can ensure the specified clearance and preload for DF, DB, and DT sets, but it is possible only if the combined bearings have the same clearance/preload symbols. Flush ground is provided as standard on BNT type angular contact ball bearings for grinding machines/motors as well as BST and 2A-BST type angular contact thrust ball bearings for ball screw support.

Note: The flush ground technique is also adopted for other types of angular contact ball bearings. When ordering a bearing, append "G" to the product number to specify the flush ground type.
Example: 7010UC G /GNP4

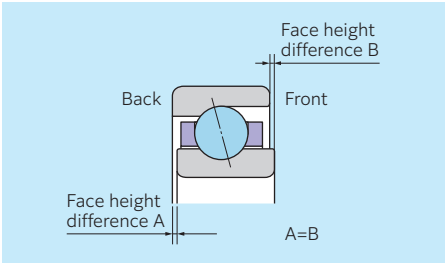


Fig. 9.13 Flush ground

■ Universal Matching

In addition to the flush ground technique, universal matching is employed for duplex angular contact ball bearings. Universal matching controls the bearing-to-bearing dimensional differences in the bore and outside diameters.

NTN can control the bearing-to-bearing difference in the bore and outside diameters to no more than one-third the tolerance (a minimum of 2 μm). Universal matching is adopted for duplex angular contact ball bearings of JIS Class 5 or better. When ordering a bearing, specify the desired number of duplex bearings to be used in combination ("D2" for DB, DF or DT; and "D3" for DBT, DFT or DTT). Alternately, indicate the basic combination and specify universal matching.

If two duplex bearings are combined, "D2" is appended to the product number.
Example: 7010UC G D2 /GNP4

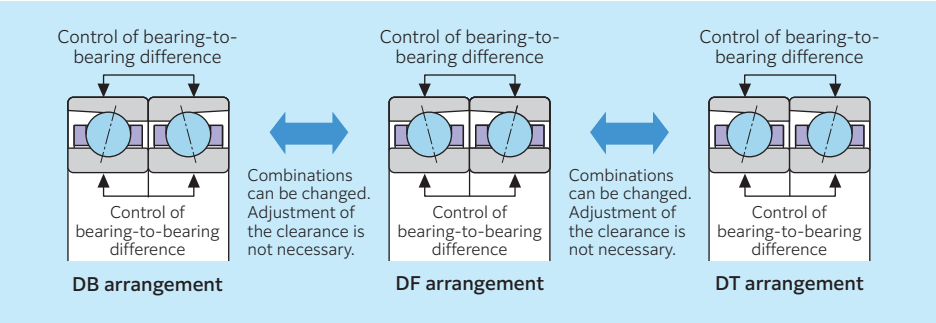


Fig. 9.14 Universal matching

9.10 Angular contact ball bearings with ceramic balls

Recently, the main spindles of machining centers, NC machines and other machine tools have been required to operate at much higher speeds. Bearings for main spindles therefore must meet the requirements of high speed and rigidity as well as accuracy. To meet such requirements, many of our customers want the rolling element made of ceramic material. The features of angular contact ball bearings with ceramic balls are described below.

■ Limited temperature rise and ultra high speeds

The specific gravity of ceramic material is one-half that of bearing steel. In addition, the ball diameter of 5S-HSE type is smaller than that of the standard 70 type. For this reason, use of ceramic balls greatly reduces the influence of centrifugal force (ball sliding and spinning caused by gyratory moment).

The linear expansion coefficient for ceramics can be as low as a 1/4 of that for bearing steel. This will reduce the increase in preload at high speeds due to a fixed position preload.

As a result, these angular contact ball bearings inhibit temperature buildup and ensure high speed.

[Test conditions]

Test bearing	2LA-HSEO16C
Speed	4 000 to 12 000 min^{-1}
Lubrication	Air-oil lubrication Airflow rate 30 NL/min Oil supply rate 0.36 mL/h

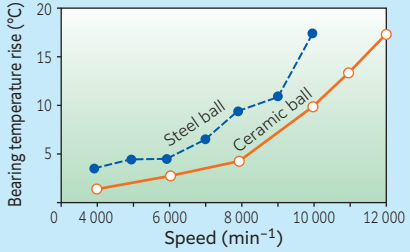


Fig. 9.15 Comparison of temperature rise between bearings with ceramic balls and those with steel balls

■ High bearing rigidity for high accuracy of manufactured products

The Young's modulus of ceramic material is approximately 1.5 times that of bearing steel, which increases bearing rigidity and can be expected to improve the precision of the workpiece.

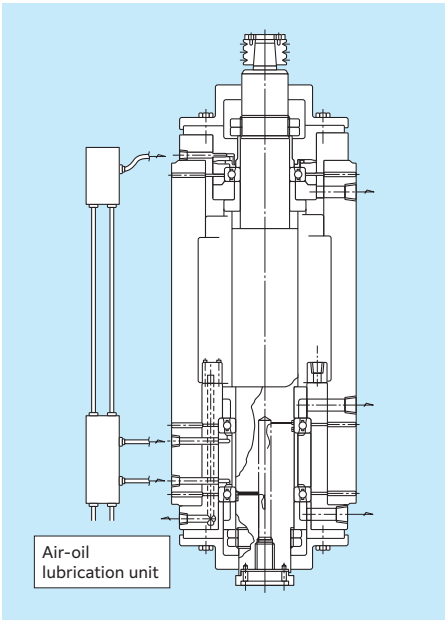


Fig. 9.16 Test rig for measuring temperature rise

Table 9.24 Comparison of physical properties between ceramic and steel balls

Item	Ceramic (Si_3N_4)	Bearing steel (SUJ2)
Density (g/cm^3)	3.24	7.83
Young's modulus (GPa)	308	208
Poisson's ratio	0.25	0.3
Linear expansion coefficient (×10^{-6}/°C)	3.0	12.5
Thermal conductivity (W/m・°C)	20	46

9.11 Operating life of bearings with ceramic balls

[Test conditions]

Test bearing	6206
Bearing load	6 860 N
Speed	2 000 min^{-1}
Lubrication	Class 1 turbine oil (ISO VG56), circulating lubrication

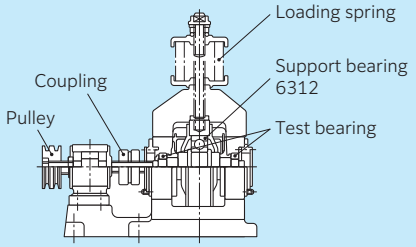


Fig. 9.17 Radial load-type bearing life test machine

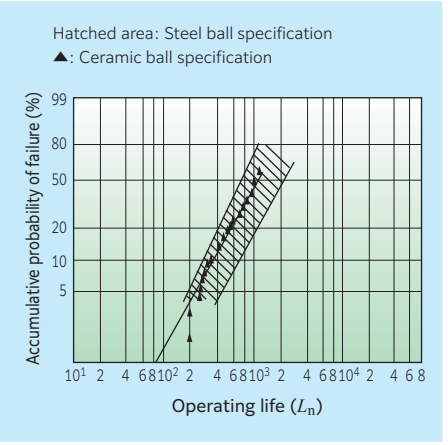


Fig. 9.18 Operating life of ball bearing with ceramic balls

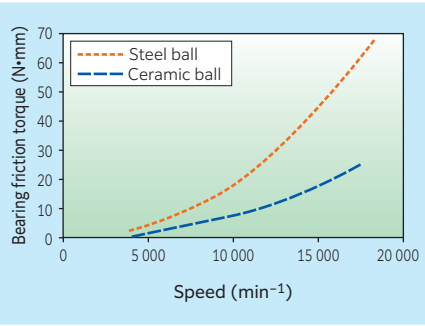


Fig. 9.19 Bearing friction torque

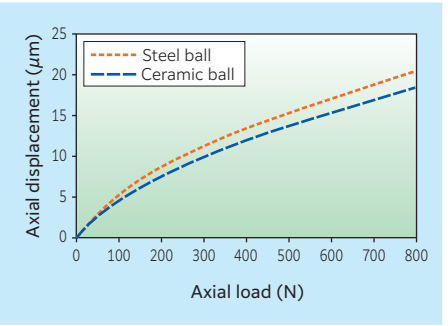


Fig. 9.20 Axial rigidity diagram

9.12 Recommended lubrication specifications

Angular contact ball bearings are usually used with grease lubrication or air-oil lubrication. Recommended lubrication specifications are described below.

■ Grease lubrication

- **Recommended brand of grease**
  Refer to 7. Lubrication of Bearings, 7.1 Grease lubrication in the Technical Data section.
- **Recommended grease fill**
  $d_m n$ value ≤ 0.65 × 10^6
  15 to 20 % of the capacity shown in the dimension tables
  $d_m n$ value > 0.65 × 10^6
  12 to 17 % of the capacity shown in the dimension tables
- **Recommended grease filling method**
  Refer to 6. Handling of Bearings, 6.1 Cleaning and filling with grease in the Technical Data section.
- **Notes**
  Grease-lubricated sealed angular contact ball bearings (79 LLB/70 LLB types, and BNS type bearings) are prefilled with long-life SE-1 grease. Wipe rust preventive oil from the outside of the bearing with a clean cloth.

■ Air-oil lubrication

- **Recommended location of nozzle**
  Refer to 7. Lubrication of Bearings, 7.2 Air-oil lubrication in the Technical Data section.
- **Recommended specifications of nozzle**
  Nozzle bore dia.: From 1 to 1.5 mm
  Number of nozzles: One nozzle per bearing, depth of nozzle bore should be four to six times as large as the bore diameter.
- **Recommended specifications of air-oil**
  Oil type: Spindle oil
  Viscosity grade: ISO VG from 22 to 32 (32 is preferable)

Table 9.25 Air and oil amount

Bearing type	$d_m n$ value (×10^6) Over	Incl.	Oil valume per shot mL	Lubrication intervals min	Oil consumption mL/h	Recommended air consumption NL/min 1)
78C, 79U, 70U, 72C	—	1.0	0.03	8	0.23	20 to 40
HSE9U, HSE0	1.0	1.5		5	0.36	
HSF	1.5	2.6		2	0.90	
HSEW	—	2.2		10	0.18	
HSL	—	2.6				
HSFL						

1) NL/min (Normal liter/minute) ··· NL means the volume of air at 0 °C and 1 atmosphere.
Note) The amount of oil and air needs to be adjusted to suit the spindle structure or the differences in discharge channels.
Set the amounts after checking with actual machine tests.

Angular Contact Ball Bearings for Radial Loads NTN

Main Spindle Bearings

9.13 ULTAGE Standard angular contact ball bearings 79U and 70U types

ULTAGE series 79U and 70U types bearings were developed from standard angular contact ball bearings (79 and 70). Optimized internal design and adoption of a new resin cage allows high speed operation and ensures high rigidity.

■ Features

1. Optimized internal design enables high speed operation and high rigidity.
2. A new resin cage enables improvement in grease retention for grease lubrication and enhanced performance in feeding and discharge of oil for air-oil lubrication.
3. Bearings are available with either steel or ceramic balls.
4. Three contact angles (15°, 20°, and 30°) are available to handle a wide range of applications.

■ Bearing specification

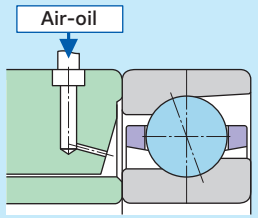


Fig. 9.21 79U and 70U types

Photo 9.1 New resin cage

■ Data

Optimized internal design and adoption of a new resin cage enable stable operation at $d_m n$ value 0.95 × 10^6, with grease lubrication.

[Test conditions]

Bearing	7010UCDB (ϕ50×ϕ80×16)
Speed	0 to 15 000 min^{-1}
Preload after assembled	200 N (fixed position preloading)
Grease lubrication	ISOFLEX NBU 15

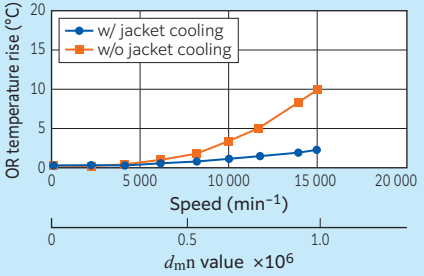


Fig. 9.22 High speed test with grease lubrication

Stable operation is possible with $d_m n$ value 1.5 × 10^6, with air-oil lubrication.

[Test conditions]

Bearing	7010UCDB (ϕ50×ϕ80×16)
Speed	0 to 23 000 min^{-1}
Preload after assembled	200 N (fixed position preloading)
Air-oil lubrication	0.03 mL/shot (oil injection intervals: 5 min, air consumption: 40 NL/min)

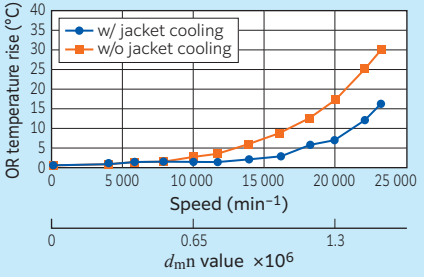
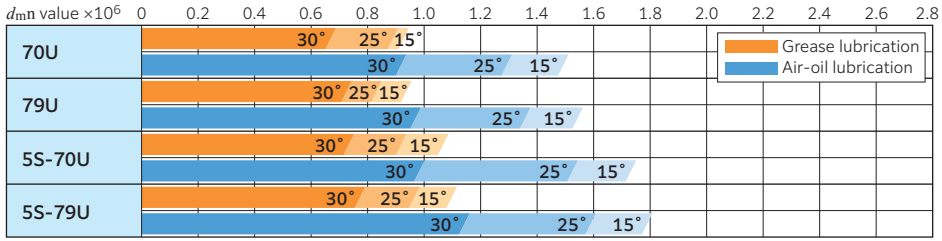


Fig. 9.23 High speed test with air-oil lubrication

■ Permissible speed range



Notes) Permissible speed of each bearing (d_{mn} value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

9.14 *ULTAGE* High speed angular contact ball bearings HSE type

The HSE type employs a special material featuring greatly improved wear resistance and anti-seizure properties as well as a special surface modification technique. Furthermore, thanks to an optimized internal design, this type achieves high speed, high rigidity and high reliability.

■ Features

1. Adoption of special materials and a unique internal design improve anti-seizure properties (15 times better than the conventional type) and wear resistance (1/6 reduction compared the conventional type).
2. Optimized internal design enables high speed operation and high rigidity.
3. Bearings are available with either steel or ceramic balls.
4. Three contact angles (15°, 20°, and 25°) are available to handle a wide range of applications.

■ Bearing specification

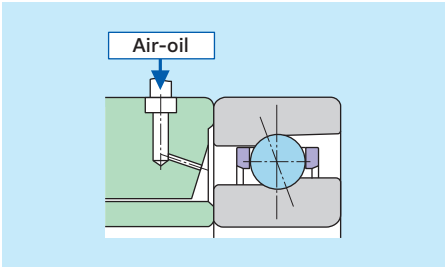
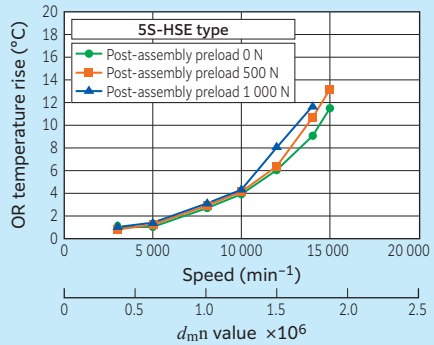


Fig. 9.24 HSE type

■ Data 1

The 5S-HSE type features high speed and limited temperature rise. Even if its preload is increased after assembly into the spindle, it maintains stable performance at high speeds (see **Fig. 9.25**).



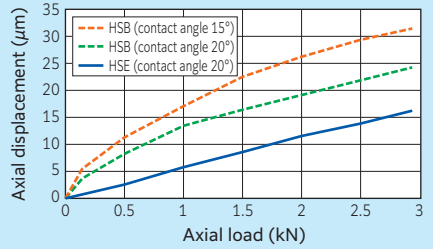
[Test conditions]

Bearing	5S-2LA-HSE020 (contact angle 20°) (ϕ100×ϕ150×24×2 rows)
Speed	3 000 to 15 000 min^{-1}
Lubrication	Air-oil lubrication
Oil consumption	0.03 mL/shot (oil shot intervals 5 min)
Air consumption	40 NL/min
Jacket cooling	w/

Fig. 9.25 Relationship between preload and temperature rise

■ Data 2

When built into a high speed main spindle, the preload of the 5S-HSE type is maintained, allowing high rigidity (1.9 times greater than a conventional bearing) (see **Fig. 9.26**).

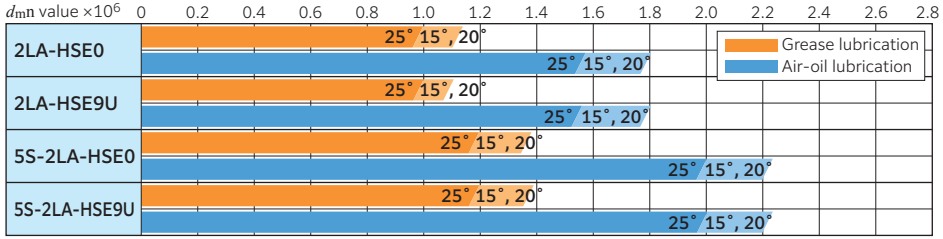


[Test conditions]

Bearing	5S-HSB020 (contact angles 15°and 20°) 5S-2LA-HSE020 (contact angle 20°) (ϕ100×ϕ150×24×2 rows)	
Preload after assembled	5S-HSB020	0 N
	5S-HSE020	500 N

Fig. 9.26 Comparison of rigidity relative to conventional bearing (HSB type) in terms of preload after assembled

■ Permissible speed range



Notes) Permissible speed of each bearing (d_{mn} value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

9.15 ULTAGE Ultra high speed angular contact ball bearings HSF type

The HSF type realizes further improvement in high speed running and inhibited temperature rise by adoption of smaller diameter ceramic balls, while retaining features of the HSE type. This type attains $d_m n$ values as high as 2.6×10^6 with fixed pressure preloading.

■ Features

1. Adoption of special materials and a unique internal design improve anti-seizure property (15 times better than the conventional type) and wear resistance (1/6 reduction compared the conventional type).
2. Optimized internal design enables high speed operation and high rigidity.
3. Ceramic balls are used.
4. Initial contact angle is set to 25° to accommodate the change in contact angle during ultra high speed operation.

■ Bearing specification

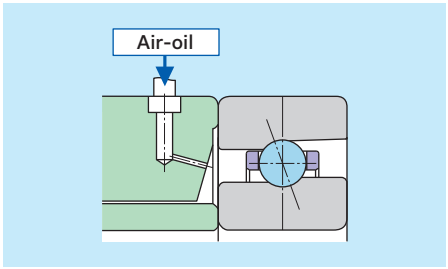


Fig. 9.27 HSF type

■ Low temperature rise

Ultra high speed 5S-HSF type angular contact ball bearings utilize smaller balls than those of the high speed HSE type. This reduces heating due to centrifugal force and ensures lower temperature rise. Thus, the 5S-HSF type boasts an approximately 10 % reduction in temperature rise as compared to the 5S-HSE type (see **Fig. 9.28**).

[Test conditions]

Bearing	5S-2LA-HSE020 (contact angle 20°) 5S-2LA-HSF020 (contact angle 25°) (ϕ100×ϕ150×24×2 rows)
Speed	4 000 to 14 000 min^{-1}
Lubrication	Air-oil lubrication
Oil consumption	0.03 mL/shot (oil shot intervals 5 min)
Air consumption	40 NL/min
Jacket cooling	w/o

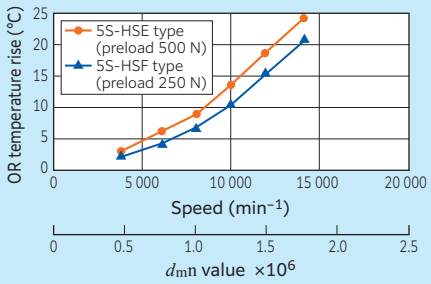


Fig. 9.28 Comparison of temperature rise

■ Permissible speed range

Notes) Permissible speed of each bearing ($d_m n$ value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

Angular Contact Ball Bearings for Radial Loads NTN

Main Spindle Bearings

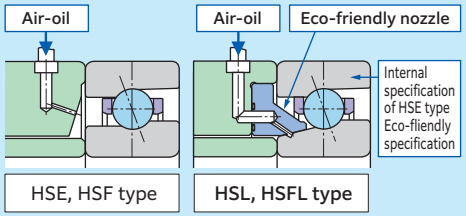
9.16 ULTAGE Eco-friendly air-oil lubricated angular contact ball bearings HSL type, HSFL type

The HSL/HSFL type is an advanced variation of the HSE/HSF type, characterized by incorporation of **NTN**'s unique eco-conscious lubrication technology. The HSL type helps decrease oil mist emissions and consumption of air and oil, improving the working environment for machine tool operators and reducing energy consumption.

■ Features

1. Adoption of special materials and a unique internal design improve anti-seizure properties (15 times better compared with the conventional type) and wear resistance (1/6 reduction compared the conventional type).
2. Ceramic balls are used.
3. Adoption of eco-friendly nozzle reduces noise (reduction of 2 to 8 dBA), air consumption (reduction of 50 to 75 %) and oil consumption (reduction of 20 to 90 %)

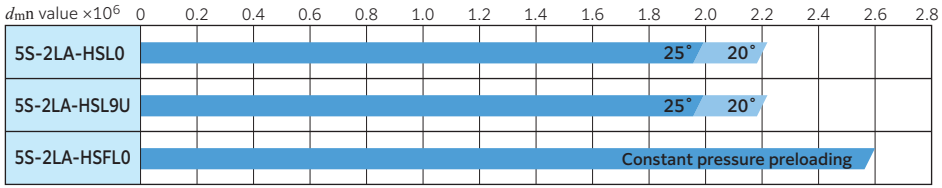
■ Bearing specification



NOTE) The HSL/HSFL type is packed together with the spacer with the eco-fliendly nozzle. The bearing type code HSL represents the bearing proper, while a spacer code stands for an eco-conscious nozzle proper or a spacer having a built-in nozzle.
For more details, see "9.3 Bearing Designation".

Fig. 9.29 HSL and HSFL types

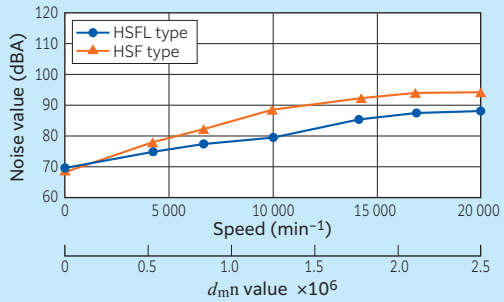
■ Permissible speed range



Notes) Permissible speed of each bearing ($d_m n$ value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

Data 1

In the high speed region of 10 000 min^{-1}, the noise level is 6 to 8 dBA lower (see **Fig. 9.30**).



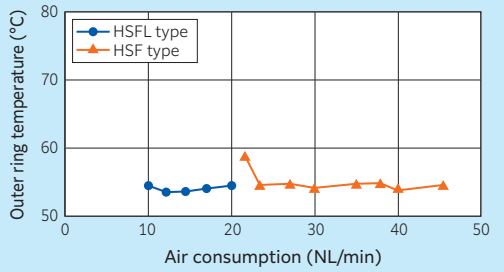
[Test conditions]

Bearing	5S-2LA-HSFL020 5S-2LA-HSF020 (φ100×φ150×24×2 rows)
Speed	0 to 20 000 min^{-1}
Preload	2.5 kN (constant pressure preloading)

Fig. 9.30 Comparison of noise levels

Data 2

For 5S-HSFL type bearings, the temperature of the outer rings remains stable even with an air consumption as low as 10 NL/min (50 to 25 % of the recommended air consumption for standard bearings) at a speed of 21 000 min^{-1} ($d_m n$ value 2.6 × 10^6) (see **Fig. 9.31**).



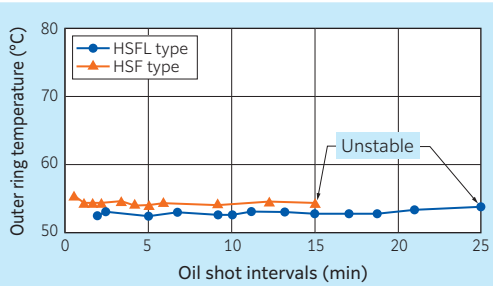
[Test conditions]

Bearing	5S-2LA-HSFL020 5S-2LA-HSF020 (φ100×φ150×24×2 rows)
Speed	21 000 min^{-1}
Preload	2.5 kN (constant pressure preloading)
Oil consumption	0.03 mL/shot (oil shot intervals, 5 min)

Fig. 9.31 Relationship between air consumption and temperature rise

Data 3

The 5S-HSFL type bearings can operate at 21 000 min^{-1} ($d_m n$ value 2.6 × 10^6) with oil shot intervals of 21 min (reduction of 20 to 90 % as compared with the recommended oil consumption for standard bearings) (see **Fig. 9.32**).



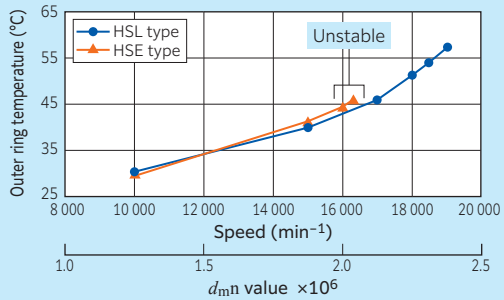
[Test conditions]

Bearing	5S-2LA-HSFL020 5S-2LA-HSF020 (φ100×φ150×24×2 rows)
Speed	21 000 min^{-1}
Preload	2.5 kN (constant pressure preloading)
Oil consumption	0.03 mL/shot
Air consumption	12.5 NL/min (HSFL) 30 NL/min (HSF)

Fig. 9.32 Relationship between oil shot intervals and temperature rise

Data 4

5S-HSL type bearings can reliably run at a speed of 19 000 min^{-1} ($d_m n$ value 2.38 × 10^6) (fixed position preloading) (see **Fig. 9.33**) with both decrease air and oil consumption.



[Test conditions]

Bearing	5S-2LA-HSL020 5S-2LA-HSE020 (φ100×φ150×24×2 rows)
Speed	10 000 to 19 000 min^{-1}
Preload	After assembled, 0 (fixed position preloading)
Oil consumption	0.03 mL/shot (oil shot intervals, 10 min)
Air consumption	10 NL/min (HSL) 30 NL/min (HSE)

Fig. 9.33 High speed test results (fixed position preloading)

9.17 ULTAGE Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring, HSEW type

HSEW type is an air-oil lubricated high speed angular contact ball bearing equipped with re-lubricating holes on the outer ring of the HSE type. Because there is no requirement for providing a nozzle hole on the spacer, the spacer width can be kept short, contributing to the more compact main spindle and improvement of spindle rigidity due to the placement of the bearings on the tool tip side.

In addition, lubrication reliability is increased due to the direct lubrication from the outer ring, enabling the reduction of air consumption and the supplied oil amount.

■ Bearing specification

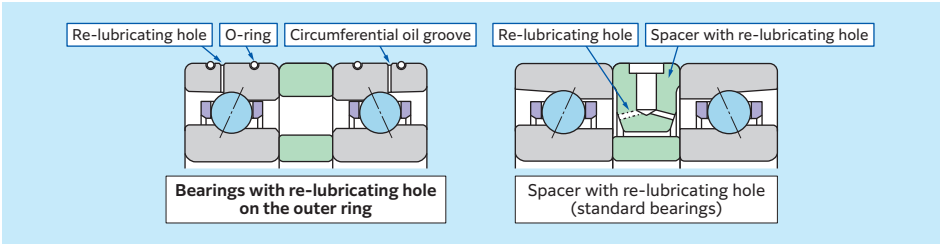
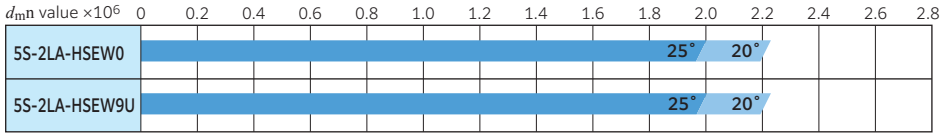


Fig. 9.34 HSEW type

■ Features

1. Compact main spindle design is possible due to the shorter spacer
2. Higher re-lubricating efficiency by the direct lubrication from the outer ring
3. Reduced noise level due to the air reduction effect

■ Permissible speed range



Notes) Permissible speed of each bearing (d_mn value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

■ About chamfering of re-lubricating hole on the housing

Ensure to provide chamfering on the re-lubricating hole of the housing to avoid damage of outer O-ring when the HSEW type is inserted into the housing (see **Fig. 9.35**).

We recommend that chamfering is only applied to the hole.

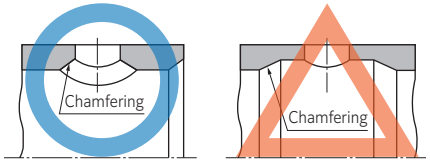


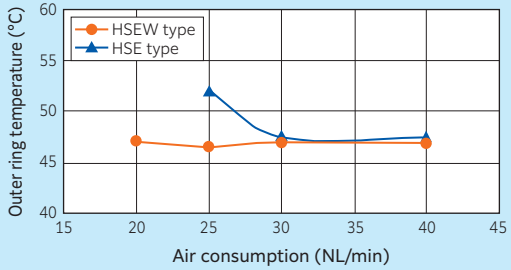
Fig. 9.35 Chamfering of re-lubricating hole on the housing

■ About phases of re-lubricating hole on the housing and re-lubricating hole on the outer ring

For producing the air reduction effect, be sure to stagger the position of re-lubricating hole on the housing and re-lubricating hole on the outer ring.

■ Data 1

For the HSEW type bearings, the temperature of the outer rings remains stable even with an air consumption as low as 20 NL/min (1/2 of the recommended air consumption for standard bearings) at a speed of 18 000 min^{-1} (d_mn value 2.25 × 10^6) (see **Fig. 9.36**).



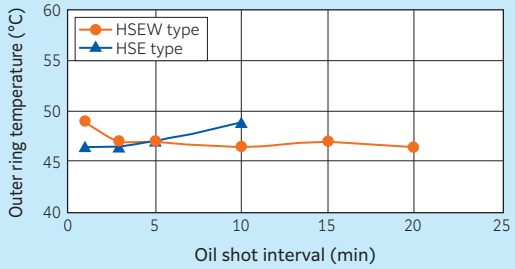
[Test conditions]

Bearing	5S-2LA-HSEW020 5S-2LA-HSE020 (ϕ100×ϕ150×24×2 rows)
Speed	18 000 min^{-1}
Preload	98 N after assembled (fixed position preloading)
Oil consumption	0.03 mL/shot (oil shot intervals) HSEW : 10 min, HSE : 5 min

Fig. 9.36 Relationship between air consumption and temperature rise

■ **Data 2**

The HSEW type bearings can operate at 18 000 min^{-1} ($d_m n$ value 2.25 × 10^6) with an oil shot interval of 20 min (1/4 of the recommended oil consumption for standard bearings) (see **Fig. 9.37**).



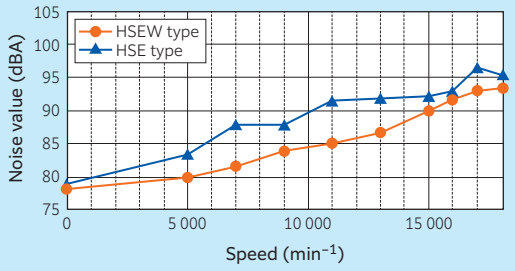
[Test conditions]

Bearing	5S-2LA-HSEW020 5S-2LA-HSE020 (ϕ100×ϕ150×24×2 rows)
Speed	18 000 min^{-1}
Preload	98 N after assembled (fixed position preloading)
Air consumption	HSEW : 20 NL/min HSE : 40 NL/min
Oil consumption	0.03 mL/shot

Fig. 9.37 Relationship between oil shot interval and temperature rise

■ **Data 3**

The HSEW type has achieved reduced noise level compared with the HSE type (see **Fig. 9.38**).



[Test conditions]

Bearing	5S-2LA-HSEW020 5S-2LA-HSE020 (ϕ100×ϕ150×24×2 rows)
Speed	0 to 18 000 min^{-1}
Preload	98 N after assembled (fixed position preloading)
Air consumption	HSEW : 20 NL/min HSE : 40 NL/min
Oil consumption	0.03 mL/shot (oil shot intervals) HSEW : 10 min HSE : 5 min

Fig. 9.38 Comparison of noise levels

9.18 ULTAGE Grease-lubricated sealed standard angular contact ball bearings 79LLB and 70LLB types

The 79LLB and 70LLB types are grease-lubricated, eco-friendly bearings that can achieve stable high speed operation with limited temperature rise.

They can allow, longer service life and preservation of healthy working environment for rotating tools with shaft diameters less than 50 mm.

■ **Bearing specification**

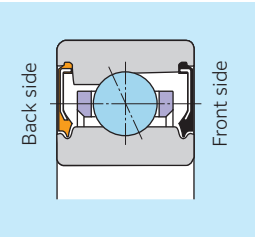


Fig. 9.39
79LLB and 70LLB types

■ **Features**

1. Internal design is optimized for high speed operation and limited temperature rise.
2. Longer grease life due to adoption of special grease and non-contact seals for grease retention.
3. Contact angles of 15° and 25° are available.
4. The standard types meet special precision P42 requirements (dimensional precision JIS Class 4 and running accuracy JIS Class 2).
5. Seals of different colors are used for front (black) and back (orange) sides.
   Bearing configuration can be easily identified by color.
6. Available with either steel or ceramic balls.

■ **Simplified main spindle configuration**

Due to the optimized internal structure, the 79LLB and 70LLB types can reliably run at a higher speed with grease lubrication. The grease lubricating system is virtually free from oil mist emission, and contributes to a simpler main spindle structure, reduction in environmental impact and decrease in cost (see **Fig. 9.40**).

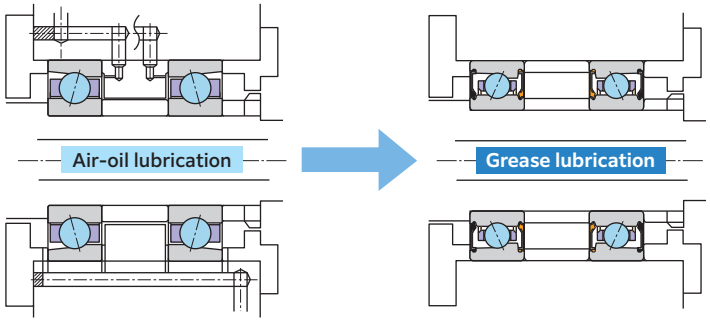
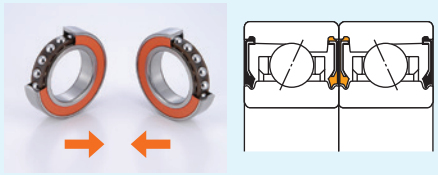
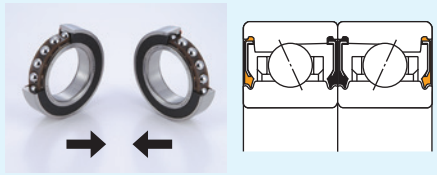


Fig. 9.40 Modification of lubrication system (air-oil lubrication to grease lubrication)

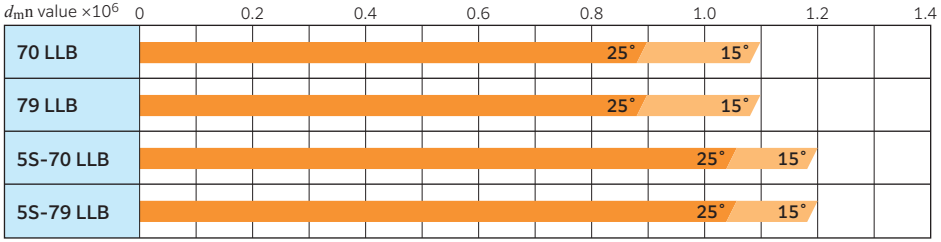
■ Easier handling with 79LLB and 70LLB types

The 79LLB and 70LLB types are prefilled with grease. They can be readily used after only wiping away rust preventive oil. Seals of different colors are used for the front and back sides of the bearing. Black seals are used for the front sides and orange seals are used for the back sides, so configurations are readily identified by colors (see **Table 9.26**).

Table 9.26 Bearing Combinations and Seal Colors

DB set (back faces in combination)	DF set (front faces in combination)
Orange seal + Orange seal	Black seal + Black seal
	

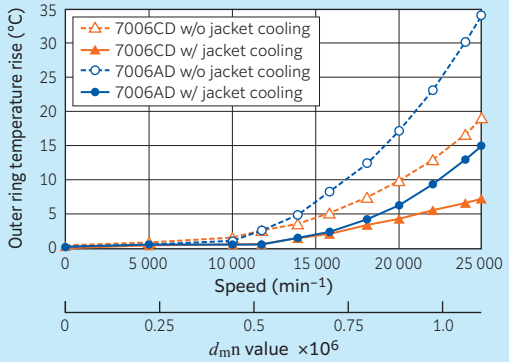
■ Permissible speed range



Notes) Permissible speed of each bearing (d_mn value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

■ Data

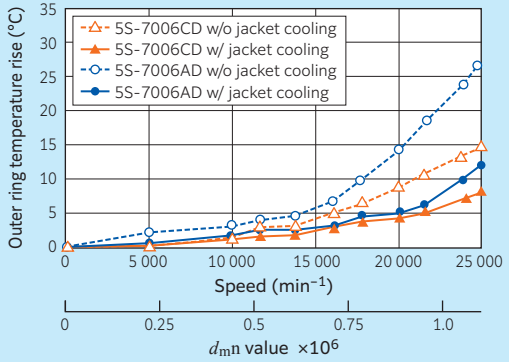
Optimization of the internal design promotes stable operation of d_mn value 1.1 × 10⁶ (see **Fig. 9.41** and **Fig. 9.42**).



[Test conditions]

Bearing	7006CDLLB 7006ADLLB (ϕ30×ϕ55×13×2 rows)
Speed	0 to 25 000 min⁻¹
Preload after assembled	180 N (7006CDLLB) 250 N (7006ADLLB)

Fig. 9.41 High speed test results (Steel ball specification, contact angles 15°, 25°)



[Test conditions]

Bearing	5S-7006CDLLB 5S-7006ADLLB (ϕ30×ϕ55×13×2 rows)
Speed	0 to 25 000 min⁻¹
Preload after assembled	180 N (5S-7006CDLLB) 250 N (5S-7006ADLLB)

Fig. 9.42 High speed test results (Ceramic ball specification, contact angles 15°, 25°)

9.19 ULTAGE Grease-lubricated sealed high speed angular contact ball bearings BNS LLB type

By the optimized material and internal structure, BNS LLB type bearings have excellent performance at higher speeds. This helps to reduce pollution and cost.

■ Features

1. Adoption of special materials and unique internal design improve anti-seizure properties (15 times better than the conventional type) and wear resistance (1/6 reduction compared the conventional type).
2. Optimized internal design enables high speed operation and high rigidity.
3. Available with either steel or ceramic balls.
4. Adoption of grease pockets, special grease, and non-contact seals improves service life.

■ Bearing specification

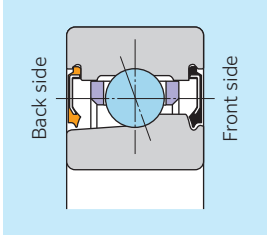
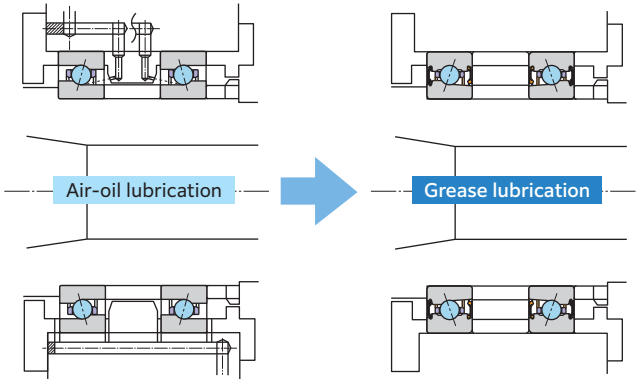


Fig. 9.43 BNS LLB type

■ Simplified main spindle configuration

BNS LLB type bearings can reliably operate at a higher speed with grease lubrication. The grease lubrication system is virtually free from oil mist emission can simplify the main spindle structure, reduce pollution and decrease cost (see **Fig. 9.44**).



Capable of replacing air-oil lubricated bearings up to $d_m n$ value of 1.4×10^6

Simplifies the main spindle structure and reduces the initial and operating costs.

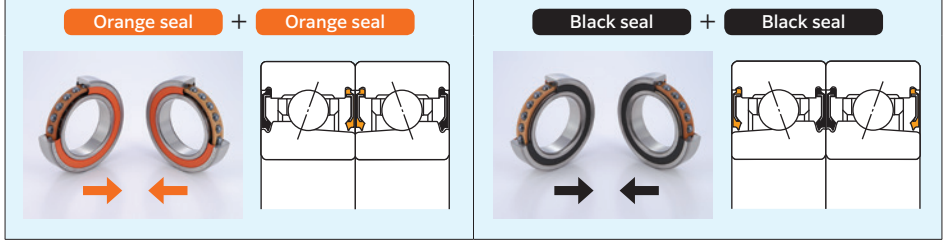
Fig. 9.44 Modification of lubrication system (air-oil lubrication to grease lubrication)

■ Easier handling with BNS LLB type

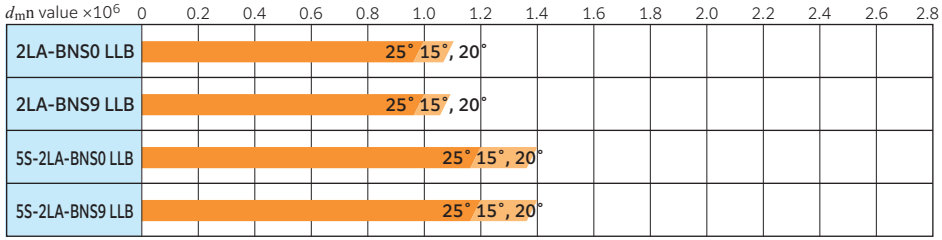
The BNS LLB type has been packed with grease in advance. They can be used after wiping away rust preventive oil. Seals in different colors are used for the front and back sides of the bearings. Black seals are used for the front sides and orange seals are used for the back sides, so configurations can be easily identified by color (see **Table 9.27**).

Table 9.27 Bearing Combinations and Seal Colors

DB set (back faces in combination)	DF set (front faces in combination)
Orange seal + Orange seal	Black seal + Black seal



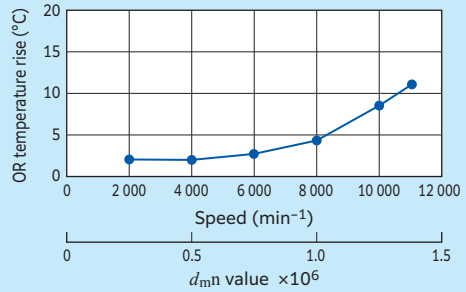
■ Permissible speed range



Notes) Permissible speed of each bearing ($d_m n$ value) varies depending on the specifications of the machine on which the bearing is used (motor drive system, cooling system, and construction around the bearing). Consider the optimal choice referring to the above guideline (for two-row arrangement), and then, contact **NTN** Engineering for technical assistance.

■ **Data 1**

5S-2LA-BNS LLB type bearings exhibit stable temperature rise up to a $d_m n$ value of 1.4×10^6 (see **Fig. 9.45**).



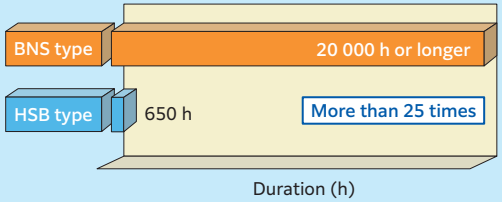
[Test conditions]

Bearing	5S-2LA-BNS020 LLB (ϕ100×ϕ150×24×2 rows)
Speed	2 000 to 11 000 min^{-1}
Jacket cooling	w/

Fig. 9.45 High speed test results

■ **Data 2**

As a result of optimized design (such as grease reservoir) and special grease, 5S-2LA-BNS LLB type bearing have successfully achieved continuous operation in excess of 20 000 hours at a $d_m n$ value of 1.4×10^6 (see **Fig. 9.46**).



[Test conditions]

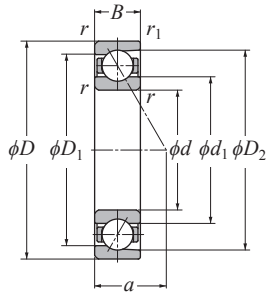
Bearing	5S-2LA-BNS020 LLB 5S-HSB020C (ϕ100×ϕ150×24×2 rows)
Speed	11 000 min^{-1}
Preload	After assembled, 0
Jacket cooling	w/

Fig. 9.46 Durability test results

Angular Contact Ball Bearings for Radial Loads NTN

Main Spindle Bearings

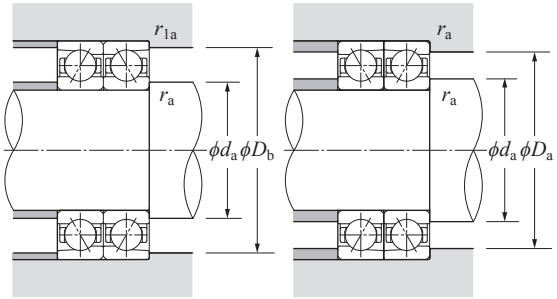
Standard angular contact ball bearings (steel ball spec.) 78 type



Contact angle 15° *d* 25–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7805C	25	37	7	0.3	0.15	5.60	3.85	570	390	1.04	106	16.2	27 100	36 100	7.7	0.8	0.021	28.6	33.2	34.6	27.5	34.5	35.8	0.3	0.15	7805C
7806C	30	42	7	0.3	0.15	5.95	4.50	605	460	1.20	122	16.5	23 300	31 100	8.3	1.1	0.025	33.6	38.4	39.6	32.5	39.5	40.8	0.3	0.15	7806C
7807C	35	47	7	0.3	0.15	6.40	5.25	655	535	1.41	144	16.4	20 500	27 300	9.0	1.3	0.028	38.6	43.4	44.6	37.5	44.5	45.8	0.3	0.15	7807C
7808C	40	52	7	0.3	0.15	6.70	5.75	685	585	1.57	160	16.2	18 300	24 300	9.7	1.4	0.031	43.6	48.4	49.6	42.5	49.5	50.8	0.3	0.15	7808C
7809C	45	58	7	0.3	0.15	6.95	6.25	705	640	1.73	176	16.0	16 300	21 700	10.4	1.6	0.039	49.1	53.9	55.1	47.5	55.5	56.8	0.3	0.15	7809C
7810C	50	65	7	0.3	0.15	8.70	8.05	890	820	2.31	236	16.1	14 600	19 500	11.2	1.8	0.049	54.8	60.2	61.6	52.5	62.5	63.8	0.3	0.15	7810C
7811C	55	72	9	0.3	0.15	14.5	12.7	1 470	1 300	5.55	565	16.4	13 200	17 600	13.0	3.2	0.079	60.1	66.9	69.2	57.5	69.5	70.8	0.3	0.15	7811C
7812C	60	78	10	0.3	0.15	14.9	13.6	1 520	1 390	6.00	610	16.3	12 200	16 200	14.3	3.9	0.10	65.6	72.4	74.7	62.5	75.5	76.8	0.3	0.15	7812C
7813C	65	85	10	0.6	0.3	15.6	14.9	1 590	1 520	5.30	540	16.2	11 200	14 900	15.1	4.4	0.12	71.4	78.6	80.7	69.5	80.5	82.5	0.6	0.3	7813C
7814C	70	90	10	0.6	0.3	16.0	15.8	1 630	1 610	7.10	720	16.1	10 500	14 000	15.7	5.1	0.13	76.6	83.4	85.7	74.5	85.5	87.5	0.6	0.3	7814C
7815C	75	95	10	0.6	0.3	16.4	16.7	1 670	1 700	6.00	615	16.0	9 900	13 200	16.4	5.0	0.14	81.4	88.6	90.7	79.5	90.5	92.5	0.6	0.3	7815C
7816C	80	100	10	0.6	0.3	16.8	17.6	1 710	1 790	7.95	810	15.9	9 300	12 400	17.1	5.7	0.15	86.6	93.4	95.7	84.5	95.5	97.5	0.6	0.3	7816C
7817C	85	110	13	1	0.6	24.5	24.7	2 500	2 520	10.7	1 090	16.1	8 600	11 500	19.6	9.8	0.26	93.1	101.9	104.9	90.5	104.5	105.5	1	0.6	7817C
7818C	90	115	13	1	0.6	25.2	26.1	2 570	2 670	10.5	1 070	16.1	8 200	10 900	20.3	11	0.27	98.0	107.0	109.8	95.5	109.5	110.5	1	0.6	7818C
7819C	95	120	13	1	0.6	25.9	27.6	2 640	2 820	12.1	1 240	16.0	7 800	10 400	20.9	11	0.28	103.1	111.9	114.8	100.5	114.5	115.5	1	0.6	7819C
7820C	100	125	13	1	0.6	26.1	28.3	2 660	2 890	12.5	1 270	16.0	7 500	10 000	21.6	12	0.30	108.1	116.9	119.8	105.5	119.5	120.5	1	0.6	7820C
7821C	105	130	13	1	0.6	26.7	29.8	2 720	3 050	13.2	1 340	15.9	7 100	9 500	22.3	13	0.31	113.1	122.0	124.8	110.5	124.5	125.5	1	0.6	7821C
7822C	110	140	16	1	0.6	38.5	42.5	3 900	4 350	21.0	2 140	16.1	6 700	9 000	24.8	19	0.49	119.8	130.2	134.0	115.5	134.5	135.5	1	0.6	7822C
7824C	120	150	16	1	0.6	39.0	44.5	3 950	4 550	22.1	2 260	16.0	6 200	8 300	26.1	20	0.52	129.8	140.2	144.0	125.5	144.5	145.5	1	0.6	7824C
7826C	130	165	18	1.1	0.6	52.0	59.5	5 300	6 050	28.4	2 900	16.1	5 700	7 600	28.8	28	0.91	141.3	153.7	158.1	137	158	160.5	1	0.6	7826C
7828C	140	175	18	1.1	0.6	53.0	62.5	5 400	6 350	30.0	3 050	16.0	5 300	7 100	30.1	30	0.97	151.3	163.7	168.1	147	168	170.5	1	0.6	7828C
7830C	150	190	20	1.1	0.6	67.0	79.5	6 850	8 100	48.5	4 950	16.1	4 900	6 600	32.8	45	1.33	163.4	177.1	182.2	157	183	185.5	1	0.6	7830C
7832C	160	200	20	1.1	0.6	68.5	83.5	7 000	8 500	41.0	4 200	16.0	4 700	6 200	34.2	46	1.41	172.9	187.1	192.2	167	193	195.5	1	0.6	7832C
7834C	170	215	22	1.1	0.6	84.0	102	8 550	10 400	49.0	4 950	16.1	4 400	5 800	36.8	53	1.87	184.4	200.6	206.3	177	208	210.5	1	0.6	7834C

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	Single row / Tandem $F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	Back-to-back / Face-to-face $F_a/F_r > e$ X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

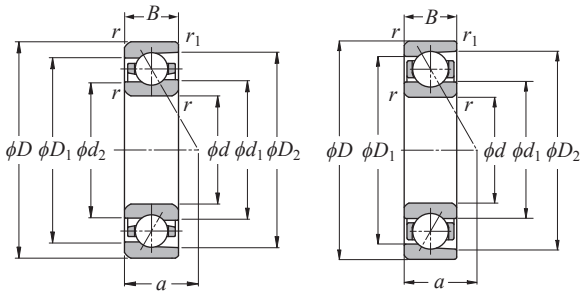
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Standard angular contact ball bearings (steel ball spec.) 79U type / 79 type



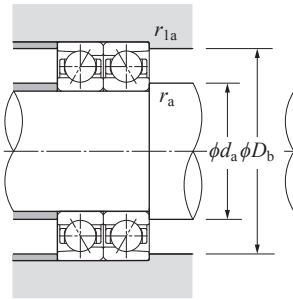
d =10–130 mm

d =140–170 mm

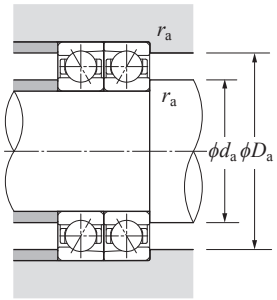
Contact angle 15° d 10–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7900UC	10	22	6	0.3	0.15	3.55	1.65	360	169	2.40	245	14.2	73 200	117 200	5.2	0.4	0.01	14.3	13.5	17.7	19.4	12.5	19.5	20.8	0.3	0.15	7900UC
7901UC	12	24	6	0.3	0.15	3.70	1.86	380	189	2.61	267	14.7	65 100	104 100	5.4	0.4	0.01	16.3	15.5	19.7	21.3	14.5	21.5	22.8	0.3	0.15	7901UC
7902UC	15	28	7	0.3	0.15	5.65	2.90	575	296	3.85	395	14.4	54 500	87 200	6.4	0.8	0.02	19.3	18.3	23.7	25.6	17.5	25.5	26.8	0.3	0.15	7902UC
7903UC	17	30	7	0.3	0.15	5.90	3.20	605	325	4.15	425	14.8	49 900	79 800	6.7	0.8	0.02	21.3	20.3	25.7	27.8	19.5	27.5	28.8	0.3	0.15	7903UC
7904UC	20	37	9	0.3	0.15	8.45	4.90	865	500	6.45	655	14.9	41 100	65 800	8.3	1.5	0.04	25.9	24.7	31.1	33.6	22.5	34.5	35.8	0.3	0.15	7904UC
7905UC	25	42	9	0.3	0.15	9.05	5.75	925	590	7.35	750	15.5	35 000	56 000	9.0	1.8	0.04	30.9	29.7	36.1	38.6	27.5	39.5	40.8	0.3	0.15	7905UC
7906UC	30	47	9	0.3	0.15	9.55	6.60	975	675	8.20	840	15.9	30 400	48 700	9.7	2.0	0.05	35.9	34.7	41.1	43.6	32.5	44.5	45.8	0.3	0.15	7906UC
7907UC	35	55	10	0.6	0.3	15.2	10.3	1 550	1 050	13.7	1 400	15.5	26 000	41 700	11.1	3.4	0.07	41.6	39.9	48.4	51.7	39.5	50.5	52.5	0.6	0.3	7907UC
7908UC	40	62	12	0.6	0.3	16.0	11.8	1 640	1 200	15.4	1 570	15.9	23 000	36 800	12.9	4.7	0.11	47.6	45.9	54.4	57.8	44.5	57.5	59.5	0.6	0.3	7908UC
7909UC	45	68	12	0.6	0.3	19.9	14.8	2 030	1 510	19.4	1 980	15.8	20 700	33 200	13.6	5.9	0.12	52.7	50.8	60.4	64.1	49.5	63.5	65.5	0.6	0.3	7909UC
7910UC	50	72	12	0.6	0.3	21.0	16.6	2 140	1 700	21.4	2 190	16.1	19 200	30 700	14.2	6.2	0.13	57.2	55.3	64.9	68.6	54.5	67.5	69.5	0.6	0.3	7910UC
7911UC	55	80	13	1	0.6	21.8	18.5	2 230	1 890	23.4	2 390	16.3	17 400	27 800	15.6	7.5	0.18	63.7	61.8	71.4	75.1	60.5	74.5	75.5	1	0.6	7911UC
7912UC	60	85	13	1	0.6	22.7	20.3	2 320	2 080	25.5	2 600	16.5	16 200	25 900	16.3	8.0	0.19	68.7	66.8	76.4	80.1	65.5	79.5	80.5	1	0.6	7912UC
7913UC	65	90	13	1	0.6	23.0	21.2	2 350	2 160	26.5	2 700	16.5	15 100	24 200	16.9	8.6	0.21	73.7	71.8	81.4	85.1	70.5	84.5	85.5	1	0.6	7913UC
7914UC	70	100	16	1	0.6	33.0	30.0	3 350	3 100	38.0	3 850	16.4	13 800	22 100	19.4	14	0.34	80.3	78.0	89.7	94.3	75.5	94.5	95.5	1	0.6	7914UC
7915UC	75	105	16	1	0.6	33.5	31.5	3 400	3 250	39.5	4 000	16.5	13 000	20 800	20.1	15	0.36	85.3	83.0	94.7	99.3	80.5	99.5	100.5	1	0.6	7915UC
7916UC	80	110	16	1	0.6	34.0	33.0	3 450	3 350	41.0	4 200	16.5	12 300	19 600	20.8	16	0.38	90.8	88.5	100.2	104.8	85.5	104.5	105.5	1	0.6	7916UC
7917UC	85	120	18	1.1	0.6	45.5	44.0	4 650	4 500	54.0	5 500	16.5	11 400	18 300	22.8	22	0.54	96.9	94.3	108.1	113.4	92	113	115.5	1	0.6	7917UC
7918UC	90	125	18	1.1	0.6	46.0	46.0	4 700	4 700	56.0	5 700	16.6	10 900	17 400	23.5	23	0.56	101.9	99.3	113.1	118.4	97	118	120.5	1	0.6	7918UC
7919UC	95	130	18	1.1	0.6	47.0	47.5	4 750	4 850	58.0	5 950	16.5	10 400	16 700	24.1	24	0.59	106.9	104.3	118.1	123.4	102	123	125.5	1	0.6	7919UC
7920UC	100	140	20	1.1	0.6	60.0	61.0	6 150	6 200	76.5	7 800	16.5	9 800	15 600	26.1	33	0.81	113.6	110.5	126.4	132.6	107	133	135.5	1	0.6	7920UC
7921UC	105	145	20	1.1	0.6	61.0	63.5	6 250	6 500	79.5	8 100	16.6	9 400	15 000	26.8	34	0.84	118.6	115.5	131.4	137.6	112	138	140.5	1	0.6	7921UC
7922UC	110	150	20	1.1	0.6	62.0	65.5	6 300	6 700	82.5	8 400	16.5	9 000	14 400	27.5	36	0.87	123.6	120.5	136.4	142.6	117	143	145.5	1	0.6	7922UC
7924UC	120	165	22	1.1	0.6	76.5	81.5	7 800	8 300	100	10 200	16.6	8 200	13 200	30.2	48	1.19	135.2	131.7	149.8	156.7	127	158	160.5	1	0.6	7924UC
7926UC	130	180	24	1.5	1	94.0	102	9 600	10 400	128	13 000	16.5	7 600	12 100	32.9	63	1.57	146.9	143.0	163.2	170.9	138.5	171.5	174.5	1.5	1	7926UC
7928CT1B	140	190	24	1.5	1	92.5	101	9 450	10 300	48.0	4 900	16.5	5 100	6 600	34.2	67	1.66	156.0	—	174.1	180.5	148.5	181.5	184.5	1.5	1	7928CT1B
7930CT1B	150	210	28	2	1	119	132	12 200	13 400	60.5	6 200	16.5	4 700	6 100	38.2	100	2.59	169.5	—	190.5	198.0	160	200	204.5	2	1	7930CT1B
7932CT1B	160	220	28	2	1	121	136	12 300	13 900	63.0	6 400	16.5	4 400	5 700	39.6	106	2.72	179.5	—	200.6	208.0	170	210	214.5	2	1	7932CT1B
7934CT1B	170	230	28	2	1	125	145	12 700	14 800	79.0	8 050	16.4	4 200	5 400	40.9	109	2.89	190.0	—	210.5	218.0	180	220	224.5	2	1	7934CT1B

1) Minimum allowable value for corner radius dimension r or r_1.
Remarks: A part number containing a suffix **U** means an **ULTAGE series**.



Back-to-back (DB)



Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

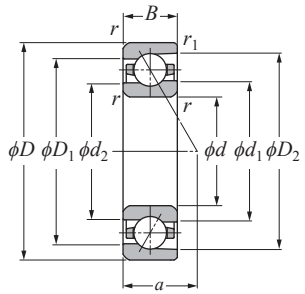
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

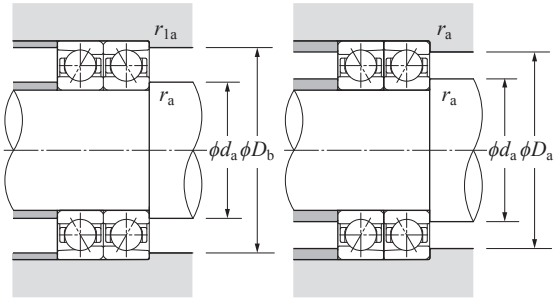
ULTAGE Standard angular contact ball bearings (steel ball spec.) 79U type



Contact angle 25° d 10–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}					a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7900UAD	10	22	6	0.3	0.15	3.40	1.58	345	161	1.77	180	63 400	102 500	6.8	0.4	0.01	14.3	13.5	17.7	19.4	12.5	19.5	20.8	0.3	0.15	7900UAD
7901UAD	12	24	6	0.3	0.15	3.55	1.77	360	181	1.92	196	56 400	91 100	7.2	0.4	0.01	16.3	15.5	19.7	21.3	14.5	21.5	22.8	0.3	0.15	7901UAD
7902UAD	15	28	7	0.3	0.15	5.40	2.77	550	283	2.81	287	47 200	76 300	8.6	0.8	0.02	19.3	18.3	23.7	25.6	17.5	25.5	26.8	0.3	0.15	7902UAD
7903UAD	17	30	7	0.3	0.15	5.60	3.05	575	310	3.00	310	43 200	69 800	9.0	0.8	0.02	21.3	20.3	25.7	27.7	19.5	27.5	28.8	0.3	0.15	7903UAD
7904UAD	20	37	9	0.3	0.15	8.05	4.65	820	475	4.70	480	35 600	57 500	11.2	1.5	0.04	25.9	24.7	31.1	33.6	22.5	34.5	35.8	0.3	0.15	7904UAD
7905UAD	25	42	9	0.3	0.15	8.60	5.50	875	560	5.35	545	30 300	49 000	12.4	1.8	0.04	30.9	29.7	36.1	38.6	27.5	39.5	40.8	0.3	0.15	7905UAD
7906UAD	30	47	9	0.3	0.15	9.00	6.30	920	640	6.00	610	26 400	42 600	13.5	2.0	0.05	35.9	34.7	41.1	43.6	32.5	44.5	45.8	0.3	0.15	7906UAD
7907UAD	35	55	10	0.6	0.3	14.4	9.75	1 470	995	10.1	1 030	22 600	36 400	15.6	3.4	0.07	41.6	39.9	48.4	51.7	39.5	50.5	52.5	0.6	0.3	7907UAD
7908UAD	40	62	12	0.6	0.3	15.2	11.2	1 550	1 140	11.3	1 160	19 900	32 200	18.0	4.7	0.11	47.6	45.9	54.4	57.8	44.5	57.5	59.5	0.6	0.3	7908UAD
7909UAD	45	68	12	0.6	0.3	18.8	14.1	1 920	1 440	14.6	1 490	18 000	29 000	19.2	5.9	0.12	52.7	50.8	60.4	64.0	49.5	63.5	65.5	0.6	0.3	7909UAD
7910UAD	50	72	12	0.6	0.3	19.8	15.8	2 020	1 610	16.2	1 650	16 600	26 900	20.3	6.2	0.13	57.2	55.3	64.9	68.5	54.5	67.5	69.5	0.6	0.3	7910UAD
7911UAD	55	80	13	1	0.6	20.6	17.5	2 100	1 790	17.7	1 800	15 000	24 300	22.3	7.5	0.18	63.7	61.8	71.4	75.1	60.5	74.5	75.5	1	0.6	7911UAD
7912UAD	60	85	13	1	0.6	21.4	19.1	2 190	1 950	19.2	1 960	14 000	22 600	23.5	8.0	0.19	68.7	66.8	76.4	80.1	65.5	79.5	80.5	1	0.6	7912UAD
7913UAD	65	90	13	1	0.6	21.7	19.7	2 210	2 010	19.9	2 030	13 100	21 200	24.6	8.6	0.21	73.7	71.8	81.4	85.0	70.5	84.5	85.5	1	0.6	7913UAD
7914UAD	70	100	16	1	0.6	31.0	28.6	3 150	2 920	27.9	2 840	11 900	19 300	27.9	14	0.34	80.3	78.0	89.7	94.3	75.5	94.5	95.5	1	0.6	7914UAD
7915UAD	75	105	16	1	0.6	31.5	29.6	3 200	3 000	29.0	2 960	11 300	18 200	29.1	15	0.36	85.3	83.0	94.7	99.2	80.5	99.5	100.5	1	0.6	7915UAD
7916UAD	80	110	16	1	0.6	32.0	30.5	3 250	3 100	30.0	3 050	10 600	17 200	30.4	16	0.38	90.8	88.5	100.2	104.7	85.5	104.5	105.5	1	0.6	7916UAD
7917UAD	85	120	18	1.1	0.6	43.0	41.5	4 350	4 250	39.5	4 000	9 900	16 000	33.0	22	0.54	96.9	94.3	108.1	113.4	92	113	115.5	1	0.6	7917UAD
7918UAD	90	125	18	1.1	0.6	43.5	43.0	4 450	4 400	41.0	4 200	9 400	15 300	34.2	23	0.56	101.9	99.3	113.1	118.4	97	118	120.5	1	0.6	7918UAD
7919UAD	95	130	18	1.1	0.6	44.0	44.5	4 500	4 500	42.5	4 350	9 000	14 600	35.3	24	0.59	106.9	104.3	118.1	123.4	102	123	125.5	1	0.6	7919UAD
7920UAD	100	140	20	1.1	0.6	56.5	57.5	5 800	5 850	56.0	5 750	8 500	13 700	38.1	33	0.81	113.6	110.5	126.4	132.5	107	133	135.5	1	0.6	7920UAD
7921UAD	105	145	20	1.1	0.6	57.5	59.0	5 850	6 050	58.5	5 950	8 100	13 100	39.3	34	0.84	118.6	115.5	131.4	137.5	112	138	140.5	1	0.6	7921UAD
7922UAD	110	150	20	1.1	0.6	58.5	61.0	5 950	6 250	60.5	6 150	7 800	12 600	40.4	36	0.87	123.6	120.5	136.4	142.5	117	143	145.5	1	0.6	7922UAD
7924UAD	120	165	22	1.1	0.6	72.0	76.0	7 350	7 750	73.5	7 500	7 100	11 500	44.4	48	1.19	135.2	131.7	149.8	156.7	127	158	160.5	1	0.6	7924UAD
7926UAD	130	180	24	1.5	1	88.5	95.0	9 050	9 700	94.0	9 550	6 600	10 600	48.3	63	1.57	146.9	143.0	163.2	170.8	138.5	171.5	174.5	1.5	1	7926UAD

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

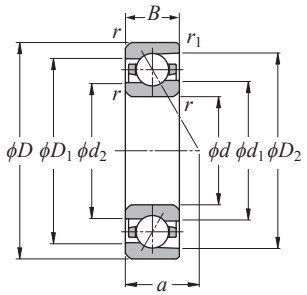
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Standard angular contact ball bearings (steel ball spec.) 79U type

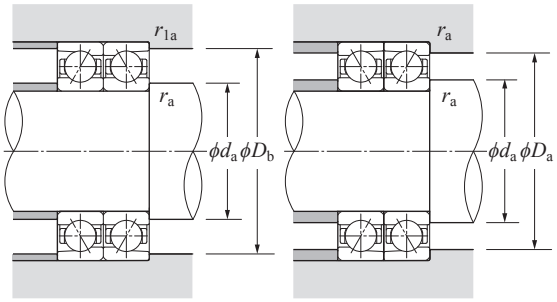


Contact angle 30° d 10–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7900U	10	22	6	0.3	0.15	3.25	1.53	335	156	1.36	139	53 700	73 200	7.7	0.4	0.01	14.3	13.5	17.7	19.3	12.5	19.5	20.8	0.3	0.15	7900U
7901U	12	24	6	0.3	0.15	3.40	1.71	350	175	1.48	151	47 700	65 000	8.2	0.4	0.01	16.3	15.5	19.7	21.3	14.5	21.5	22.8	0.3	0.15	7901U
7902U	15	28	7	0.3	0.15	5.20	2.68	530	274	2.14	218	40 000	54 500	9.8	0.8	0.02	19.3	18.3	23.7	25.6	17.5	25.5	26.8	0.3	0.15	7902U
7903U	17	30	7	0.3	0.15	5.40	2.95	555	300	2.29	234	36 600	49 800	10.3	0.8	0.02	21.3	20.3	25.7	27.7	19.5	27.5	28.8	0.3	0.15	7903U
7904U	20	37	9	0.3	0.15	7.75	4.50	790	460	3.60	365	30 100	41 100	12.8	1.5	0.04	25.9	24.7	31.1	33.5	22.5	34.5	35.8	0.3	0.15	7904U
7905U	25	42	9	0.3	0.15	8.25	5.30	840	540	4.10	415	25 600	35 000	14.2	1.8	0.04	30.9	29.7	36.1	38.5	27.5	39.5	40.8	0.3	0.15	7905U
7906U	30	47	9	0.3	0.15	8.65	6.05	885	615	4.60	465	22 300	30 400	15.7	2.0	0.05	35.9	34.7	41.1	43.5	32.5	44.5	45.8	0.3	0.15	7906U
7907U	35	55	10	0.6	0.3	13.8	9.40	1 410	960	7.85	800	19 100	26 000	18.1	3.4	0.07	41.6	39.9	48.4	51.6	39.5	50.5	52.5	0.6	0.3	7907U
7908U	40	62	12	0.6	0.3	14.6	10.7	1 490	1 100	8.75	895	16 900	23 000	20.8	4.7	0.11	47.6	45.9	54.4	57.7	44.5	57.5	59.5	0.6	0.3	7908U
7909U	45	68	12	0.6	0.3	18.1	13.6	1 840	1 380	11.4	1 160	15 200	20 700	22.4	5.9	0.12	52.7	50.8	60.4	64.0	49.5	63.5	65.5	0.6	0.3	7909U
7910U	50	72	12	0.6	0.3	19.0	15.2	1 940	1 550	12.6	1 280	14 100	19 200	23.7	6.2	0.13	57.2	55.3	64.9	68.5	54.5	67.5	69.5	0.6	0.3	7910U
7911U	55	80	13	1	0.6	19.8	16.8	2 020	1 720	13.8	1 410	12 700	17 400	26.1	7.5	0.18	63.7	61.8	71.4	75.0	60.5	74.5	75.5	1	0.6	7911U
7912U	60	85	13	1	0.6	20.6	18.2	2 100	1 850	15.0	1 530	11 900	16 200	27.5	8.0	0.19	68.7	66.8	76.4	80.1	65.5	79.5	80.5	1	0.6	7912U
7913U	65	90	13	1	0.6	20.8	18.8	2 120	1 910	15.6	1 590	11 100	15 100	29.0	8.6	0.21	73.7	71.8	81.4	85.0	70.5	84.5	85.5	1	0.6	7913U
7914U	70	100	16	1	0.6	29.8	27.3	3 050	2 780	21.5	2 190	10 100	13 800	32.6	14	0.34	80.3	78.0	89.7	94.2	75.5	94.5	95.5	1	0.6	7914U
7915U	75	105	16	1	0.6	30.0	28.2	3 100	2 870	22.3	2 280	9 600	13 000	34.1	15	0.36	85.3	83.0	94.7	99.2	80.5	99.5	100.5	1	0.6	7915U
7916U	80	110	16	1	0.6	30.5	29.1	3 100	2 970	23.2	2 370	9 000	12 300	35.7	16	0.38	90.8	88.5	100.2	104.7	85.5	104.5	105.5	1	0.6	7916U
7917U	85	120	18	1.1	0.6	41.0	39.5	4 200	4 050	30.5	3 100	8 400	11 400	38.7	22	0.54	96.9	94.3	108.1	113.4	92	113	115.5	1	0.6	7917U
7918U	90	125	18	1.1	0.6	41.5	41.0	4 250	4 150	31.5	3 200	8 000	10 900	40.2	23	0.56	101.9	99.3	113.1	118.3	97	118	120.5	1	0.6	7918U
7919U	95	130	18	1.1	0.6	42.5	42.0	4 300	4 300	32.5	3 350	7 600	10 400	41.6	24	0.59	106.9	104.3	118.1	123.3	102	123	125.5	1	0.6	7919U
7920U	100	140	20	1.1	0.6	54.5	54.5	5 550	5 550	43.5	4 450	7 200	9 800	44.8	33	0.81	113.6	110.5	126.4	132.5	107	133	135.5	1	0.6	7920U
7921U	105	145	20	1.1	0.6	55.0	56.5	5 650	5 750	45.0	4 600	6 900	9 400	46.2	34	0.84	118.6	115.5	131.4	137.5	112	138	140.5	1	0.6	7921U
7922U	110	150	20	1.1	0.6	56.0	58.0	5 700	5 900	46.5	4 750	6 600	9 000	47.7	36	0.87	123.6	120.5	136.4	142.5	117	143	145.5	1	0.6	7922U
7924U	120	165	22	1.1	0.6	69.0	72.5	7 050	7 350	56.5	5 750	6 000	8 200	52.3	48	1.19	135.2	131.7	149.8	156.6	127	158	160.5	1	0.6	7924U
7926U	130	180	24	1.5	1	85.0	90.5	8 650	9 250	72.5	7 400	5 500	7 600	56.9	63	1.57	146.9	143.0	163.2	170.8	138.5	171.5	174.5	1.5	1	7926U

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.8	1	0	0.39	0.76	1	0.78	0.63	1.24

Static equivalent radial load

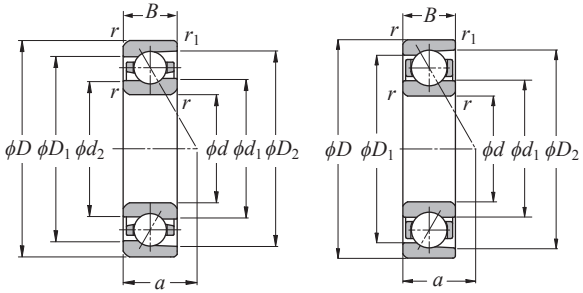
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.33	1	0.66

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Standard angular contact ball bearings (steel ball spec.) 70U type / 70 type



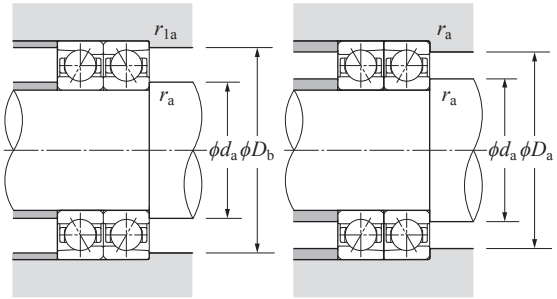
d =10–140 mm

d =150–200 mm

Contact angle 15° d 10–200 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7000UC	10	26	8	0.3	0.15	5.90	2.48	600	253	3.80	390	12.6	65 800	105 300	6.4	0.9	0.019	15.2	14.0	20.4	22.7	12.5	23.5	24.8	0.3	0.15	7000UC
7001UC	12	28	8	0.3	0.15	6.45	2.93	655	299	4.25	435	13.4	57 100	91 400	6.8	1.0	0.021	17.9	16.7	23.1	25.4	14.5	25.5	26.8	0.3	0.15	7001UC
7002UC	15	32	9	0.3	0.15	7.35	3.70	750	375	5.15	525	14.1	49 900	79 800	7.7	1.3	0.030	20.9	19.7	26.1	28.5	17.5	29.5	30.8	0.3	0.15	7002UC
7003UC	17	35	10	0.3	0.15	9.10	4.55	930	460	6.60	670	13.8	45 100	72 100	8.5	1.8	0.037	23.0	21.6	29.0	32.0	19.5	32.5	33.8	0.3	0.15	7003UC
7004UC	20	42	12	0.6	0.3	12.3	6.60	1 250	670	9.60	980	14.1	37 200	59 500	10.3	2.9	0.067	28.1	26.4	34.9	38.4	24.5	37.5	39.5	0.6	0.3	7004UC
7005UC	25	47	12	0.6	0.3	13.6	8.00	1 390	815	11.3	1 150	14.7	32 500	52 100	10.9	3.3	0.079	32.6	30.9	39.4	42.9	29.5	42.5	44.5	0.6	0.3	7005UC
7006UC	30	55	13	1	0.6	17.5	11.0	1 790	1 120	15.4	1 570	14.9	27 200	43 600	12.3	4.8	0.11	39.2	37.3	46.9	50.6	35.5	49.5	50.5	1	0.6	7006UC
7007UC	35	62	14	1	0.6	22.1	14.6	2 260	1 490	19.5	1 990	15.0	24 200	38 700	13.5	6.3	0.15	44.2	42.2	52.8	57.0	40.5	56.5	57.5	1	0.6	7007UC
7008UC	40	68	15	1	0.6	23.7	16.8	2 410	1 720	22.0	2 250	15.4	21 700	34 700	14.8	7.4	0.19	49.7	47.7	58.3	62.5	45.5	62.5	63.5	1	0.6	7008UC
7009UC	45	75	16	1	0.6	28.1	20.4	2 860	2 080	27.1	2 770	15.4	19 500	31 200	16.1	9.4	0.24	55.3	53.0	64.7	69.3	50.5	69.5	70.5	1	0.6	7009UC
7010UC	50	80	16	1	0.6	29.8	23.1	3 050	2 350	30.0	3 100	15.7	18 000	28 800	16.8	11	0.26	60.3	58.0	69.7	74.3	55.5	74.5	75.5	1	0.6	7010UC
7011UC	55	90	18	1.1	0.6	39.0	30.0	4 000	3 100	39.0	4 000	15.5	16 200	25 900	18.8	16	0.38	66.9	64.3	78.1	83.5	62	83	85.5	1	0.6	7011UC
7012UC	60	95	18	1.1	0.6	40.0	32.5	4 100	3 300	41.5	4 200	15.7	15 100	24 200	19.4	17	0.41	71.9	69.3	83.1	88.5	67	88	90.5	1	0.6	7012UC
7013UC	65	100	18	1.1	0.6	42.5	36.0	4 300	3 650	45.5	4 650	15.9	14 200	22 700	20.1	18	0.44	76.9	74.3	88.1	93.5	72	93	95.5	1	0.6	7013UC
7014UC	70	110	20	1.1	0.6	53.5	45.0	5 450	4 600	59.0	6 050	15.7	13 000	20 800	22.1	24	0.61	83.6	80.5	96.4	102.6	77	103	105.5	1	0.6	7014UC
7015UC	75	115	20	1.1	0.6	55.0	48.0	5 600	4 900	62.0	6 350	15.9	12 300	19 700	22.8	26	0.64	88.6	85.5	101.4	107.6	82	108	110.5	1	0.6	7015UC
7016UC	80	125	22	1.1	0.6	67.0	58.0	6 850	5 900	74.5	7 600	15.7	11 400	18 300	24.8	34	0.86	95.2	91.7	109.8	116.8	87	118	120.5	1	0.6	7016UC
7017UC	85	130	22	1.1	0.6	69.0	61.5	7 000	6 250	78.5	8 000	15.9	10 900	17 400	25.5	36	0.90	100.2	96.7	114.8	121.8	92	123	125.5	1	0.6	7017UC
7018UC	90	140	24	1.5	1	82.0	72.5	8 350	7 400	95.0	9 700	15.7	10 200	16 300	27.5	47	1.17	106.9	103.0	123.2	131.0	98.5	131.5	134.5	1.5	1	7018UC
7019UC	95	145	24	1.5	1	84.0	76.5	8 550	7 800	100	10 200	15.9	9 800	15 600	28.2	49	1.22	111.9	108.0	128.2	136.0	103.5	136.5	139.5	1.5	1	7019UC
7020UC	100	150	24	1.5	1	86.0	81.0	8 750	8 250	104	10 600	16.0	9 400	15 000	28.8	51	1.27	116.9	113.0	133.2	140.9	108.5	141.5	144.5	1.5	1	7020UC
7021UC	105	160	26	2	1	101	93.5	10 300	9 550	120	12 300	15.9	8 800	14 100	30.8	70	1.58	123.5	119.2	141.5	150.1	115	150	154.5	2	1	7021UC
7022UC	110	170	28	2	1	116	106	11 800	10 900	140	14 200	15.8	8 400	13 400	32.9	83	1.98	130.2	125.4	149.9	159.3	120	160	164.5	2	1	7022UC
7024UC	120	180	28	2	1	118	113	12 000	11 500	147	14 900	16.0	7 800	12 500	34.2	90	2.11	140.2	135.4	159.9	169.3	130	170	174.5	2	1	7024UC
7026UC	130	200	33	2	1	148	144	15 100	14 700	186	19 000	15.9	7 100	11 400	38.7	131	3.25	153.9	148.5	176.2	186.9	140	190	194.5	2	1	7026UC
7028UC	140	210	33	2	1	151	152	15 400	15 500	193	19 700	16.0	6 700	10 700	40.1	144	3.38	164.0	158.7	186.3	196.8	150	200	204.5	2	1	7028UC
7030CT1B	150	225	35	2.1	1.1	167	168	17 000	17 200	81.0	8 300	16.0	4 500	5 800	42.7	166	4.19	174.2	—	200.8	210.5	162	213	218	2	1	7030CT1B
7032CT1B	160	240	38	2.1	1.1	189	193	19 300	19 700	87.5	8 950	16.0	4 200	5 400	45.9	214	5.14	185.5	—	214.5	224.6	172	228	233	2	1	7032CT1B
7034CT1B	170	260	42	2.1	1.1	227	234	23 100	23 900	118	12 000	15.9	3 900	5 100	49.9	278	6.94	199.0	—	231.0	242.9	182	248	253	2	1	7034CT1B
7036CT1B	180	280	46	2.1	1.1	268	288	27 400	29 300	144	14 700	15.7	3 700	4 700	53.9	360	9.12	212.0	—	248.0	261.2	192	268	273	2	1	7036CT1B
7038CT1B	190	290	46	2.1	1.1	273	305	27 900	31 500	151	15 400	15.9	3 500	4 500	55.2	375	9.53	222.0	—	258.0	271.2	202	278	283	2	1	7038CT1B
7040CT1B	200	310	51	2.1	1.1	305	355	31 500	36 000	173	17 600	15.7	3 300	4 300	59.8	492	12.3	235.0	—	275.0	289.5	212	298	303	2	1	7040CT1B

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	$F_a/F_r \le e$ Y	$F_a/F_r > e$ X	$F_a/F_r > e$ Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	$F_a/F_r \le e$ Y	$F_a/F_r > e$ X	$F_a/F_r > e$ Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

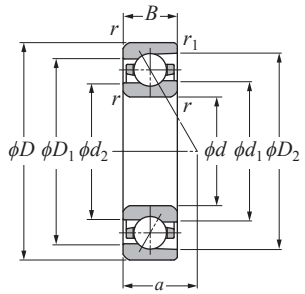
Single row / Tandem X_0	Single row / Tandem Y_0	Back-to-back / Face-to-face X_0	Back-to-back / Face-to-face Y_0
0.5	0.46	1	0.92

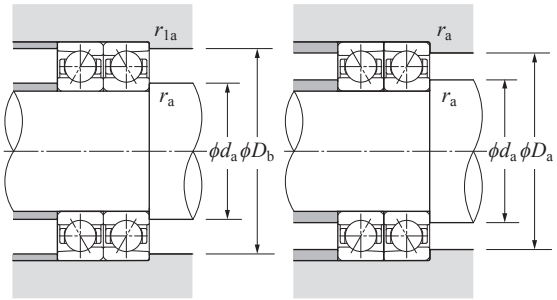
When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Remarks: A part number containing a suffix **U** means an **ULTAGE series**.

Main Spindle Bearings

ULTAGE Standard angular contact ball bearings (steel ball spec.) 70U type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

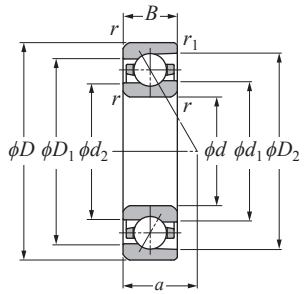
Contact angle 25° d 10–140 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}					a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7000UAD	10	26	8	0.3	0.15	5.70	2.40	580	244	2.77	283	57 000	92 100	8.2	0.9	0.019	15.2	14.0	20.4	22.7	12.5	23.5	24.8	0.3	0.15	7000UAD
7001UAD	12	28	8	0.3	0.15	6.20	2.82	630	287	3.10	315	49 500	80 000	8.8	1.0	0.021	17.9	16.7	23.1	25.4	14.5	25.5	26.8	0.3	0.15	7001UAD
7002UAD	15	32	9	0.3	0.15	7.00	3.55	715	360	3.75	380	43 200	69 800	10.0	1.3	0.030	20.9	19.7	26.1	28.5	17.5	29.5	30.8	0.3	0.15	7002UAD
7003UAD	17	35	10	0.3	0.15	8.75	4.35	890	445	4.85	495	39 000	63 100	11.1	1.8	0.037	23.0	21.6	29.0	32.0	19.5	32.5	33.8	0.3	0.15	7003UAD
7004UAD	20	42	12	0.6	0.3	11.8	6.30	1 200	645	7.10	720	32 200	52 100	13.4	2.9	0.067	28.1	26.4	34.9	38.3	24.5	37.5	39.5	0.6	0.3	7004UAD
7005UAD	25	47	12	0.6	0.3	13.0	7.65	1 320	780	8.30	845	28 200	45 600	14.5	3.3	0.079	32.6	30.9	39.4	42.8	29.5	42.5	44.5	0.6	0.3	7005UAD
7006UAD	30	55	13	1	0.6	16.7	10.5	1 700	1 070	11.5	1 170	23 600	38 100	16.6	4.8	0.11	39.2	37.3	46.9	50.6	35.5	49.5	50.5	1	0.6	7006UAD
7007UAD	35	62	14	1	0.6	21.0	13.9	2 140	1 420	14.3	1 460	20 900	33 800	18.4	6.3	0.15	44.2	42.2	52.8	56.9	40.5	56.5	57.5	1	0.6	7007UAD
7008UAD	40	68	15	1	0.6	22.5	16.0	2 290	1 630	16.1	1 650	18 800	30 400	20.2	7.4	0.19	49.7	47.7	58.3	62.5	45.5	62.5	63.5	1	0.6	7008UAD
7009UAD	45	75	16	1	0.6	26.6	19.4	2 710	1 980	19.9	2 030	16 900	27 300	22.1	9.4	0.24	55.3	53.0	64.7	69.3	50.5	69.5	70.5	1	0.6	7009UAD
7010UAD	50	80	16	1	0.6	28.2	21.9	2 880	2 230	22.2	2 260	15 600	25 200	23.2	11	0.26	60.3	58.0	69.7	74.3	55.5	74.5	75.5	1	0.6	7010UAD
7011UAD	55	90	18	1.1	0.6	37.0	28.7	3 800	2 930	28.6	2 920	14 000	22 600	26.0	16	0.38	66.9	64.3	78.1	83.5	62	83	85.5	1	0.6	7011UAD
7012UAD	60	95	18	1.1	0.6	38.0	30.5	3 900	3 150	30.0	3 100	13 100	21 200	27.2	17	0.41	71.9	69.3	83.1	88.4	67	88	90.5	1	0.6	7012UAD
7013UAD	65	100	18	1.1	0.6	40.0	34.0	4 100	3 500	33.5	3 400	12 300	19 900	28.3	18	0.44	76.9	74.3	88.1	93.4	72	93	95.5	1	0.6	7013UAD
7014UAD	70	110	20	1.1	0.6	51.0	43.0	5 200	4 350	43.5	4 450	11 300	18 200	31.1	24	0.61	83.6	80.5	96.4	102.6	77	103	105.5	1	0.6	7014UAD
7015UAD	75	115	20	1.1	0.6	52.0	45.5	5 300	4 650	45.5	4 650	10 700	17 300	32.3	26	0.64	88.6	85.5	101.4	107.6	82	108	110.5	1	0.6	7015UAD
7016UAD	80	125	22	1.1	0.6	63.5	55.0	6 500	5 600	55.0	5 600	9 900	16 000	35.0	34	0.86	95.2	91.7	109.8	116.8	87	118	120.5	1	0.6	7016UAD
7017UAD	85	130	22	1.1	0.6	65.0	58.5	6 650	5 950	57.5	5 850	9 400	15 300	36.2	36	0.90	100.2	96.7	114.8	121.7	92	123	125.5	1	0.6	7017UAD
7018UAD	90	140	24	1.5	1	77.5	69.0	7 900	7 050	70.0	7 150	8 800	14 300	39.0	47	1.17	106.9	103.0	123.2	130.9	98.5	131.5	134.5	1.5	1	7018UAD
7019UAD	95	145	24	1.5	1	79.5	73.0	8 100	7 400	73.5	7 500	8 500	13 700	40.1	49	1.22	111.9	108.0	128.2	135.9	103.5	136.5	139.5	1.5	1	7019UAD
7020UAD	100	150	24	1.5	1	81.0	76.5	8 300	7 800	77.0	7 850	8 100	13 100	41.3	51	1.27	116.9	113.0	133.2	140.9	108.5	141.5	144.5	1.5	1	7020UAD
7021UAD	105	160	26	2	1	95.0	89.0	9 700	9 050	88.0	9 000	7 700	12 400	44.1	70	1.58	123.5	119.2	141.5	150.1	115	150	154.5	2	1	7021UAD
7022UAD	110	170	28	2	1	109	101	11 200	10 300	103	10 500	7 300	11 700	46.8	83	1.98	130.2	125.4	149.9	159.2	120	160	164.5	2	1	7022UAD
7024UAD	120	180	28	2	1	111	107	11 400	10 900	108	11 000	6 800	10 900	49.2	90	2.11	140.2	135.4	159.9	169.2	130	170	174.5	2	1	7024UAD
7026UAD	130	200	33	2	1	140	136	14 200	13 900	137	14 000	6 200	9 900	55.2	131	3.25	153.9	148.5	176.2	186.8	140	190	194.5	2	1	7026UAD
7028UAD	140	210	33	2	1	142	144	14 500	14 700	141	14 400	5 800	9 300	57.5	144	3.38	164.0	158.7	186.3	196.8	150	200	204.5	2	1	7028UAD

1) Minimum allowable value for corner radius dimension r or r_1.

Main Spindle Bearings

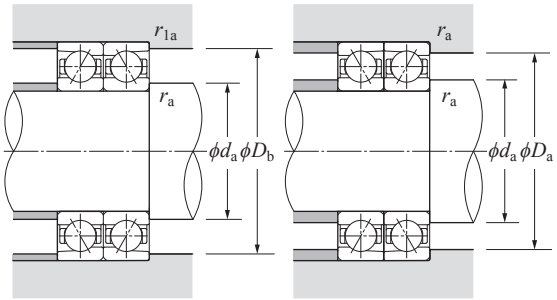
ULTAGE Standard angular contact ball bearings (steel ball spec.) 70U type



Contact angle 30° d 10–140 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)				a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7000U	10	26	8	0.3	0.15	5.55	2.33	565	238	2.12	216	48 200	65 700	9.2	0.9	0.019	15.2	14.0	20.4	22.7	12.5	23.5	24.8	0.3	0.15	7000U
7001U	12	28	8	0.3	0.15	6.00	2.74	615	279	2.37	242	41 900	57 100	10.0	1.0	0.021	17.9	16.7	23.1	25.4	14.5	25.5	26.8	0.3	0.15	7001U
7002U	15	32	9	0.3	0.15	6.80	3.45	690	350	2.86	292	36 600	49 800	11.3	1.3	0.030	20.9	19.7	26.1	28.4	17.5	29.5	30.8	0.3	0.15	7002U
7003U	17	35	10	0.3	0.15	8.45	4.20	865	430	3.70	380	33 000	45 000	12.6	1.8	0.037	23.0	21.6	29.0	31.9	19.5	32.5	33.8	0.3	0.15	7003U
7004U	20	42	12	0.6	0.3	11.4	6.10	1 160	620	5.45	560	27 300	37 200	15.2	2.9	0.067	28.1	26.4	34.9	38.3	24.5	37.5	39.5	0.6	0.3	7004U
7005U	25	47	12	0.6	0.3	12.5	7.40	1 280	755	6.40	655	23 900	32 500	16.5	3.3	0.079	32.6	30.9	39.4	42.8	29.5	42.5	44.5	0.6	0.3	7005U
7006U	30	55	13	1	0.6	16.1	10.2	1 640	1 040	8.90	910	20 000	27 200	19.0	4.8	0.11	39.2	37.3	46.9	50.6	35.5	49.5	50.5	1	0.6	7006U
7007U	35	62	14	1	0.6	20.3	13.4	2 070	1 370	11.0	1 120	17 700	24 100	21.1	6.3	0.15	44.2	42.2	52.8	56.9	40.5	56.5	57.5	1	0.6	7007U
7008U	40	68	15	1	0.6	21.6	15.4	2 200	1 570	12.4	1 260	15 900	21 700	23.2	7.4	0.19	49.7	47.7	58.3	62.4	45.5	62.5	63.5	1	0.6	7008U
7009U	45	75	16	1	0.6	25.6	18.7	2 610	1 910	15.4	1 570	14 300	19 500	25.4	9.4	0.24	55.3	53.0	64.7	69.3	50.5	69.5	70.5	1	0.6	7009U
7010U	50	80	16	1	0.6	27.1	21.1	2 760	2 150	17.1	1 740	13 200	18 000	26.9	11	0.26	60.3	58.0	69.7	74.3	55.5	74.5	75.5	1	0.6	7010U
7011U	55	90	18	1.1	0.6	35.5	27.7	3 650	2 830	22.0	2 240	11 900	16 200	30.1	16	0.38	66.9	64.3	78.1	83.4	62	83	85.5	1	0.6	7011U
7012U	60	95	18	1.1	0.6	36.5	29.5	3 750	3 000	23.2	2 360	11 100	15 100	31.5	17	0.41	71.9	69.3	83.1	88.4	67	88	90.5	1	0.6	7012U
7013U	65	100	18	1.1	0.6	38.5	33.0	3 950	3 350	25.5	2 600	10 400	14 200	32.9	18	0.44	76.9	74.3	88.1	93.4	72	93	95.5	1	0.6	7013U
7014U	70	110	20	1.1	0.6	49.0	41.5	5 000	4 200	33.5	3 450	9 500	13 000	36.1	24	0.61	83.6	80.5	96.4	102.5	77	103	105.5	1	0.6	7014U
7015U	75	115	20	1.1	0.6	50.0	43.5	5 100	4 450	35.0	3 600	9 000	12 300	37.6	26	0.64	88.6	85.5	101.4	107.5	82	108	110.5	1	0.6	7015U
7016U	80	125	22	1.1	0.6	61.0	53.0	6 250	5 400	42.0	4 300	8 400	11 400	40.8	34	0.86	95.2	91.7	109.8	116.7	87	118	120.5	1	0.6	7016U
7017U	85	130	22	1.1	0.6	62.5	56.0	6 350	5 700	44.0	4 500	8 000	10 900	42.2	36	0.90	100.2	96.7	114.8	121.7	92	123	125.5	1	0.6	7017U
7018U	90	140	24	1.5	1	74.5	66.5	7 600	6 750	54.0	5 500	7 500	10 200	45.4	47	1.17	106.9	103.0	123.2	130.8	98.5	131.5	134.5	1.5	1	7018U
7019U	95	145	24	1.5	1	76.5	70.0	7 800	7 150	56.5	5 800	7 200	9 800	46.8	49	1.22	111.9	108.0	128.2	135.8	103.5	136.5	139.5	1.5	1	7019U
7020U	100	150	24	1.5	1	78.0	74.0	7 950	7 500	59.5	6 050	6 900	9 400	48.3	51	1.27	116.9	113.0	133.2	140.8	108.5	141.5	144.5	1.5	1	7020U
7021U	105	160	26	2	1	91.5	85.5	9 300	8 750	68.0	6 900	6 500	8 800	51.5	70	1.58	123.5	119.2	141.5	150.0	115	150	154.5	2	1	7021U
7022U	110	170	28	2	1	105	97.5	10 700	9 950	79.5	8 100	6 100	8 400	54.6	83	1.98	130.2	125.4	149.9	159.1	120	160	164.5	2	1	7022U
7024U	120	180	28	2	1	107	103	10 900	10 500	83.5	8 500	5 700	7 800	57.5	90	2.11	140.2	135.4	159.9	169.1	130	170	174.5	2	1	7024U
7026U	130	200	33	2	1	134	131	13 700	13 400	106	10 800	5 200	7 100	64.4	131	3.25	153.9	148.5	176.2	186.7	140	190	194.5	2	1	7026U
7028U	140	210	33	2	1	137	139	13 900	14 100	109	11 100	4 900	6 700	67.3	144	3.38	164.0	158.7	186.3	196.7	150	200	204.5	2	1	7028U

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.8	1	0	0.39	0.76	1	0.78	0.63	1.24

Static equivalent radial load

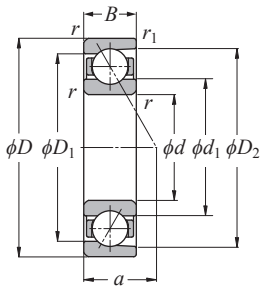
$P_{0r} = X_0 F_r + Y_0 F_a$

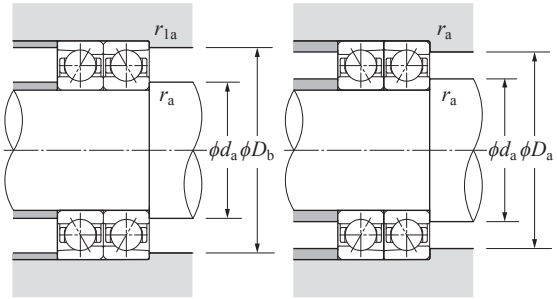
Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.33	1	0.66

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

Standard angular contact ball bearings (steel ball spec.) 72 type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.38	1	0	0.44	1.47	1	1.65	0.72	2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47				1.19		1.34		1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

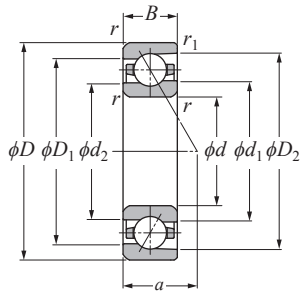
Contact angle 15° d 10–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7200C	10	30	9	0.6	0.3	6.00	2.64	610	269	1.01	103	13.4	42 900	55 600	7.3	0.9	0.029	17.4	23.5	25.5	14.5	25.5	27.8	0.6	0.3	**7200C**
7201C	12	32	10	0.6	0.3	7.85	3.45	800	355	1.59	162	12.9	40 000	51 800	8.0	1.3	0.036	18.4	25.6	27.8	16.5	27.5	29.5	0.6	0.3	**7201C**
7202C	15	35	11	0.6	0.3	9.95	4.50	1 020	460	1.89	193	12.9	35 200	45 600	8.9	1.5	0.045	20.8	29.0	31.6	19.5	30.5	32.5	0.6	0.3	**7202C**
7203C	17	40	12	0.6	0.3	12.4	5.75	1 260	590	2.67	272	13.0	30 500	39 600	9.9	2.1	0.062	24.2	33.2	36.2	21.5	35.5	37.5	0.6	0.3	**7203C**
7204C	20	47	14	1	0.6	16.2	8.15	1 650	835	3.70	375	13.4	25 500	33 000	11.6	3.1	0.10	29.4	39.4	42.8	25.5	41.5	42.5	1	0.6	**7204C**
7205C	25	52	15	1	0.6	18.4	10.2	1 870	1 050	3.75	385	14.0	22 600	29 200	12.7	4.1	0.12	33.8	44.2	47.3	30.5	46.5	47.5	1	0.6	**7205C**
7206C	30	62	16	1	0.6	25.5	14.7	2 600	1 500	7.10	725	14.0	18 900	24 500	14.3	6.6	0.19	40.6	52.2	56.4	35.5	56.5	57.5	1	0.6	**7206C**
7207C	35	72	17	1.1	0.6	33.5	19.9	3 450	2 030	10.6	1 090	13.9	16 400	21 300	15.7	8.8	0.27	46.8	60.2	65.0	42	65	67.5	1	0.6	**7207C**
7208C	40	80	18	1.1	0.6	40.5	25.2	4 100	2 570	14.4	1 470	14.2	14 700	19 000	17.1	11	0.35	53.0	67.0	72.3	47	73	75.5	1	0.6	**7208C**
7209C	45	85	19	1.1	0.6	45.0	28.8	4 600	2 940	14.8	1 510	14.2	13 500	17 500	18.2	14	0.40	57.3	72.5	78.1	52	78	80.5	1	0.6	**7209C**
7210C	50	90	20	1.1	0.6	47.5	31.5	4 850	3 250	15.3	1 560	14.5	12 600	16 300	19.4	17	0.45	62.2	77.6	83.2	57	83	85.5	1	0.6	**7210C**
7211C	55	100	21	1.5	1	58.5	40.0	6 000	4 100	21.6	2 200	14.5	11 400	14 700	20.9	21	0.59	69.0	86.0	92.3	63.5	91.5	94.5	1.5	1	**7211C**
7212C	60	110	22	1.5	1	71.0	49.5	7 250	5 050	26.1	2 660	14.5	10 200	13 200	22.6	28	0.76	77.0	96.0	102.9	68.5	101.5	104.5	1.5	1	**7212C**
7213C	65	120	23	1.5	1	77.5	55.0	7 900	5 600	28.5	2 910	14.6	9 500	12 300	23.9	34	0.95	82.5	102.5	109.7	73.5	111.5	114.5	1.5	1	**7213C**
7214C	70	125	24	1.5	1	84.0	60.0	8 600	6 150	31.0	3 150	14.6	9 000	11 700	25.1	40	1.04	87.0	108.0	115.5	78.5	116.5	119.5	1.5	1	**7214C**
7215C	75	130	25	1.5	1	88.0	65.5	8 950	6 700	33.5	3 400	14.8	8 500	11 000	26.4	43	1.14	93.0	114.0	121.5	83.5	121.5	124.5	1.5	1	**7215C**
7216C	80	140	26	2	1	103	77.5	10 500	7 900	34.5	3 550	14.7	8 000	10 400	27.8	54	1.39	98.1	121.4	129.6	90	130	134.5	2	1	**7216C**
7217C	85	150	28	2	1	115	90.5	11 800	9 200	46.5	4 750	14.9	7 500	9 700	29.9	63	1.73	106.1	129.9	138.5	95	140	144.5	2	1	**7217C**
7218C	90	160	30	2	1	136	105	13 900	10 700	53.5	5 450	14.6	7 000	9 100	31.8	80	2.13	111.6	138.5	147.9	100	150	154.5	2	1	**7218C**
7219C	95	170	32	2.1	1.1	154	120	15 700	12 200	62.0	6 350	14.6	6 600	8 600	33.8	96	2.58	118.2	146.8	157.0	107	158	163	2	1	**7219C**
7220C	100	180	34	2.1	1.1	165	127	16 800	12 900	67.0	6 800	14.5	6 300	8 100	35.8	119	3.21	124.8	155.2	166.2	112	168	173	2	1	**7220C**
7221CT1B	105	190	36	2.1	1.1	180	143	18 300	14 600	74.5	7 600	14.5	6 000	7 700	37.8	147	3.81	131.3	163.7	175.3	117	178	183	2	1	**7221CT1B**
7222CT1B	110	200	38	2.1	1.1	195	160	19 900	16 300	86.0	8 800	14.5	5 700	7 400	39.9	171	4.49	138.0	172.0	184.4	122	188	193	2	1	**7222CT1B**
7224CT1B	120	215	40	2.1	1.1	220	192	22 400	19 600	91.5	9 300	14.6	5 300	6 800	42.5	206	5.44	149.0	186.0	198.6	132	203	208	2	1	**7224CT1B**
7226CT1B	130	230	40	3	1.1	236	214	24 100	21 800	111	11 300	14.7	4 900	6 300	44.2	232	6.19	161.0	199.0	212.6	144	216	223	2.5	1	**7226CT1B**

1) Minimum allowable value for corner radius dimension r or r_1.

Main Spindle Bearings

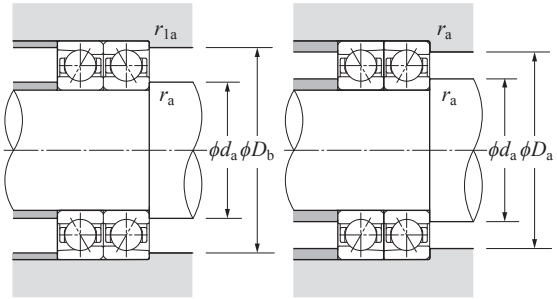
ULTAGE Standard angular contact ball bearings (ceramic ball spec.) 5S-79U type



Contact angle 15° d 10–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7900UC	10	22	6	0.3	0.15	3.55	1.15	360	117	1.94	198	9.8	84 000	136 800	5.2	0.4	0.009	14.3	13.5	17.7	19.4	12.5	19.5	20.8	0.3	0.15	5S-7900UC
5S-7901UC	12	24	6	0.3	0.15	3.70	1.29	380	131	2.18	223	10.2	74 600	121 600	5.4	0.4	0.010	16.3	15.5	19.7	21.3	14.5	21.5	22.8	0.3	0.15	5S-7901UC
5S-7902UC	15	28	7	0.3	0.15	5.65	2.01	575	205	3.40	345	10.0	62 500	101 900	6.4	0.8	0.013	19.3	18.3	23.7	25.6	17.5	25.5	26.8	0.3	0.15	5S-7902UC
5S-7903UC	17	30	7	0.3	0.15	5.90	2.22	605	226	3.75	385	10.3	57 200	93 200	6.7	0.8	0.015	21.3	20.3	25.7	27.8	19.5	27.5	28.8	0.3	0.15	5S-7903UC
5S-7904UC	20	37	9	0.3	0.15	8.45	3.40	865	345	5.75	585	10.3	47 100	76 800	8.3	1.5	0.033	25.9	24.7	31.1	33.6	22.5	34.5	35.8	0.3	0.15	5S-7904UC
5S-7905UC	25	42	9	0.3	0.15	9.05	4.00	925	405	6.80	695	10.7	40 100	65 400	9.0	1.8	0.039	30.9	29.7	36.1	38.6	27.5	39.5	40.8	0.3	0.15	5S-7905UC
5S-7906UC	30	47	9	0.3	0.15	9.55	4.60	975	470	7.85	800	11.0	34 900	56 900	9.7	2.0	0.044	35.9	34.7	41.1	43.6	32.5	44.5	45.8	0.3	0.15	5S-7906UC
5S-7907UC	35	55	10	0.6	0.3	15.2	7.10	1 550	725	12.1	1 240	10.7	29 900	48 700	11.1	3.4	0.062	41.6	39.9	48.4	51.7	39.5	50.5	52.5	0.6	0.3	5S-7907UC
5S-7908UC	40	62	12	0.6	0.3	16.0	8.15	1 640	830	13.9	1 420	11.0	26 300	42 900	12.9	4.7	0.10	47.6	45.9	54.4	57.8	44.5	57.5	59.5	0.6	0.3	5S-7908UC
5S-7909UC	45	68	12	0.6	0.3	19.9	10.3	2 030	1 050	17.6	1 790	11.0	23 800	38 800	13.6	5.9	0.11	52.7	50.8	60.4	64.1	49.5	63.5	65.5	0.6	0.3	5S-7909UC
5S-7910UC	50	72	12	0.6	0.3	21.0	11.5	2 140	1 180	19.7	2 010	11.1	22 000	35 900	14.2	6.2	0.11	57.2	55.3	64.9	68.6	54.5	67.5	69.5	0.6	0.3	5S-7910UC
5S-7911UC	55	80	13	1	0.6	21.8	12.8	2 230	1 310	22.0	2 240	11.3	19 900	32 400	15.6	7.5	0.16	63.7	61.8	71.4	75.1	60.5	74.5	75.5	1	0.6	5S-7911UC
5S-7912UC	60	85	13	1	0.6	22.7	14.1	2 320	1 440	24.2	2 460	11.4	18 500	30 200	16.3	8.0	0.17	68.7	66.8	76.4	80.1	65.5	79.5	80.5	1	0.6	5S-7912UC
5S-7913UC	65	90	13	1	0.6	23.0	14.7	2 350	1 500	25.4	2 590	11.4	17 300	28 300	16.9	8.6	0.19	73.7	71.8	81.4	85.1	70.5	84.5	85.5	1	0.6	5S-7913UC
5S-7914UC	70	100	16	1	0.6	33.0	20.9	3 350	2 140	36.0	3 650	11.4	15 800	25 800	19.4	14	0.30	80.3	78.0	89.7	94.3	75.5	94.5	95.5	1	0.6	5S-7914UC
5S-7915UC	75	105	16	1	0.6	33.5	22.0	3 400	2 240	37.5	3 850	11.5	14 900	24 300	20.1	15	0.32	85.3	83.0	94.7	99.3	80.5	99.5	100.5	1	0.6	5S-7915UC
5S-7916UC	80	110	16	1	0.6	34.0	22.7	3 450	2 320	39.5	4 000	11.4	14 100	22 900	20.8	16	0.33	90.8	88.5	100.2	104.8	85.5	104.5	105.5	1	0.6	5S-7916UC
5S-7917UC	85	120	18	1.1	0.6	45.5	30.5	4 650	3 100	52.0	5 350	11.4	13 100	21 400	22.8	22	0.47	96.9	94.3	108.1	113.4	92	113	115.5	1	0.6	5S-7917UC
5S-7918UC	90	125	18	1.1	0.6	46.0	32.0	4 700	3 250	54.5	5 550	11.5	12 500	20 400	23.5	23	0.49	101.9	99.3	113.1	118.4	97	118	120.5	1	0.6	5S-7918UC
5S-7919UC	95	130	18	1.1	0.6	47.0	33.0	4 750	3 350	57.0	5 800	11.4	11 900	19 500	24.1	24	0.52	106.9	104.3	118.1	123.4	102	123	125.5	1	0.6	5S-7919UC
5S-7920UC	100	140	20	1.1	0.6	60.0	42.5	6 150	4 300	72.5	7 400	11.4	11 200	18 200	26.1	33	0.70	113.6	110.5	126.4	132.6	107	133	135.5	1	0.6	5S-7920UC
5S-7921UC	105	145	20	1.1	0.6	61.0	44.0	6 250	4 500	75.5	7 700	11.5	10 800	17 500	26.8	34	0.73	118.6	115.5	131.4	137.6	112	138	140.5	1	0.6	5S-7921UC
5S-7922UC	110	150	20	1.1	0.6	62.0	45.5	6 300	4 650	78.5	8 050	11.4	10 300	16 800	27.5	36	0.76	123.6	120.5	136.4	142.6	117	143	145.5	1	0.6	5S-7922UC
5S-7924UC	120	165	22	1.1	0.6	76.5	56.5	7 800	5 750	97.0	9 900	11.5	9 400	15 400	30.2	48	1.03	135.2	131.7	149.8	156.7	127	158	160.5	1	0.6	5S-7924UC
5S-7926UC	130	180	24	1.5	1	94.0	70.5	9 600	7 200	121	12 300	11.5	8 700	14 100	32.9	63	1.34	146.9	143.0	163.2	170.9	138.5	171.5	174.5	1.5	1	5S-7926UC

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

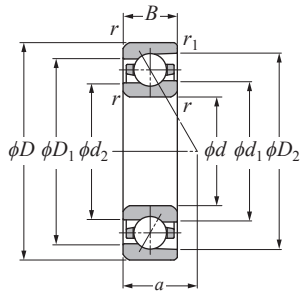
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

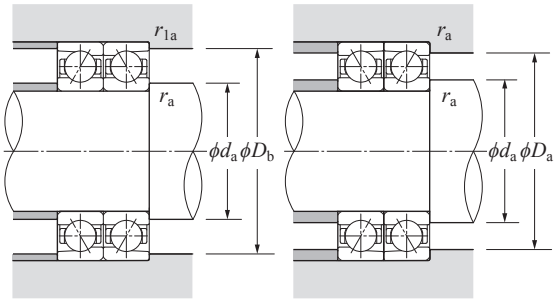
ULTAGE Standard angular contact ball bearings (ceramic ball spec.) 5S-79U type



Contact angle 25° d 10–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)				a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7900UAD	10	22	6	0.3	0.15	3.40	1.10	345	112	2.12	216	73 200	120 100	6.8	0.4	0.009	14.3	13.5	17.7	19.4	12.5	19.5	20.8	0.3	0.15	5S-7900UAD
5S-7901UAD	12	24	6	0.3	0.15	3.55	1.23	360	125	2.30	234	65 100	106 800	7.2	0.4	0.010	16.3	15.5	19.7	21.3	14.5	21.5	22.8	0.3	0.15	5S-7901UAD
5S-7902UAD	15	28	7	0.3	0.15	5.40	1.92	550	196	3.35	345	54 500	89 400	8.6	0.8	0.013	19.3	18.3	23.7	25.6	17.5	25.5	26.8	0.3	0.15	5S-7902UAD
5S-7903UAD	17	30	7	0.3	0.15	5.60	2.12	575	216	3.60	370	49 800	81 800	9.0	0.8	0.015	21.3	20.3	25.7	27.7	19.5	27.5	28.8	0.3	0.15	5S-7903UAD
5S-7904UAD	20	37	9	0.3	0.15	8.05	3.25	820	330	5.60	575	41 100	67 400	11.2	1.5	0.033	25.9	24.7	31.1	33.6	22.5	34.5	35.8	0.3	0.15	5S-7904UAD
5S-7905UAD	25	42	9	0.3	0.15	8.60	3.80	875	385	6.40	650	35 000	57 400	12.4	1.8	0.039	30.9	29.7	36.1	38.6	27.5	39.5	40.8	0.3	0.15	5S-7905UAD
5S-7906UAD	30	47	9	0.3	0.15	9.00	4.35	920	445	7.15	730	30 400	49 900	13.5	2.0	0.044	35.9	34.7	41.1	43.6	32.5	44.5	45.8	0.3	0.15	5S-7906UAD
5S-7907UAD	35	55	10	0.6	0.3	14.4	6.75	1 470	690	12.1	1 240	26 000	42 700	15.6	3.4	0.062	41.6	39.9	48.4	51.7	39.5	50.5	52.5	0.6	0.3	5S-7907UAD
5S-7908UAD	40	62	12	0.6	0.3	15.2	7.75	1 550	790	13.6	1 380	23 000	37 700	18.0	4.7	0.100	47.6	45.9	54.4	57.8	44.5	57.5	59.5	0.6	0.3	5S-7908UAD
5S-7909UAD	45	68	12	0.6	0.3	18.8	9.75	1 920	995	17.5	1 790	20 700	34 000	19.2	5.9	0.110	52.7	50.8	60.4	64.0	49.5	63.5	65.5	0.6	0.3	5S-7909UAD
5S-7910UAD	50	72	12	0.6	0.3	19.8	10.9	2 020	1 110	19.3	1 970	19 200	31 500	20.3	6.2	0.110	57.2	55.3	64.9	68.5	54.5	67.5	69.5	0.6	0.3	5S-7910UAD
5S-7911UAD	55	80	13	1	0.6	20.6	12.2	2 100	1 240	21.1	2 160	17 400	28 500	22.3	7.5	0.160	63.7	61.8	71.4	75.1	60.5	74.5	75.5	1	0.6	5S-7911UAD
5S-7912UAD	60	85	13	1	0.6	21.4	13.2	2 190	1 350	23.0	2 340	16 200	26 500	23.5	8.0	0.170	68.7	66.8	76.4	80.1	65.5	79.5	80.5	1	0.6	5S-7912UAD
5S-7913UAD	65	90	13	1	0.6	21.7	13.7	2 210	1 390	23.9	2 430	15 100	24 800	24.6	8.6	0.190	73.7	71.8	81.4	85.0	70.5	84.5	85.5	1	0.6	5S-7913UAD
5S-7914UAD	70	100	16	1	0.6	31.0	19.8	3 150	2 020	33.5	3 400	13 800	22 600	27.9	14	0.300	80.3	78	89.7	94.3	75.5	94.5	95.5	1	0.6	5S-7914UAD
5S-7915UAD	75	105	16	1	0.6	31.5	20.5	3 200	2 090	34.5	3 550	13 000	21 400	29.1	15	0.320	85.3	83	94.7	99.2	80.5	99.5	100.5	1	0.6	5S-7915UAD
5S-7916UAD	80	110	16	1	0.6	32.0	21.2	3 250	2 160	36.0	3 700	12 300	20 100	30.4	16	0.330	90.8	88.5	100.2	104.7	85.5	104.5	105.5	1	0.6	5S-7916UAD
5S-7917UAD	85	120	18	1.1	0.6	43.0	28.8	4 350	2 940	47.0	4 800	11 400	18 800	33.0	22	0.470	96.9	94.3	108.1	113.4	92	113	115.5	1	0.6	5S-7917UAD
5S-7918UAD	90	125	18	1.1	0.6	43.5	29.7	4 450	3 050	49.0	5 000	10 900	17 900	34.2	23	0.490	101.9	99.3	113.1	118.4	97	118	120.5	1	0.6	5S-7918UAD
5S-7919UAD	95	130	18	1.1	0.6	44.0	30.5	4 500	3 150	51.0	5 200	10 400	17 100	35.3	24	0.520	106.9	104.3	118.1	123.4	102	123	125.5	1	0.6	5S-7919UAD
5S-7920UAD	100	140	20	1.1	0.6	56.5	39.5	5 800	4 050	67.5	6 850	9 800	16 000	38.1	33	0.700	113.6	110.5	126.4	132.5	107	133	135.5	1	0.6	5S-7920UAD
5S-7921UAD	105	145	20	1.1	0.6	57.5	41.0	5 850	4 200	70.0	7 100	9 400	15 400	39.3	34	0.730	118.6	115.5	131.4	137.5	112	138	140.5	1	0.6	5S-7921UAD
5S-7922UAD	110	150	20	1.1	0.6	58.5	42.5	5 950	4 300	72.5	7 400	9 000	14 800	40.4	36	0.760	123.6	120.5	136.4	142.5	117	143	145.5	1	0.6	5S-7922UAD
5S-7924UAD	120	165	22	1.1	0.6	72.0	52.5	7 350	5 350	88.0	8 950	8 200	13 500	44.4	48	1.03	135.2	131.7	149.8	156.7	127	158	160.5	1	0.6	5S-7924UAD
5S-7926UAD	130	180	24	1.5	1	88.5	66.0	9 050	6 750	112	11 400	7 600	12 400	48.3	63	1.34	146.9	143	163.2	170.8	138.5	171.5	174.5	1.5	1	5S-7926UAD

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

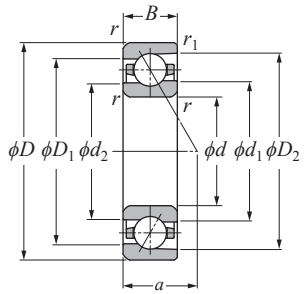
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

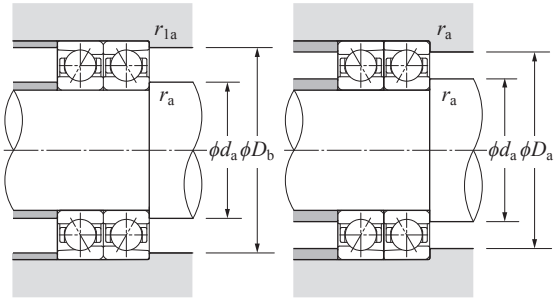
ULTAGE Standard angular contact ball bearings (ceramic ball spec.) 5S-79U type



Contact angle 30° d 10–130 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)				a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7900U	10	22	6	0.3	0.15	3.25	1.06	335	108	1.63	166	58 600	78 000	7.7	0.4	0.009	14.3	13.5	17.7	19.3	12.5	19.5	20.8	0.3	0.15	5S-7900U
5S-7901U	12	24	6	0.3	0.15	3.40	1.19	350	121	1.77	181	52 100	69 400	8.2	0.4	0.010	16.3	15.5	19.7	21.3	14.5	21.5	22.8	0.3	0.15	5S-7901U
5S-7902U	15	28	7	0.3	0.15	5.20	1.86	530	190	2.56	261	43 600	58 100	9.8	0.8	0.013	19.3	18.3	23.7	25.6	17.5	25.5	26.8	0.3	0.15	5S-7902U
5S-7903U	17	30	7	0.3	0.15	5.40	2.05	555	209	2.74	280	39 900	53 100	10.3	0.8	0.015	21.3	20.3	25.7	27.7	19.5	27.5	28.8	0.3	0.15	5S-7903U
5S-7904U	20	37	9	0.3	0.15	7.75	3.10	790	320	4.30	440	32 900	43 800	12.8	1.5	0.033	25.9	24.7	31.1	33.5	22.5	34.5	35.8	0.3	0.15	5S-7904U
5S-7905U	25	42	9	0.3	0.15	8.25	3.65	840	375	4.90	500	28 000	37 300	14.2	1.8	0.039	30.9	29.7	36.1	38.5	27.5	39.5	40.8	0.3	0.15	5S-7905U
5S-7906U	30	47	9	0.3	0.15	8.65	4.20	885	430	5.50	560	24 300	32 400	15.7	2.0	0.044	35.9	34.7	41.1	43.5	32.5	44.5	45.8	0.3	0.15	5S-7906U
5S-7907U	35	55	10	0.6	0.3	13.8	6.50	1 410	665	9.35	955	20 800	27 800	18.1	3.4	0.062	41.6	39.9	48.4	51.6	39.5	50.5	52.5	0.6	0.3	5S-7907U
5S-7908U	40	62	12	0.6	0.3	14.6	7.45	1 490	760	10.5	1 070	18 400	24 500	20.8	4.7	0.10	47.6	45.9	54.4	57.7	44.5	57.5	59.5	0.6	0.3	5S-7908U
5S-7909U	45	68	12	0.6	0.3	18.1	9.40	1 840	960	13.6	1 390	16 600	22 100	22.4	5.9	0.11	52.7	50.8	60.4	64.0	49.5	63.5	65.5	0.6	0.3	5S-7909U
5S-7910U	50	72	12	0.6	0.3	19.0	10.5	1 940	1 070	15.0	1 530	15 400	20 500	23.7	6.2	0.11	57.2	55.3	64.9	68.5	54.5	67.5	69.5	0.6	0.3	5S-7910U
5S-7911U	55	80	13	1	0.6	19.8	11.7	2 020	1 190	16.5	1 680	13 900	18 500	26.1	7.5	0.16	63.7	61.8	71.4	75.0	60.5	74.5	75.5	1	0.6	5S-7911U
5S-7912U	60	85	13	1	0.6	20.6	12.6	2 100	1 280	18.0	1 830	12 900	17 200	27.5	8.0	0.17	68.7	66.8	76.4	80.1	65.5	79.5	80.5	1	0.6	5S-7912U
5S-7913U	65	90	13	1	0.6	20.8	13.0	2 120	1 330	18.7	1 910	12 100	16 100	29.0	8.6	0.19	73.7	71.8	81.4	85.0	70.5	84.5	85.5	1	0.6	5S-7913U
5S-7914U	70	100	16	1	0.6	29.8	18.9	3 050	1 930	25.7	2 620	11 000	14 700	32.6	14	0.30	80.3	78.0	89.7	94.2	75.5	94.5	95.5	1	0.6	5S-7914U
5S-7915U	75	105	16	1	0.6	30.0	19.5	3 100	1 990	26.7	2 730	10 400	13 900	34.1	15	0.32	85.3	83.0	94.7	99.2	80.5	99.5	100.5	1	0.6	5S-7915U
5S-7916U	80	110	16	1	0.6	30.5	20.2	3 100	2 050	27.8	2 830	9 800	13 100	35.7	16	0.30	90.8	88.5	100.2	104.7	85.5	104.5	105.5	1	0.6	5S-7916U
5S-7917U	85	120	18	1.1	0.6	41.0	27.4	4 200	2 790	36.0	3 700	9 100	12 200	38.7	22	0.47	96.9	94.3	108.1	113.4	92	113	115.5	1	0.6	5S-7917U
5S-7918U	90	125	18	1.1	0.6	41.5	28.3	4 250	2 880	37.5	3 850	8 700	11 600	40.2	23	0.49	101.9	99.3	113.1	118.3	97	118	120.5	1	0.6	5S-7918U
5S-7919U	95	130	18	1.1	0.6	42.5	29.2	4 300	2 980	39.0	4 000	8 300	11 100	41.6	24	0.52	106.9	104.3	118.1	123.3	102	123	125.5	1	0.6	5S-7919U
5S-7920U	100	140	20	1.1	0.6	54.5	38.0	5 550	3 850	52.0	5 300	7 800	10 400	44.8	33	0.70	113.6	110.5	126.4	132.5	107	133	135.5	1	0.6	5S-7920U
5S-7921U	105	145	20	1.1	0.6	55.0	39.0	5 650	4 000	54.0	5 500	7 500	10 000	46.2	34	0.73	118.6	115.5	131.4	137.5	112	138	140.5	1	0.6	5S-7921U
5S-7922U	110	150	20	1.1	0.6	56.0	40.5	5 700	4 100	56.0	5 700	7 200	9 600	47.7	36	0.76	123.6	120.5	136.4	142.5	117	143	145.5	1	0.6	5S-7922U
5S-7924U	120	165	22	1.1	0.6	69.0	50.0	7 050	5 100	67.5	6 900	6 600	8 800	52.3	48	1.03	135.2	131.7	149.8	156.6	127	158	160.5	1	0.6	5S-7924U
5S-7926U	130	180	24	1.5	1	85.0	62.5	8 650	6 400	86.5	8 850	6 000	8 100	56.9	63	1.34	146.9	143.0	163.2	170.8	138.5	171.5	174.5	1.5	1	5S-7926U

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.8	1	0	0.39	0.76	1	0.78	0.63	1.24

Static equivalent radial load

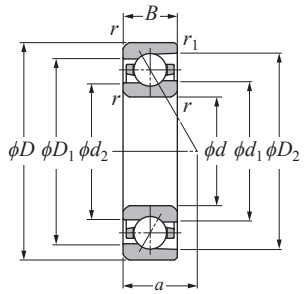
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.33	1	0.66

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

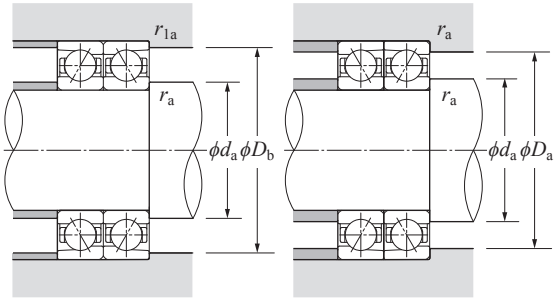
ULTAGE Standard angular contact ball bearings (ceramic ball spec.) 5S-70U type



Contact angle 15° d 10–140 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min⁻¹ grease lubrication	oil lubrication	Load center mm	Internal free space cm³	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7000UC	10	26	8	0.3	0.15	5.90	1.72	600	175	2.88	293	8.7	75 500	123 000	6.4	0.9	0.017	15.2	14.0	20.4	22.7	12.5	23.5	24.8	0.3	0.15	5S-7000UC
5S-7001UC	12	28	8	0.3	0.15	6.45	2.03	655	207	3.40	350	9.3	65 500	106 800	6.8	1.0	0.018	17.9	16.7	23.1	25.4	14.5	25.5	26.8	0.3	0.15	5S-7001UC
5S-7002UC	15	32	9	0.3	0.15	7.35	2.56	750	261	4.35	440	9.7	57 200	93 200	7.7	1.3	0.027	20.9	19.7	26.1	28.5	17.5	29.5	30.8	0.3	0.15	5S-7002UC
5S-7003UC	17	35	10	0.3	0.15	9.10	3.15	930	320	5.30	540	9.6	51 700	84 200	8.5	1.8	0.033	23.0	21.6	29.0	32.0	19.5	32.5	33.8	0.3	0.15	5S-7003UC
5S-7004UC	20	42	12	0.6	0.3	12.3	4.55	1 250	465	7.70	785	9.8	42 700	69 500	10.3	2.9	0.060	28.1	26.4	34.9	38.4	24.5	37.5	39.5	0.6	0.3	5S-7004UC
5S-7005UC	25	47	12	0.6	0.3	13.6	5.55	1 390	565	9.40	960	10.2	37 300	60 800	10.9	3.3	0.071	32.6	30.9	39.4	42.9	29.5	42.5	44.5	0.6	0.3	5S-7005UC
5S-7006UC	30	55	13	1	0.6	17.5	7.65	1 790	780	13.0	1 320	10.3	31 200	50 900	12.3	4.8	0.10	39.2	37.3	46.9	50.6	35.5	49.5	50.5	1	0.6	5S-7006UC
5S-7007UC	35	62	14	1	0.6	22.1	10.1	2 260	1 030	17.2	1 750	10.4	27 700	45 100	13.5	6.3	0.13	44.2	42.2	52.8	57.0	40.5	56.5	57.5	1	0.6	5S-7007UC
5S-7008UC	40	68	15	1	0.6	23.7	11.7	2 410	1 190	19.9	2 020	10.6	24 900	40 500	14.8	7.4	0.17	49.7	47.7	58.3	62.5	45.5	62.5	63.5	1	0.6	5S-7008UC
5S-7009UC	45	75	16	1	0.6	28.1	14.1	2 860	1 440	24.1	2 460	10.7	22 400	36 500	16.1	9.4	0.21	55.3	53.0	64.7	69.3	50.5	69.5	70.5	1	0.6	5S-7009UC
5S-7010UC	50	80	16	1	0.6	29.8	16.0	3 050	1 630	27.3	2 780	10.9	20 700	33 700	16.8	11	0.23	60.3	58.0	69.7	74.3	55.5	74.5	75.5	1	0.6	5S-7010UC
5S-7011UC	55	90	18	1.1	0.6	39.0	20.9	4 000	2 140	35.5	3 650	10.7	18 500	30 200	18.8	16	0.33	66.9	64.3	78.1	83.5	62	83	85.5	1	0.6	5S-7011UC
5S-7012UC	60	95	18	1.1	0.6	40.0	22.4	4 100	2 280	38.0	3 900	10.9	17 300	28 300	19.4	17	0.36	71.9	69.3	83.1	88.5	67	88	90.5	1	0.6	5S-7012UC
5S-7013UC	65	100	18	1.1	0.6	42.5	24.9	4 300	2 540	42.5	4 350	11.0	16 300	26 500	20.1	18	0.38	76.9	74.3	88.1	93.5	72	93	95.5	1	0.6	5S-7013UC
5S-7014UC	70	110	20	1.1	0.6	53.5	31.5	5 450	3 200	53.5	5 450	10.9	14 900	24 300	22.1	24	0.53	83.6	80.5	96.4	102.6	77	103	105.5	1	0.6	5S-7014UC
5S-7015UC	75	115	20	1.1	0.6	55.0	33.0	5 600	3 400	56.5	5 750	11.0	14 100	23 000	22.8	26	0.56	88.6	85.5	101.4	107.6	82	108	110.5	1	0.6	5S-7015UC
5S-7016UC	80	125	22	1.1	0.6	67.0	40.0	6 850	4 100	68.5	7 000	10.9	13 100	21 400	24.8	34	0.74	95.2	91.7	109.8	116.8	87	118	120.5	1	0.6	5S-7016UC
5S-7017UC	85	130	22	1.1	0.6	69.0	42.5	7 000	4 350	72.5	7 400	11.0	12 500	20 400	25.5	36	0.78	100.2	96.7	114.8	121.8	92	123	125.5	1	0.6	5S-7017UC
5S-7018UC	90	140	24	1.5	1	82.0	50.5	8 350	5 150	86.0	8 750	10.9	11 700	19 000	27.5	47	1.00	106.9	103.0	123.2	131.0	98.5	131.5	134.5	1.5	1	5S-7018UC
5S-7019UC	95	145	24	1.5	1	84.0	53.0	8 550	5 400	90.5	9 250	11.0	11 200	18 200	28.2	49	1.04	111.9	108.0	128.2	136.0	103.5	136.5	139.5	1.5	1	5S-7019UC
5S-7020UC	100	150	24	1.5	1	86.0	56.0	8 750	5 700	95.5	9 750	11.1	10 800	17 500	28.8	51	1.09	116.9	113.0	133.2	140.9	108.5	141.5	144.5	1.5	1	5S-7020UC
5S-7021UC	105	160	26	2	1	101	65.0	10 300	6 600	111	11 300	11.0	10 100	16 500	30.8	70	1.34	123.5	119.2	141.5	150.1	115	150	154.5	2	1	5S-7021UC
5S-7022UC	110	170	28	2	1	116	74.0	11 800	7 500	126	12 800	10.9	9 600	15 600	32.9	83	1.69	130.2	125.4	149.9	159.3	120	160	164.5	2	1	5S-7022UC
5S-7024UC	120	180	28	2	1	118	78.5	12 000	8 000	134	13 600	11.1	9 000	14 600	34.2	90	1.80	140.2	135.4	159.9	169.3	130	170	174.5	2	1	5S-7024UC
5S-7026UC	130	200	33	2	1	148	99.5	15 100	10 200	170	17 300	11.0	8 100	13 300	38.7	131	2.80	153.9	148.5	176.2	186.9	140	190	194.5	2	1	5S-7026UC
5S-7028UC	140	210	33	2	1	151	105	15 400	10 700	179	18 300	11.1	7 600	12 500	40.1	144	2.90	164.0	158.7	186.3	196.8	150	200	204.5	2	1	5S-7028UC

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

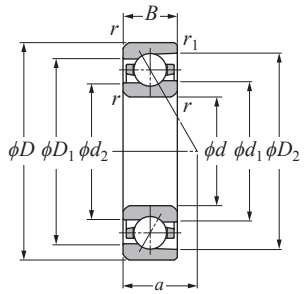
Main Spindle Bearings

Angular Contact Ball Bearings for Radial Loads

Dimension Tables

NTN

ULTAGE Standard angular contact ball bearings (ceramic ball spec.) 5S-70U type

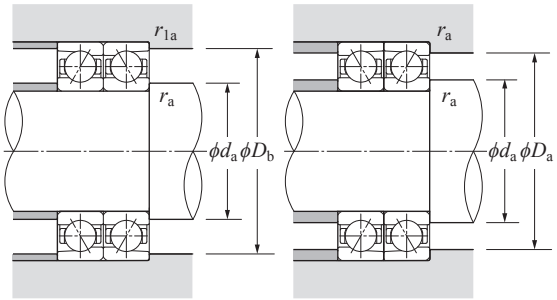


Contact angle 25° d 10–140 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	Allowable axial load kgf (static)	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}					a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7000UAD	10	26	8	0.3	0.15	5.70	1.66	580	169	3.30	340	65 800	107 900	8.2	0.9	0.017	15.2	14.0	20.4	22.7	12.5	23.5	24.8	0.3	0.15	5S-7000UAD
5S-7001UAD	12	28	8	0.3	0.15	6.20	1.95	630	199	3.70	380	57 100	93 700	8.8	1.0	0.018	17.9	16.7	23.1	25.4	14.5	25.5	26.8	0.3	0.15	5S-7001UAD
5S-7002UAD	15	32	9	0.3	0.15	7.00	2.45	715	250	4.45	455	49 800	81 800	10.0	1.3	0.027	20.9	19.7	26.1	28.5	17.5	29.5	30.8	0.3	0.15	5S-7002UAD
5S-7003UAD	17	35	10	0.3	0.15	8.75	3.00	890	305	5.80	590	45 000	73 900	11.1	1.8	0.033	23.0	21.6	29.0	32.0	19.5	32.5	33.8	0.3	0.15	5S-7003UAD
5S-7004UAD	20	42	12	0.6	0.3	11.8	4.35	1 200	445	8.45	865	37 200	61 000	13.4	2.9	0.060	28.1	26.4	34.9	38.3	24.5	37.5	39.5	0.6	0.3	5S-7004UAD
5S-7005UAD	25	47	12	0.6	0.3	13.0	5.30	1 320	540	9.90	1 010	32 500	53 400	14.5	3.3	0.071	32.6	30.9	39.4	42.8	29.5	42.5	44.5	0.6	0.3	5S-7005UAD
5S-7006UAD	30	55	13	1	0.6	16.7	7.30	1 700	745	13.8	1 400	27 200	44 700	16.6	4.8	0.10	39.2	37.3	46.9	50.6	35.5	49.5	50.5	1	0.6	5S-7006UAD
5S-7007UAD	35	62	14	1	0.6	21.0	9.65	2 140	980	17.1	1 740	24 100	39 600	18.4	6.3	0.13	44.2	42.2	52.8	56.9	40.5	56.5	57.5	1	0.6	5S-7007UAD
5S-7008UAD	40	68	15	1	0.6	22.5	11.1	2 290	1 130	19.3	1 970	21 700	35 600	20.2	7.4	0.17	49.7	47.7	58.3	62.5	45.5	62.5	63.5	1	0.6	5S-7008UAD
5S-7009UAD	45	75	16	1	0.6	26.6	13.4	2 710	1 370	23.8	2 430	19 500	32 000	22.1	9.4	0.21	55.3	53.0	64.7	69.3	50.5	69.5	70.5	1	0.6	5S-7009UAD
5S-7010UAD	50	80	16	1	0.6	28.2	15.2	2 880	1 550	26.5	2 710	18 000	29 600	23.2	11	0.23	60.3	58.0	69.7	74.3	55.5	74.5	75.5	1	0.6	5S-7010UAD
5S-7011UAD	55	90	18	1.1	0.6	37.0	19.9	3 800	2 030	34.5	3 500	16 200	26 500	26.0	16	0.33	66.9	64.3	78.1	83.5	62	83	85.5	1	0.6	5S-7011UAD
5S-7012UAD	60	95	18	1.1	0.6	38.0	21.2	3 900	2 170	36.0	3 700	15 100	24 800	27.2	17	0.36	71.9	69.3	83.1	88.4	67	88	90.5	1	0.6	5S-7012UAD
5S-7013UAD	65	100	18	1.1	0.6	40.0	23.6	4 100	2 410	40.0	4 050	14 200	23 300	28.3	18	0.38	76.9	74.3	88.1	93.4	72	93	95.5	1	0.6	5S-7013UAD
5S-7014UAD	70	110	20	1.1	0.6	51.0	29.7	5 200	3 050	52.0	5 300	13 000	21 400	31.1	24	0.53	83.6	80.5	96.4	102.6	77	103	105.5	1	0.6	5S-7014UAD
5S-7015UAD	75	115	20	1.1	0.6	52.0	31.5	5 300	3 200	54.5	5 550	12 300	20 200	32.3	26	0.56	88.6	85.5	101.4	107.6	82	108	110.5	1	0.6	5S-7015UAD
5S-7016UAD	80	125	22	1.1	0.6	63.5	38.0	6 500	3 900	65.5	6 700	11 400	18 800	35.0	34	0.74	95.2	91.7	109.8	116.8	87	118	120.5	1	0.6	5S-7016UAD
5S-7017UAD	85	130	22	1.1	0.6	65.0	40.5	6 650	4 100	68.5	7 000	10 900	17 900	36.2	36	0.78	100.2	96.7	114.8	121.7	92	123	125.5	1	0.6	5S-7017UAD
5S-7018UAD	90	140	24	1.5	1	77.5	48.0	7 900	4 850	84.0	8 550	10 200	16 700	39.0	47	1.00	106.9	103.0	123.2	130.9	98.5	131.5	134.5	1.5	1	5S-7018UAD
5S-7019UAD	95	145	24	1.5	1	79.5	50.5	8 100	5 150	88.0	8 950	9 800	16 000	40.1	49	1.04	111.9	108.0	128.2	135.9	103.5	136.5	139.5	1.5	1	5S-7019UAD
5S-7020UAD	100	150	24	1.5	1	81.0	53.0	8 300	5 400	92.0	9 350	9 400	15 400	41.3	51	1.09	116.9	113.0	133.2	140.9	108.5	141.5	144.5	1.5	1	5S-7020UAD
5S-7021UAD	105	160	26	2	1	95.0	61.5	9 700	6 300	106	10 800	8 800	14 500	44.1	70	1.34	123.5	119.2	141.5	150.1	115	150	154.5	2	1	5S-7021UAD
5S-7022UAD	110	170	28	2	1	109	70.0	11 200	7 150	123	12 500	8 400	13 700	46.8	83	1.69	130.2	125.4	149.9	159.2	120	160	164.5	2	1	5S-7022UAD
5S-7024UAD	120	180	28	2	1	111	74.5	11 400	7 600	129	13 200	7 800	12 800	49.2	90	1.80	140.2	135.4	159.9	169.2	130	170	174.5	2	1	5S-7024UAD
5S-7026UAD	130	200	33	2	1	140	94.5	14 200	9 650	164	16 700	7 100	11 600	55.2	131	2.80	153.9	148.5	176.2	186.8	140	190	194.5	2	1	5S-7026UAD
5S-7028UAD	140	210	33	2	1	142	100	14 500	10 200	170	17 300	6 700	11 000	57.5	144	2.90	164.0	158.7	186.3	196.8	150	200	204.5	2	1	5S-7028UAD

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

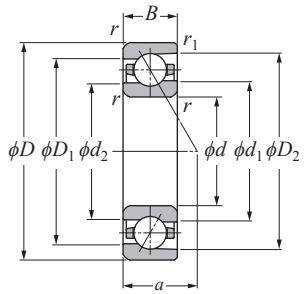
Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

ULTAGE Standard angular contact ball bearings (ceramic ball spec.) 5S-70U type

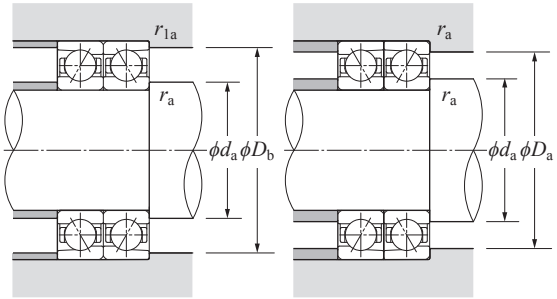


Contact angle 30° d 10–140 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)				a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7000U	10	26	8	0.3	0.15	5.55	1.62	565	165	2.54	259	52 600	70 100	9.2	0.9	0.017	15.2	14.0	20.4	22.7	12.5	23.5	24.8	0.3	0.15	5S-7000U
5S-7001U	12	28	8	0.3	0.15	6.00	1.90	615	193	2.84	289	45 700	60 900	10.0	1.0	0.018	17.9	16.7	23.1	25.4	14.5	25.5	26.8	0.3	0.15	5S-7001U
5S-7002U	15	32	9	0.3	0.15	6.80	2.38	690	242	3.40	350	39 900	53 100	11.3	1.3	0.027	20.9	19.7	26.1	28.4	17.5	29.5	30.8	0.3	0.15	5S-7002U
5S-7003U	17	35	10	0.3	0.15	8.45	2.92	865	298	4.45	455	36 000	48 000	12.6	1.8	0.033	23.0	21.6	29.0	31.9	19.5	32.5	33.8	0.3	0.15	5S-7003U
5S-7004U	20	42	12	0.6	0.3	11.4	4.25	1 160	430	6.55	670	29 700	39 600	15.2	2.9	0.060	28.1	26.4	34.9	38.3	24.5	37.5	39.5	0.6	0.3	5S-7004U
5S-7005U	25	47	12	0.6	0.3	12.5	5.10	1 280	520	7.65	780	26 000	34 700	16.5	3.3	0.071	32.6	30.9	39.4	42.8	29.5	42.5	44.5	0.6	0.3	5S-7005U
5S-7006U	30	55	13	1	0.6	16.1	7.05	1 640	715	10.7	1 090	21 800	29 000	19.0	4.8	0.10	39.2	37.3	46.9	50.6	35.5	49.5	50.5	1	0.6	5S-7006U
5S-7007U	35	62	14	1	0.6	20.3	9.30	2 070	950	13.2	1 340	19 300	25 700	21.1	6.3	0.13	44.2	42.2	52.8	56.9	40.5	56.5	57.5	1	0.6	5S-7007U
5S-7008U	40	68	15	1	0.6	21.6	10.7	2 200	1 090	14.8	1 510	17 400	23 100	23.2	7.4	0.17	49.7	47.7	58.3	62.4	45.5	62.5	63.5	1	0.6	5S-7008U
5S-7009U	45	75	16	1	0.6	25.6	13.0	2 610	1 320	18.4	1 870	15 600	20 800	25.4	9.4	0.21	55.3	53.0	64.7	69.3	50.5	69.5	70.5	1	0.6	5S-7009U
5S-7010U	50	80	16	1	0.6	27.1	14.6	2 760	1 490	20.5	2 090	14 400	19 200	26.9	11	0.23	60.3	58.0	69.7	74.3	55.5	74.5	75.5	1	0.6	5S-7010U
5S-7011U	55	90	18	1.1	0.6	35.5	19.2	3 650	1 960	26.3	2 680	12 900	17 200	30.1	16	0.33	66.9	64.3	78.1	83.4	62	83	85.5	1	0.6	5S-7011U
5S-7012U	60	95	18	1.1	0.6	36.5	20.5	3 750	2 090	27.7	2 830	12 100	16 100	31.5	17	0.36	71.9	69.3	83.1	88.4	67	88	90.5	1	0.6	5S-7012U
5S-7013U	65	100	18	1.1	0.6	38.5	22.8	3 950	2 320	30.5	3 100	11 400	15 100	32.9	18	0.38	76.9	74.3	88.1	93.4	72	93	95.5	1	0.6	5S-7013U
5S-7014U	70	110	20	1.1	0.6	49.0	28.6	5 000	2 920	40.0	4 100	10 400	13 900	36.1	24	0.53	83.6	80.5	96.4	102.5	77	103	105.5	1	0.6	5S-7014U
5S-7015U	75	115	20	1.1	0.6	50.0	30.5	5 100	3 100	42.0	4 300	9 900	13 100	37.6	26	0.56	88.6	85.5	101.4	107.5	82	108	110.5	1	0.6	5S-7015U
5S-7016U	80	125	22	1.1	0.6	61.0	37.0	6 250	3 750	50.5	5 150	9 100	12 200	40.8	34	0.74	95.2	91.7	109.8	116.7	87	118	120.5	1	0.6	5S-7016U
5S-7017U	85	130	22	1.1	0.6	62.5	39.0	6 350	3 950	53.0	5 400	8 700	11 600	42.2	36	0.78	100.2	96.7	114.8	121.7	92	123	125.5	1	0.6	5S-7017U
5S-7018U	90	140	24	1.5	1	74.5	46.0	7 600	4 700	64.5	6 600	8 200	10 900	45.4	47	1.00	106.9	103.0	123.2	130.8	98.5	131.5	134.5	1.5	1	5S-7018U
5S-7019U	95	145	24	1.5	1	76.5	48.5	7 800	4 950	68.0	6 900	7 800	10 400	46.8	49	1.04	111.9	108.0	128.2	135.8	103.5	136.5	139.5	1.5	1	5S-7019U
5S-7020U	100	150	24	1.5	1	78.0	51.0	7 950	5 200	71.0	7 250	7 500	10 000	48.3	51	1.09	116.9	113.0	133.2	140.8	108.5	141.5	144.5	1.5	1	5S-7020U
5S-7021U	105	160	26	2	1	91.5	59.5	9 300	6 050	81.0	8 300	7 100	9 400	51.5	70	1.34	123.5	119.2	141.5	150.0	115	150	154.5	2	1	5S-7021U
5S-7022U	110	170	28	2	1	105	67.5	10 700	6 900	95.0	9 700	6 700	8 900	54.6	83	1.69	130.2	125.4	149.9	159.1	120	160	164.5	2	1	5S-7022U
5S-7024U	120	180	28	2	1	107	71.5	10 900	7 300	99.5	10 200	6 200	8 300	57.5	90	1.80	140.2	135.4	159.9	169.1	130	170	174.5	2	1	5S-7024U
5S-7026U	130	200	33	2	1	134	91.0	13 700	9 300	126	12 900	5 700	7 600	64.4	131	2.80	153.9	148.5	176.2	186.7	140	190	194.5	2	1	5S-7026U
5S-7028U	140	210	33	2	1	137	96.0	13 900	9 800	130	13 300	5 300	7 100	67.3	144	2.90	164.0	158.7	186.3	196.7	150	200	204.5	2	1	5S-7028U

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.8	1	0	0.39	0.76	1	0.78	0.63	1.24

Static equivalent radial load

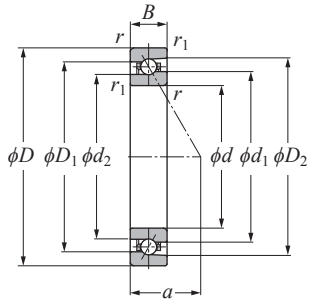
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.33	1	0.66

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (steel ball spec.) 2LA-HSE9U type

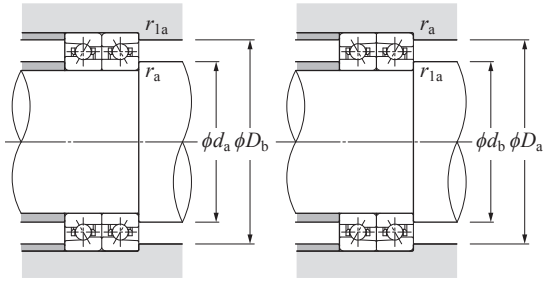


Contact angle 15° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	Allowable axial load kgf (static)	Factor	Allowable speed min^{-1} grease lubrication	Allowable speed min^{-1} oil lubrication	Load center mm	Internal free space cm^3 Single-row (approx.)	Mass kg Single-row (approx.)	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_r	C_{0r}			f_0			*a*			d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
2LA-HSE910UC	50	72	12	0.6	0.3	12.1	8.10	1 240	830	11.8	1 210	10.9	21 800	34 600	14.2	6.0	0.13	57.6	56.6	64.4	66.8	54.5	52.5	67.5	69.5	0.6	0.3
2LA-HSE911UC	55	80	13	1	0.6	15.1	10.1	1 540	1 030	14.8	1 510	10.8	19 700	31 300	15.6	7.7	0.18	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
2LA-HSE912UC	60	85	13	1	0.6	15.7	11.1	1 600	1 130	16.2	1 660	10.9	18 300	29 100	16.3	8.3	0.20	68.6	67.4	76.4	79.1	65.5	64.5	79.5	80.5	1	0.6
2LA-HSE913UC	65	90	13	1	0.6	15.8	11.6	1 620	1 180	17.0	1 740	11.0	17 200	27 200	17.0	8.9	0.21	73.6	72.4	81.4	84.1	70.5	69.5	84.5	85.5	1	0.6
2LA-HSE914UC	70	100	16	1	0.6	23.2	16.5	2 370	1 680	24.2	2 470	10.9	15 600	24 800	19.5	14	0.34	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
2LA-HSE915UC	75	105	16	1	0.6	24.1	18.0	2 460	1 830	26.3	2 690	10.9	14 800	23 400	20.1	15	0.36	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
2LA-HSE916UC	80	110	16	1	0.6	24.4	18.8	2 490	1 910	27.5	2 810	11.0	14 000	22 200	20.8	16	0.38	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
2LA-HSE917UC	85	120	18	1.1	0.6	33.0	24.8	3 350	2 520	36.0	3 700	10.9	13 000	20 600	22.8	22	0.54	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
2LA-HSE918UC	90	125	18	1.1	0.6	34.5	26.8	3 500	2 740	39.0	4 000	10.9	12 400	19 600	23.5	23	0.56	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
2LA-HSE919UC	95	130	18	1.1	0.6	35.0	27.9	3 550	2 850	40.5	4 150	11.0	11 800	18 800	24.2	24	0.59	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
2LA-HSE920UC	100	140	20	1.1	0.6	40.5	32.5	4 100	3 350	48.0	4 900	11.0	11 100	17 600	26.2	32	0.82	113.8	111.7	126.2	130.7	107	104.5	133	135.5	1	0.6
2LA-HSE921UC	105	145	20	1.1	0.6	41.0	34.0	4 150	3 450	50.0	5 100	11.0	10 600	16 900	26.9	33	0.85	118.8	116.7	131.2	135.7	112	109.5	138	140.5	1	0.6
2LA-HSE922UC	110	150	20	1.1	0.6	41.5	35.5	4 200	3 600	51.0	5 250	11.1	10 200	16 200	27.5	35	0.88	123.8	121.7	136.2	140.7	117	114.5	143	145.5	1	0.6
2LA-HSE924UC	120	165	22	1.1	0.6	53.0	45.0	5 400	4 600	66.0	6 750	11.0	9 300	14 800	30.2	47	1.20	135.4	133.0	149.6	154.8	127	124.5	158	160.5	1	0.6
2LA-HSE926UC	130	180	24	1.5	1	65.5	56.0	6 700	5 700	81.5	8 350	11.0	8 600	13 600	32.9	62	1.56	146.9	144.2	163.1	168.9	138.5	135.5	171.5	174.5	1.5	1
2LA-HSE928UC	140	190	24	1.5	1	66.0	58.0	6 750	5 950	85.0	8 700	11.0	8 100	12 800	34.3	66	1.66	156.9	154.2	173.1	178.9	148.5	145.5	181.5	184.5	1.5	1
2LA-HSE930UC	150	210	28	2	1	88.0	77.0	8 950	7 850	112	11 500	10.9	7 400	11 700	38.3	99	2.58	170.5	167.3	189.5	196.4	160	155.5	200	204.5	2	1
2LA-HSE932UC	160	220	28	2	1	89.0	80.5	9 050	8 200	117	12 000	11.0	7 000	11 100	39.6	105	2.71	180.5	177.3	199.5	206.3	170	165.5	210	214.5	2	1
2LA-HSE934UC	170	230	28	2	1	89.5	83.5	9 150	8 500	122	12 500	11.1	6 700	10 600	41.0	111	2.84	190.5	187.3	209.5	216.3	180	175.5	220	224.5	2	1

1) Minimum allowable value for corner radius dimension *r* or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	*e*	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

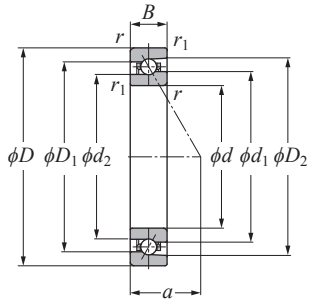
$P_{0r} = X_0 F_r + Y_0 F_a$

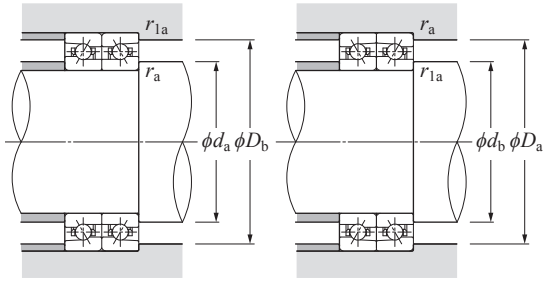
Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (steel ball spec.) 2LA-HSE9U type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

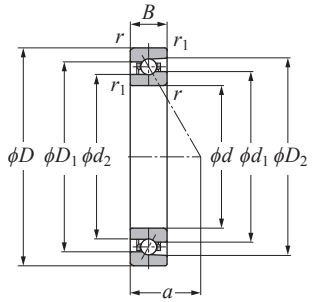
Contact angle 20° d 50–170 mm

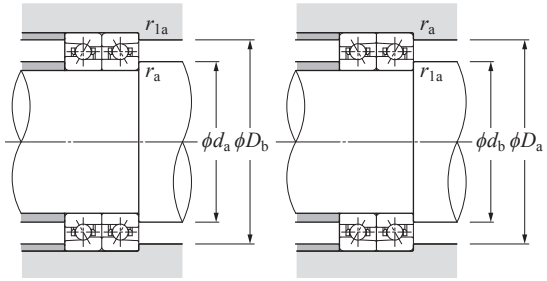
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}					a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
2LA-HSE910U	50	72	12	0.6	0.3	11.8	7.95	1 210	810	13.2	1 350	23 100	37 200	17.2	6.0	0.13	57.6	56.6	64.4	66.8	54.5	52.5	67.5	69.5	0.6	0.3
2LA-HSE911U	55	80	13	1	0.6	14.7	9.90	1 500	1 010	16.5	1 690	20 800	33 600	18.9	7.7	0.18	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
2LA-HSE912U	60	85	13	1	0.6	15.3	10.8	1 560	1 100	18.1	1 850	19 400	31 300	19.8	8.3	0.20	68.6	67.4	76.4	79.1	65.5	64.5	79.5	80.5	1	0.6
2LA-HSE913U	65	90	13	1	0.6	15.4	11.3	1 570	1 150	18.9	1 930	18 200	29 300	20.7	8.9	0.21	73.6	72.4	81.4	84.0	70.5	69.5	84.5	85.5	1	0.6
2LA-HSE914U	70	100	16	1	0.6	22.6	16.1	2 310	1 640	26.9	2 750	16 600	26 700	23.6	14	0.34	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
2LA-HSE915U	75	105	16	1	0.6	23.5	17.5	2 390	1 790	29.4	3 000	15 600	25 200	24.5	15	0.36	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
2LA-HSE916U	80	110	16	1	0.6	23.7	18.3	2 420	1 870	30.0	3 100	14 800	23 900	25.4	16	0.38	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
2LA-HSE917U	85	120	18	1.1	0.6	32.0	24.2	3 300	2 470	40.0	4 100	13 700	22 100	27.8	22	0.54	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
2LA-HSE918U	90	125	18	1.1	0.6	33.5	26.2	3 400	2 670	43.5	4 450	13 100	21 100	28.7	23	0.56	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
2LA-HSE919U	95	130	18	1.1	0.6	34.0	27.3	3 450	2 780	45.5	4 650	12 500	20 200	29.6	24	0.59	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
2LA-HSE920U	100	140	20	1.1	0.6	39.5	32.0	4 000	3 250	53.0	5 450	11 700	18 900	32.0	32	0.82	113.8	111.7	126.2	130.6	107	104.5	133	135.5	1	0.6
2LA-HSE921U	105	145	20	1.1	0.6	40.0	33.0	4 050	3 400	55.0	5 650	11 300	18 200	32.9	33	0.85	118.8	116.7	131.2	135.6	112	109.5	138	140.5	1	0.6
2LA-HSE922U	110	150	20	1.1	0.6	40.0	34.5	4 100	3 500	57.0	5 850	10 800	17 500	33.8	35	0.88	123.8	121.7	136.2	140.6	117	114.5	143	145.5	1	0.6
2LA-HSE924U	120	165	22	1.1	0.6	51.5	44.0	5 250	4 500	74.0	7 550	9 900	15 900	37.1	47	1.20	135.4	133.0	149.6	154.7	127	124.5	158	160.5	1	0.6
2LA-HSE926U	130	180	24	1.5	1	64.0	54.5	6 500	5 550	91.0	9 300	9 100	14 600	40.4	62	1.56	146.9	144.2	163.1	168.9	138.5	135.5	171.5	174.5	1.5	1
2LA-HSE928U	140	190	24	1.5	1	64.5	57.0	6 550	5 800	95.0	9 700	8 500	13 800	42.2	66	1.66	156.9	154.2	173.1	178.8	148.5	145.5	181.5	184.5	1.5	1
2LA-HSE930U	150	210	28	2	1	86.0	75.5	8 750	7 700	125	12 800	7 800	12 600	47.0	99	2.58	170.5	167.3	189.5	196.3	160	155.5	200	204.5	2	1
2LA-HSE932U	160	220	28	2	1	86.5	78.5	8 850	8 000	131	13 400	7 400	11 900	48.8	105	2.71	180.5	177.3	199.5	206.3	170	165.5	210	214.5	2	1
2LA-HSE934U	170	230	28	2	1	87.5	81.5	8 900	8 300	136	13 900	7 000	11 300	50.6	111	2.84	190.5	187.3	209.5	216.3	180	175.5	220	224.5	2	1

1) Minimum allowable value for corner radius dimension r or r_1.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (steel ball spec.) 2LA-HSE9U type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

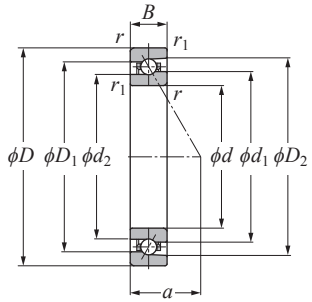
When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Contact angle 25° d 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic / static kN		dynamic / static kgf		Allowable axial load kN	kgf	Allowable speed min^{-1}		Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		grease lubrication	oil lubrication	a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
2LA-HSE910UAD	50	72	12	0.6	0.3	11.4	7.70	1 170	785	14.8	1 510	20 500	32 100	20.3	6.0	0.13	57.6	56.6	64.4	66.7	54.5	52.5	67.5	69.5	0.6	0.3
2LA-HSE911UAD	55	80	13	1	0.6	14.3	9.60	1 450	980	18.4	1 880	18 500	29 000	22.4	7.7	0.18	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
2LA-HSE912UAD	60	85	13	1	0.6	14.8	10.5	1 510	1 070	20.2	2 060	17 200	27 000	23.5	8.3	0.20	68.6	67.4	76.4	79.0	65.5	64.5	79.5	80.5	1	0.6
2LA-HSE913UAD	65	90	13	1	0.6	14.9	11.0	1 520	1 120	21.1	2 160	16 100	25 300	24.7	8.9	0.21	73.6	72.4	81.4	84.0	70.5	69.5	84.5	85.5	1	0.6
2LA-HSE914UAD	70	100	16	1	0.6	21.9	15.6	2 230	1 590	29.9	3 050	14 700	23 000	28.0	14	0.34	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
2LA-HSE915UAD	75	105	16	1	0.6	22.7	17.0	2 310	1 730	32.0	3 300	13 900	21 700	29.1	15	0.36	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
2LA-HSE916UAD	80	110	16	1	0.6	23.0	17.7	2 340	1 810	33.5	3 450	13 200	20 600	30.3	16	0.38	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
2LA-HSE917UAD	85	120	18	1.1	0.6	31.0	23.4	3 150	2 390	45.0	4 600	12 200	19 100	33.1	22	0.54	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
2LA-HSE918UAD	90	125	18	1.1	0.6	32.5	25.4	3 300	2 590	48.5	4 950	11 600	18 200	34.2	23	0.56	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
2LA-HSE919UAD	95	130	18	1.1	0.6	32.5	26.4	3 350	2 690	50.5	5 200	11 100	17 400	35.4	24	0.59	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
2LA-HSE920UAD	100	140	20	1.1	0.6	38.0	31.0	3 850	3 150	59.0	6 050	10 400	16 300	38.2	32	0.82	113.8	111.7	126.2	130.6	107	104.5	133	135.5	1	0.6
2LA-HSE921UAD	105	145	20	1.1	0.6	38.5	32.0	3 900	3 300	61.5	6 300	10 000	15 700	39.3	33	0.85	118.8	116.7	131.2	135.6	112	109.5	138	140.5	1	0.6
2LA-HSE922UAD	110	150	20	1.1	0.6	39.0	33.5	3 950	3 400	64.0	6 550	9 600	15 100	40.5	35	0.88	123.8	121.7	136.2	140.6	117	114.5	143	145.5	1	0.6
2LA-HSE924UAD	120	165	22	1.1	0.6	50.0	42.5	5 100	4 350	82.0	8 400	8 800	13 700	44.4	47	1.20	135.4	133.0	149.6	154.7	127	124.5	158	160.5	1	0.6
2LA-HSE926UAD	130	180	24	1.5	1	61.5	53.0	6 300	5 400	101	10 400	8 100	12 600	48.4	62	1.56	146.9	144.2	163.1	168.8	138.5	135.5	171.5	174.5	1.5	1
2LA-HSE928UAD	140	190	24	1.5	1	62.0	55.0	6 350	5 600	105	10 800	7 600	11 900	50.7	66	1.66	156.9	154.2	173.1	178.8	148.5	145.5	181.5	184.5	1.5	1
2LA-HSE930UAD	150	210	28	2	1	83.0	73.0	8 450	7 450	140	14 300	6 900	10 900	56.3	99	2.58	170.5	167.3	189.5	196.3	160	155.5	200	204.5	2	1
2LA-HSE932UAD	160	220	28	2	1	83.5	76.0	8 550	7 750	146	14 900	6 600	10 300	58.6	105	2.71	180.5	177.3	199.5	206.3	170	165.5	210	214.5	2	1
2LA-HSE934UAD	170	230	28	2	1	84.5	79.0	8 600	8 050	152	15 500	6 200	9 800	60.9	111	2.84	190.5	187.3	209.5	216.3	180	175.5	220	224.5	2	1

1) Minimum allowable value for corner radius dimension r or r_1.

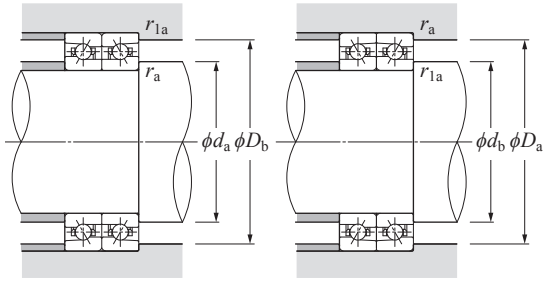
ULTAGE High speed angular contact ball bearings (steel ball spec.) 2LA-HSE0 type



Contact angle 15° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN		static kN		dynamic kgf		static kgf		Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)	f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
2LA-HSE010C	50	80	16	1	0.6	17.6	11.4	1 800	1 160	16.7	1 700	10.4	20 500	32 500					16.8	12	0.26	60.1	58.6	69.9	73.3	55.5	54.5	74.5	75.5	1	0.6
2LA-HSE011C	55	90	18	1.1	0.6	19.1	13.6	1 950	1 380	19.9	2 030	10.6	18 300	29 100					18.8	16	0.40	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
2LA-HSE012C	60	95	18	1.1	0.6	20.0	15.0	2 040	1 530	22.0	2 240	10.7	17 200	27 200					19.5	17	0.42	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
2LA-HSE013C	65	100	18	1.1	0.6	20.3	15.8	2 070	1 610	23.2	2 360	10.8	16 100	25 600					20.1	18	0.45	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
2LA-HSE014C	70	110	20	1.1	0.6	24.9	19.9	2 540	2 030	29.2	2 980	10.8	14 800	23 400					22.2	24	0.64	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
2LA-HSE015C	75	115	20	1.1	0.6	26.5	22.4	2 700	2 290	33.0	3 350	10.9	14 000	22 200					22.8	25	0.68	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
2LA-HSE016C	80	125	22	1.1	0.6	30.5	25.7	3 100	2 620	38.0	3 850	10.9	13 000	20 600					24.8	34	0.91	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
2LA-HSE017C	85	130	22	1.1	0.6	30.5	26.8	3 150	2 740	39.5	4 000	10.9	12 400	19 600					25.5	35	0.96	101.8	99.9	113.2	117.5	92	89.5	123	125.5	1	0.6
2LA-HSE018C	90	140	24	1.5	1	35.5	31.5	3 650	3 200	46.0	4 700	10.9	11 600	18 300					27.5	45	1.25	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
2LA-HSE019C	95	145	24	1.5	1	36.0	32.5	3 700	3 350	48.0	4 900	11.0	11 100	17 600					28.2	47	1.30	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
2LA-HSE020C	100	150	24	1.5	1	37.5	35.0	3 800	3 600	51.5	5 250	11.0	10 600	16 900					28.9	49	1.36	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1
2LA-HSE021C	105	160	26	2	1	43.0	40.5	4 350	4 150	60.0	6 100	11.0	10 000	15 900					30.9	61	1.73	125.8	123.6	139.2	144.1	115	110.5	150	154.5	2	1
2LA-HSE022C	110	170	28	2	1	53.0	49.5	5 400	5 000	72.5	7 400	10.9	9 500	15 100					32.9	77	2.13	132.4	129.8	147.6	153.3	120	115.5	160	164.5	2	1
2LA-HSE024C	120	180	28	2	1	53.5	51.5	5 450	5 250	75.5	7 700	11.0	8 900	14 100					34.2	82	2.28	142.4	139.8	157.6	163.3	130	125.5	170	174.5	2	1
2LA-HSE026C	130	200	33	2	1	76.5	71.0	7 800	7 250	104	10 600	10.8	8 100	12 800					38.8	130	3.40	155.5	152.3	174.5	181.6	140	135.5	190	194.5	2	1
2LA-HSE028C	140	210	33	2	1	79.5	77.0	8 100	7 850	113	11 500	10.9	7 600	12 100					40.1	129	3.68	165.5	162.4	184.5	191.5	150	145.5	200	204.5	2	1
2LA-HSE030C	150	225	35	2.1	1.1	81.5	83.0	8 300	8 450	122	12 400	11.0	7 100	11 300					42.8	163	4.46	178.0	174.8	197.0	204.1	162	157	213	218	2	1
2LA-HSE032C	160	240	38	2.1	1.1	95.5	97.0	9 750	9 850	142	14 500	11.0	6 700	10 600					46.0	206	5.46	189.5	186.0	210.5	218.2	172	167	228	233	2	1
2LA-HSE034C	170	260	42	2.1	1.1	110	111	11 200	11 300	163	16 700	10.9	6 200	9 800					50.0	272	7.37	203.6	199.8	226.4	234.9	182	177	248	253	2	1

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

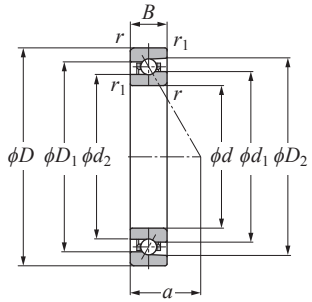
$P_{0r} = X_0 F_r + Y_0 F_a$

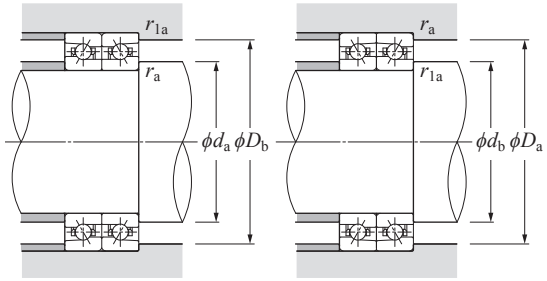
Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (steel ball spec.) 2LA-HSE0 type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Contact angle 20° d 50–170 mm

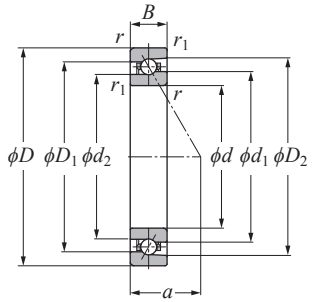
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}					a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
2LA-HSE010	50	80	16	1	0.6	17.2	11.2	1 750	1 140	18.7	1 900	21 600	34 900	19.9	12	0.26	60.1	58.6	69.9	73.2	55.5	54.5	74.5	75.5	1	0.6
2LA-HSE011	55	90	18	1.1	0.6	18.7	13.3	1 900	1 350	22.2	2 260	19 400	31 300	22.3	16	0.40	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
2LA-HSE012	60	95	18	1.1	0.6	19.5	14.7	1 990	1 490	24.6	2 500	18 200	29 300	23.2	17	0.42	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
2LA-HSE013	65	100	18	1.1	0.6	19.8	15.4	2 020	1 570	25.9	2 640	17 100	27 500	24.1	18	0.45	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
2LA-HSE014	70	110	20	1.1	0.6	24.2	19.4	2 470	1 980	32.5	3 300	15 600	25 200	26.5	24	0.64	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
2LA-HSE015	75	115	20	1.1	0.6	25.8	21.9	2 630	2 230	36.5	3 750	14 800	23 900	27.4	25	0.68	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
2LA-HSE016	80	125	22	1.1	0.6	29.6	25.1	3 000	2 560	42.0	4 300	13 700	22 100	29.8	34	0.91	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
2LA-HSE017	85	130	22	1.1	0.6	30.0	26.2	3 050	2 670	44.0	4 500	13 100	21 100	30.7	35	0.96	101.8	99.9	113.2	117.4	92	89.5	123	125.5	1	0.6
2LA-HSE018	90	140	24	1.5	1	34.5	30.5	3 550	3 150	51.5	5 250	12 200	19 700	33.1	45	1.25	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
2LA-HSE019	95	145	24	1.5	1	35.0	32.0	3 600	3 250	53.5	5 450	11 700	18 900	34.0	47	1.30	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
2LA-HSE020	100	150	24	1.5	1	36.5	34.5	3 700	3 500	57.5	5 850	11 300	18 200	34.9	49	1.36	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1
2LA-HSE021	105	160	26	2	1	42.0	39.5	4 250	4 050	66.5	6 800	10 600	17 100	37.3	61	1.73	125.8	123.6	139.2	144.1	115	110.5	150	154.5	2	1
2LA-HSE022	110	170	28	2	1	51.5	48.0	5 300	4 900	80.5	8 200	10 000	16 200	39.7	77	2.13	132.4	129.8	147.6	153.2	120	115.5	160	164.5	2	1
2LA-HSE024	120	180	28	2	1	52.0	50.0	5 300	5 100	84.0	8 600	9 400	15 100	41.5	82	2.28	142.4	139.8	157.6	163.2	130	125.5	170	174.5	2	1
2LA-HSE026	130	200	33	2	1	74.5	69.5	7 600	7 100	116	11 900	8 500	13 800	46.8	130	3.40	155.5	152.3	174.5	181.5	140	135.5	190	194.5	2	1
2LA-HSE028	140	210	33	2	1	77.5	75.0	7 900	7 650	126	12 800	8 000	13 000	48.6	129	3.68	165.5	162.4	184.5	191.5	150	145.5	200	204.5	2	1
2LA-HSE030	150	225	35	2.1	1.1	79.5	81.0	8 100	8 250	136	13 900	7 500	12 100	51.9	163	4.46	178.0	174.8	197.0	204.0	162	157	213	218	2	1
2LA-HSE032	160	240	38	2.1	1.1	93.0	94.5	9 500	9 650	159	16 200	7 000	11 300	55.7	206	5.46	189.5	186.0	210.5	218.2	172	167	228	233	2	1
2LA-HSE034	170	260	42	2.1	1.1	107	108	10 900	11 100	182	18 600	6 500	10 600	60.4	272	7.37	203.6	199.8	226.4	234.9	182	177	248	253	2	1

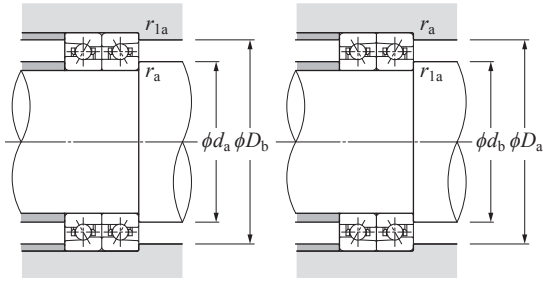
1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (steel ball spec.) 2LA-HSE0 type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

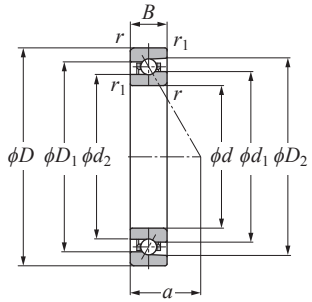
When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Contact angle 25° d 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
2LA-HSE010AD	50	80	16	1	0.6	16.6	10.8	1 700	1 100	20.9	2 130	19 200	30 100	23.3	12	0.26	60.1	58.6	69.9	73.2	55.5	54.5	74.5	75.5	1	0.6
2LA-HSE011AD	55	90	18	1.1	0.6	18.1	12.9	1 840	1 310	24.8	2 530	17 200	27 000	26.1	16	0.40	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
2LA-HSE012AD	60	95	18	1.1	0.6	18.9	14.2	1 930	1 450	27.4	2 800	16 100	25 300	27.2	17	0.42	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
2LA-HSE013AD	65	100	18	1.1	0.6	19.2	14.9	1 960	1 520	28.9	2 940	15 100	23 700	28.4	18	0.45	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
2LA-HSE014AD	70	110	20	1.1	0.6	23.4	18.8	2 390	1 920	36.5	3 700	13 900	21 700	31.1	24	0.64	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
2LA-HSE015AD	75	115	20	1.1	0.6	25.0	21.2	2 550	2 160	41.0	4 200	13 200	20 600	32.3	25	0.68	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
2LA-HSE016AD	80	125	22	1.1	0.6	28.6	24.3	2 910	2 480	47.0	4 800	12 200	19 100	35.1	34	0.91	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
2LA-HSE017AD	85	130	22	1.1	0.6	28.9	25.4	2 950	2 590	49.0	5 000	11 600	18 200	36.2	35	0.96	101.8	99.9	113.2	117.4	92	89.5	123	125.5	1	0.6
2LA-HSE018AD	90	140	24	1.5	1	33.5	29.7	3 400	3 050	57.5	5 850	10 900	17 000	39.0	45	1.25	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
2LA-HSE019AD	95	145	24	1.5	1	34.0	31.0	3 450	3 150	60.0	6 100	10 400	16 300	40.2	47	1.30	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
2LA-HSE020AD	100	150	24	1.5	1	35.0	33.0	3 600	3 400	64.0	6 550	10 000	15 700	41.3	49	1.36	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1
2LA-HSE021AD	105	160	26	2	1	40.5	38.5	4 100	3 900	74.5	7 600	9 400	14 800	44.1	61	1.73	125.8	123.6	139.2	144.1	115	110.5	150	154.5	2	1
2LA-HSE022AD	110	170	28	2	1	50.0	46.5	5 100	4 750	90.0	9 150	8 900	14 000	46.9	77	2.13	132.4	129.8	147.6	153.2	120	115.5	160	164.5	2	1
2LA-HSE024AD	120	180	28	2	1	50.5	48.5	5 150	4 950	94.0	9 550	8 300	13 000	49.2	82	2.28	142.4	139.8	157.6	163.2	130	125.5	170	174.5	2	1
2LA-HSE026AD	130	200	33	2	1	72.5	67.5	7 350	6 850	130	13 200	7 600	11 900	55.3	130	3.40	155.5	152.3	174.5	181.5	140	135.5	190	194.5	2	1
2LA-HSE028AD	140	210	33	2	1	74.5	73.0	7 600	7 400	141	14 300	7 100	11 200	57.6	129	3.68	165.5	162.4	184.5	191.5	150	145.5	200	204.5	2	1
2LA-HSE030AD	150	225	35	2.1	1.1	77.0	78.5	7 850	8 000	151	15 400	6 700	10 400	61.5	163	4.46	178.0	174.8	197.0	204.0	162	157	213	218	2	1
2LA-HSE032AD	160	240	38	2.1	1.1	90.0	91.5	9 150	9 350	177	18 000	6 200	9 800	66.0	206	5.46	189.5	186.0	210.5	218.2	172	167	228	233	2	1
2LA-HSE034AD	170	260	42	2.1	1.1	103	105	10 500	10 700	203	20 700	5 800	9 100	71.5	272	7.37	203.6	199.8	226.4	234.9	182	177	248	253	2	1

1) Minimum allowable value for corner radius dimension r or r_1.

ULTAGE High speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSE9U type

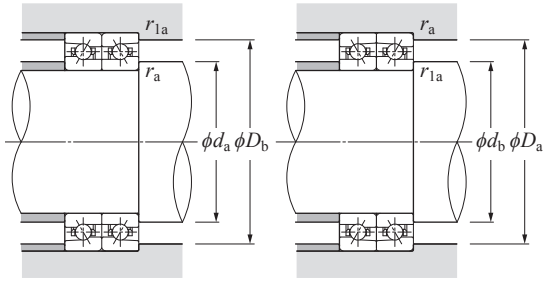


Contact angle 15° d 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf (static)	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}			f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSE910UC	50	72	12	0.6	0.3	12.1	5.65	1 240	575	7.45	760	7.6	25 600	42 400	14.2	6.0	0.12	57.6	56.6	64.4	66.8	54.5	52.5	67.5	69.5	0.6	0.3
5S-2LA-HSE911UC	55	80	13	1	0.6	15.1	7.05	1 540	715	9.30	950	7.5	23 100	38 300	15.6	7.7	0.17	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
5S-2LA-HSE912UC	60	85	13	1	0.6	15.7	7.70	1 600	785	10.1	1 040	7.6	21 500	35 700	16.3	8.3	0.18	68.6	67.4	76.4	79.1	65.5	64.5	79.5	80.5	1	0.6
5S-2LA-HSE913UC	65	90	13	1	0.6	15.8	8.05	1 620	820	10.6	1 090	7.6	20 100	33 400	17.0	8.9	0.19	73.6	72.4	81.4	84.1	70.5	69.5	84.5	85.5	1	0.6
5S-2LA-HSE914UC	70	100	16	1	0.6	23.2	11.5	2 370	1 170	15.2	1 560	7.5	18 400	30 400	19.5	14	0.31	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
5S-2LA-HSE915UC	75	105	16	1	0.6	24.1	12.5	2 460	1 270	16.6	1 700	7.6	17 300	28 700	20.1	15	0.33	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
5S-2LA-HSE916UC	80	110	16	1	0.6	24.4	13.0	2 490	1 330	17.3	1 770	7.6	16 400	27 200	20.8	16	0.34	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
5S-2LA-HSE917UC	85	120	18	1.1	0.6	33.0	17.2	3 350	1 750	22.9	2 340	7.5	15 200	25 200	22.8	22	0.48	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
5S-2LA-HSE918UC	90	125	18	1.1	0.6	34.5	18.6	3 500	1 900	24.8	2 530	7.6	14 500	24 100	23.5	23	0.51	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
5S-2LA-HSE919UC	95	130	18	1.1	0.6	35.0	19.4	3 550	1 970	25.8	2 640	7.6	13 900	23 000	24.2	24	0.53	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
5S-2LA-HSE920UC	100	140	20	1.1	0.6	40.5	22.7	4 100	2 310	29.9	3 050	7.6	13 000	21 600	26.2	32	0.74	113.8	111.7	126.2	130.7	107	104.5	133	135.5	1	0.6
5S-2LA-HSE921UC	105	145	20	1.1	0.6	41.0	23.6	4 150	2 400	31.0	3 200	7.6	12 500	20 700	26.9	33	0.77	118.8	116.7	131.2	135.7	112	109.5	138	140.5	1	0.6
5S-2LA-HSE922UC	110	150	20	1.1	0.6	41.5	24.5	4 200	2 500	32.0	3 300	7.7	12 000	19 900	27.5	35	0.80	123.8	121.7	136.2	140.7	117	114.5	143	145.5	1	0.6
5S-2LA-HSE924UC	120	165	22	1.1	0.6	53.0	31.5	5 400	3 200	41.5	4 250	7.6	10 900	18 200	30.2	47	1.08	135.4	133.0	149.6	154.8	127	124.5	158	160.5	1	0.6
5S-2LA-HSE926UC	130	180	24	1.5	1	65.5	38.5	6 700	3 950	51.0	5 250	7.6	10 100	16 700	32.9	62	1.40	146.9	144.2	163.1	168.9	138.5	135.5	171.5	174.5	1.5	1
5S-2LA-HSE928UC	140	190	24	1.5	1	66.0	40.5	6 750	4 100	53.5	5 500	7.6	9 500	15 700	34.3	66	1.48	156.9	154.2	173.1	178.9	148.5	145.5	181.5	184.5	1.5	1
5S-2LA-HSE930UC	150	210	28	2	1	88.0	53.5	8 950	5 450	71.5	7 300	7.6	8 700	14 400	38.3	99	2.30	170.5	167.3	189.5	196.4	160	155.5	200	204.5	2	1
5S-2LA-HSE932UC	160	220	28	2	1	89.0	55.5	9 050	5 700	74.5	7 600	7.6	8 200	13 600	39.6	105	2.42	180.5	177.3	199.5	206.3	170	165.5	210	214.5	2	1
5S-2LA-HSE934UC	170	230	28	2	1	89.5	58.0	9 150	5 900	77.0	7 900	7.7	7 800	12 900	41.0	111	2.55	190.5	187.3	209.5	216.3	180	175.5	220	224.5	2	1

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

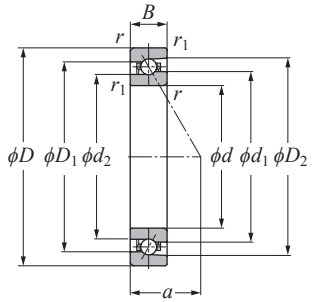
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSE9U type

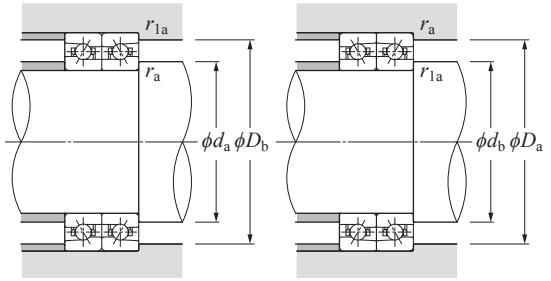


Contact angle 20° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1}		Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		grease lubrication	oil lubrication	*a*	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSE910U	50	72	12	0.6	0.3	11.8	5.50	1 210	560	8.55	875	28 200	46 100	17.2	6.0	0.12	57.6	56.6	64.4	66.8	54.5	52.5	67.5	69.5	0.6	0.3
5S-2LA-HSE911U	55	80	13	1	0.6	14.7	6.85	1 500	700	10.7	1 090	25 500	41 700	18.9	7.7	0.17	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
5S-2LA-HSE912U	60	85	13	1	0.6	15.3	7.50	1 560	765	11.6	1 190	23 700	38 800	19.8	8.3	0.18	68.6	67.4	76.4	79.1	65.5	64.5	79.5	80.5	1	0.6
5S-2LA-HSE913U	65	90	13	1	0.6	15.4	7.85	1 570	800	12.2	1 250	22 200	36 300	20.7	8.9	0.19	73.6	72.4	81.4	84.0	70.5	69.5	84.5	85.5	1	0.6
5S-2LA-HSE914U	70	100	16	1	0.6	22.6	11.2	2 310	1 140	17.4	1 780	20 200	33 100	23.6	14	0.31	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
5S-2LA-HSE915U	75	105	16	1	0.6	23.5	12.2	2 390	1 240	19.0	1 940	19 100	31 300	24.5	15	0.33	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
5S-2LA-HSE916U	80	110	16	1	0.6	23.7	12.7	2 420	1 290	19.8	2 020	18 100	29 600	25.4	16	0.34	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
5S-2LA-HSE917U	85	120	18	1.1	0.6	32.0	16.8	3 300	1 710	26.1	2 670	16 800	27 400	27.8	22	0.48	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
5S-2LA-HSE918U	90	125	18	1.1	0.6	33.5	18.1	3 400	1 850	28.3	2 890	16 000	26 200	28.7	23	0.51	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
5S-2LA-HSE919U	95	130	18	1.1	0.6	34.0	18.9	3 450	1 930	29.4	3 000	15 300	25 000	29.6	24	0.53	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
5S-2LA-HSE920U	100	140	20	1.1	0.6	39.5	22.1	4 000	2 260	34.0	3 500	14 300	23 400	32.0	32	0.74	113.8	111.7	126.2	130.6	107	104.5	133	135.5	1	0.6
5S-2LA-HSE921U	105	145	20	1.1	0.6	40.0	23.0	4 050	2 350	35.5	3 650	13 800	22 500	32.9	33	0.77	118.8	116.7	131.2	135.6	112	109.5	138	140.5	1	0.6
5S-2LA-HSE922U	110	150	20	1.1	0.6	40.0	23.9	4 100	2 430	37.0	3 800	13 200	21 600	33.8	35	0.80	123.8	121.7	136.2	140.6	117	114.5	143	145.5	1	0.6
5S-2LA-HSE924U	120	165	22	1.1	0.6	51.5	30.5	5 250	3 100	47.5	4 850	12 100	19 700	37.1	47	1.08	135.4	133.0	149.6	154.7	127	124.5	158	160.5	1	0.6
5S-2LA-HSE926U	130	180	24	1.5	1	64.0	38.0	6 500	3 850	58.5	6 000	11 100	18 100	40.4	62	1.40	146.9	144.2	163.1	168.9	138.5	135.5	171.5	174.5	1.5	1
5S-2LA-HSE928U	140	190	24	1.5	1	64.5	39.5	6 550	4 000	61.0	6 250	10 400	17 000	42.2	66	1.48	156.9	154.2	173.1	178.8	148.5	145.5	181.5	184.5	1.5	1
5S-2LA-HSE930U	150	210	28	2	1	86.0	52.0	8 750	5 350	81.0	8 300	9 600	15 600	47.0	99	2.30	170.5	167.3	189.5	196.3	160	155.5	200	204.5	2	1
5S-2LA-HSE932U	160	220	28	2	1	86.5	54.5	8 850	5 550	84.5	8 650	9 100	14 800	48.8	105	2.42	180.5	177.3	199.5	206.3	170	165.5	210	214.5	2	1
5S-2LA-HSE934U	170	230	28	2	1	87.5	56.5	8 900	5 750	88.0	9 000	8 600	14 100	50.6	111	2.55	190.5	187.3	209.5	216.3	180	175.5	220	224.5	2	1

1) Minimum allowable value for corner radius dimension *r* or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

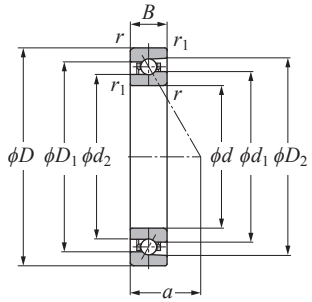
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSE9U type

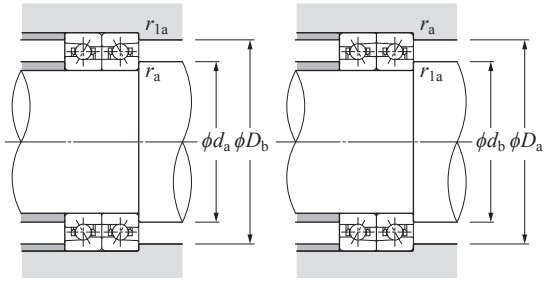


Contact angle 25° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)			*a*	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSE910UAD	50	72	12	0.6	0.3	11.4	5.30	1 170	545	9.75	995	24 300	41 000	20.3	6.0	0.12	57.6	56.6	64.4	66.7	54.5	52.5	67.5	69.5	0.6	0.3
5S-2LA-HSE911UAD	55	80	13	1	0.6	14.3	6.65	1 450	680	12.1	1 240	22 000	37 000	22.4	7.7	0.17	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
5S-2LA-HSE912UAD	60	85	13	1	0.6	14.8	7.25	1 510	740	13.3	1 360	20 500	34 500	23.5	8.3	0.18	68.6	67.4	76.4	79.0	65.5	64.5	79.5	80.5	1	0.6
5S-2LA-HSE913UAD	65	90	13	1	0.6	14.9	7.60	1 520	775	13.9	1 420	19 200	32 300	24.7	8.9	0.19	73.6	72.4	81.4	84.0	70.5	69.5	84.5	85.5	1	0.6
5S-2LA-HSE914UAD	70	100	16	1	0.6	21.9	10.8	2 230	1 100	19.9	2 030	17 500	29 400	28.0	14	0.31	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
5S-2LA-HSE915UAD	75	105	16	1	0.6	22.7	11.8	2 310	1 200	21.5	2 200	16 500	27 800	29.1	15	0.33	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
5S-2LA-HSE916UAD	80	110	16	1	0.6	23.0	12.3	2 340	1 250	22.5	2 300	15 600	26 300	30.3	16	0.34	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
5S-2LA-HSE917UAD	85	120	18	1.1	0.6	31.0	16.2	3 150	1 660	29.4	3 000	14 500	24 400	33.1	22	0.48	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
5S-2LA-HSE918UAD	90	125	18	1.1	0.6	32.5	17.6	3 300	1 790	31.5	3 250	13 800	23 300	34.2	23	0.51	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
5S-2LA-HSE919UAD	95	130	18	1.1	0.6	32.5	18.3	3 350	1 870	33.0	3 400	13 200	22 200	35.4	24	0.53	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
5S-2LA-HSE920UAD	100	140	20	1.1	0.6	38.0	21.4	3 850	2 190	39.0	4 000	12 400	20 800	38.2	32	0.74	113.8	111.7	126.2	130.6	107	104.5	133	135.5	1	0.6
5S-2LA-HSE921UAD	105	145	20	1.1	0.6	38.5	22.3	3 900	2 270	40.5	4 150	11 900	20 000	39.3	33	0.77	118.8	116.7	131.2	135.6	112	109.5	138	140.5	1	0.6
5S-2LA-HSE922UAD	110	150	20	1.1	0.6	39.0	23.1	3 950	2 360	42.0	4 300	11 400	19 200	40.5	35	0.80	123.8	121.7	136.2	140.6	117	114.5	143	145.5	1	0.6
5S-2LA-HSE924UAD	120	165	22	1.1	0.6	50.0	29.6	5 100	3 000	54.0	5 550	10 400	17 500	44.4	47	1.08	135.4	133.0	149.6	154.7	127	124.5	158	160.5	1	0.6
5S-2LA-HSE926UAD	130	180	24	1.5	1	61.5	36.5	6 300	3 750	67.0	6 850	9 600	16 100	48.4	62	1.40	146.9	144.2	163.1	168.8	138.5	135.5	171.5	174.5	1.5	1
5S-2LA-HSE928UAD	140	190	24	1.5	1	62.0	38.0	6 350	3 900	70.0	7 150	9 000	15 200	50.7	66	1.48	156.9	154.2	173.1	178.8	148.5	145.5	181.5	184.5	1.5	1
5S-2LA-HSE930UAD	150	210	28	2	1	83.0	50.5	8 450	5 150	92.5	9 450	8 200	13 900	56.3	99	2.30	170.5	167.3	189.5	196.3	160	155.5	200	204.5	2	1
5S-2LA-HSE932UAD	160	220	28	2	1	83.5	52.5	8 550	5 350	96.5	9 850	7 800	13 200	58.6	105	2.42	180.5	177.3	199.5	206.3	170	165.5	210	214.5	2	1
5S-2LA-HSE934UAD	170	230	28	2	1	84.5	54.5	8 600	5 600	100	10 200	7 400	12 500	60.9	111	2.55	190.5	187.3	209.5	216.3	180	175.5	220	224.5	2	1

1) Minimum allowable value for corner radius dimension *r* or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

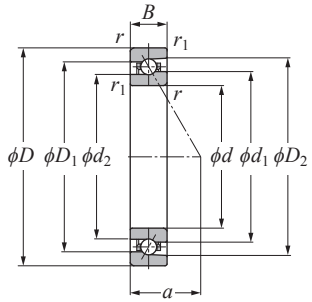
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

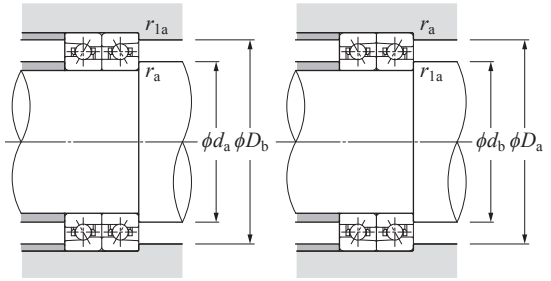
ULTAGE High speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSE0 type



Contact angle 15° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	D	B	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSE010C	50	80	16	1	0.6	17.6	7.90	1 800	805	10.5	1 070	7.2	24 000	39 800	16.8	12	0.23	60.1	58.6	69.9	73.3	55.5	54.5	74.5	75.5	1	0.6
5S-2LA-HSE011C	55	90	18	1.1	0.6	19.1	9.40	1 950	960	12.5	1 280	7.4	21 500	35 700	18.8	16	0.37	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
5S-2LA-HSE012C	60	95	18	1.1	0.6	20.0	10.4	2 040	1 060	13.9	1 420	7.4	20 100	33 400	19.5	17	0.40	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
5S-2LA-HSE013C	65	100	18	1.1	0.6	20.3	10.9	2 070	1 120	14.6	1 490	7.5	18 900	31 400	20.1	18	0.42	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
5S-2LA-HSE014C	70	110	20	1.1	0.6	24.9	13.8	2 540	1 410	18.4	1 880	7.5	17 300	28 700	22.2	24	0.60	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
5S-2LA-HSE015C	75	115	20	1.1	0.6	26.5	15.5	2 700	1 590	20.8	2 120	7.5	16 400	27 200	22.8	25	0.64	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
5S-2LA-HSE016C	80	125	22	1.1	0.6	30.5	17.8	3 100	1 820	23.8	2 430	7.5	15 200	25 200	24.8	34	0.86	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
5S-2LA-HSE017C	85	130	22	1.1	0.6	30.5	18.6	3 150	1 900	24.9	2 540	7.6	14 500	24 100	25.5	35	0.90	101.8	99.9	113.2	117.5	92	89.5	123	125.5	1	0.6
5S-2LA-HSE018C	90	140	24	1.5	1	35.5	21.8	3 650	2 220	29.2	2 970	7.6	13 600	22 500	27.5	45	1.18	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
5S-2LA-HSE019C	95	145	24	1.5	1	36.0	22.7	3 700	2 310	30.5	3 100	7.6	13 000	21 600	28.2	47	1.23	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
5S-2LA-HSE020C	100	150	24	1.5	1	37.5	24.4	3 800	2 480	32.5	3 350	7.6	12 500	20 700	28.9	49	1.28	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1
5S-2LA-HSE021C	105	160	26	2	1	43.0	28.2	4 350	2 880	38.0	3 850	7.6	11 800	19 500	30.9	61	1.63	125.8	123.6	139.2	144.1	115	110.5	150	154.5	2	1
5S-2LA-HSE022C	110	170	28	2	1	53.0	34.0	5 400	3 500	45.5	4 650	7.6	11 100	18 500	32.9	77	1.99	132.4	129.8	147.6	153.3	120	115.5	160	164.5	2	1
5S-2LA-HSE024C	120	180	28	2	1	53.5	35.5	5 450	3 650	47.5	4 850	7.6	10 400	17 200	34.2	82	2.14	142.4	139.8	157.6	163.3	130	125.5	170	174.5	2	1
5S-2LA-HSE026C	130	200	33	2	1	76.5	49.5	7 800	5 000	66.0	6 700	7.5	9 500	15 700	38.8	130	3.18	155.5	152.3	174.5	181.6	140	135.5	190	194.5	2	1
5S-2LA-HSE028C	140	210	33	2	1	79.5	53.5	8 100	5 450	71.5	7 300	7.6	8 900	14 800	40.1	129	3.41	165.5	162.4	184.5	191.5	150	145.5	200	204.5	2	1
5S-2LA-HSE030C	150	225	35	2.1	1.1	81.5	57.5	8 300	5 850	77.0	7 850	7.6	8 300	13 800	42.8	163	4.17	178.0	174.8	197.0	204.1	162	157	213	218	2	1
5S-2LA-HSE032C	160	240	38	2.1	1.1	95.5	67.0	9 750	6 850	90.0	9 150	7.6	7 800	12 900	46.0	206	5.09	189.5	186.0	210.5	218.2	172	167	228	233	2	1
5S-2LA-HSE034C	170	260	42	2.1	1.1	110	77.0	11 200	7 850	103	10 500	7.6	7 300	12 000	50.0	272	6.90	203.6	199.8	226.4	234.9	182	177	248	253	2	1

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

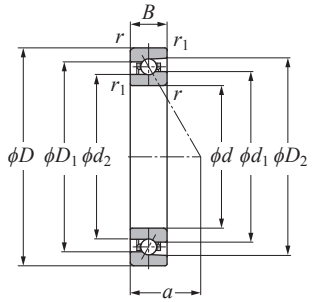
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSE0 type

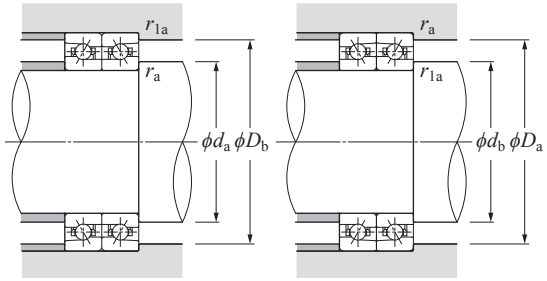


Contact angle 20° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}					*a*	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSE010	50	80	16	1	0.6	17.2	7.75	1 750	790	12.1	1 230	26 500	43 300	19.9	12	0.23	60.1	58.6	69.9	73.2	55.5	54.5	74.5	75.5	1	0.6
5S-2LA-HSE011	55	90	18	1.1	0.6	18.7	9.20	1 900	935	14.4	1 460	23 700	38 800	22.3	16	0.37	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
5S-2LA-HSE012	60	95	18	1.1	0.6	19.5	10.2	1 990	1 040	15.9	1 620	22 200	36 300	23.2	17	0.40	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
5S-2LA-HSE013	65	100	18	1.1	0.6	19.8	10.7	2 020	1 090	16.7	1 710	20 800	34 100	24.1	18	0.42	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
5S-2LA-HSE014	70	110	20	1.1	0.6	24.2	13.5	2 470	1 370	21.1	2 150	19 100	31 200	26.5	24	0.60	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
5S-2LA-HSE015	75	115	20	1.1	0.6	25.8	15.2	2 630	1 550	23.8	2 420	18 100	29 600	27.4	25	0.64	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
5S-2LA-HSE016	80	125	22	1.1	0.6	29.6	17.4	3 000	1 770	27.2	2 780	16 800	27 400	29.8	34	0.86	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
5S-2LA-HSE017	85	130	22	1.1	0.6	30.0	18.1	3 050	1 850	28.4	2 900	16 000	26 200	30.7	35	0.90	101.8	99.9	113.2	117.4	92	89.5	123	125.5	1	0.6
5S-2LA-HSE018	90	140	24	1.5	1	34.5	21.3	3 550	2 170	33.5	3 400	15 000	24 500	33.1	45	1.18	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
5S-2LA-HSE019	95	145	24	1.5	1	35.0	22.1	3 600	2 260	34.5	3 550	14 300	23 400	34.0	47	1.23	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
5S-2LA-HSE020	100	150	24	1.5	1	36.5	23.8	3 700	2 420	37.5	3 800	13 800	22 500	34.9	49	1.28	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1
5S-2LA-HSE021	105	160	26	2	1	42.0	27.5	4 250	2 810	43.0	4 400	13 000	21 200	37.3	61	1.63	125.8	123.6	139.2	144.1	115	110.5	150	154.5	2	1
5S-2LA-HSE022	110	170	28	2	1	51.5	33.5	5 300	3 400	52.0	5 300	12 300	20 100	39.7	77	1.99	132.4	129.8	147.6	153.2	120	115.5	160	164.5	2	1
5S-2LA-HSE024	120	180	28	2	1	52.0	35.0	5 300	3 550	54.5	5 550	11 500	18 700	41.5	82	2.14	142.4	139.8	157.6	163.2	130	125.5	170	174.5	2	1
5S-2LA-HSE026	130	200	33	2	1	74.5	48.0	7 600	4 900	75.5	7 700	10 400	17 000	46.8	130	3.18	155.5	152.3	174.5	181.5	140	135.5	190	194.5	2	1
5S-2LA-HSE028	140	210	33	2	1	77.5	52.0	7 900	5 300	81.5	8 300	9 800	16 100	48.6	129	3.41	165.5	162.4	184.5	191.5	150	145.5	200	204.5	2	1
5S-2LA-HSE030	150	225	35	2.1	1.1	79.5	56.0	8 100	5 700	88.0	8 950	9 200	15 000	51.9	163	4.17	178.0	174.8	197.0	204.0	162	157	213	218	2	1
5S-2LA-HSE032	160	240	38	2.1	1.1	93.0	65.5	9 500	6 700	103	10 500	8 600	14 100	55.7	206	5.09	189.5	186.0	210.5	218.2	172	167	228	233	2	1
5S-2LA-HSE034	170	260	42	2.1	1.1	107	75.0	10 900	7 650	118	12 000	8 000	13 100	60.4	272	6.90	203.6	199.8	226.4	234.9	182	177	248	253	2	1

1) Minimum allowable value for corner radius dimension *r* or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

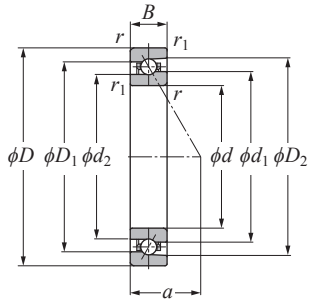
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE High speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSE0 type

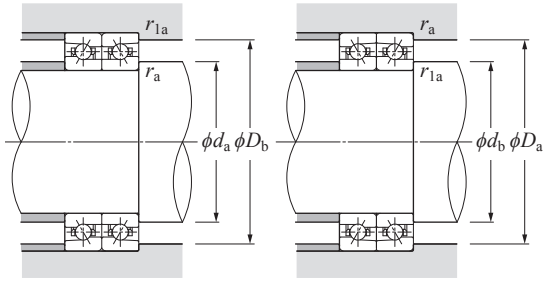


Contact angle 25° *d* 50–170 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN (static)	kgf	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}					*a*	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSE010AD	50	80	16	1	0.6	16.6	7.50	1 700	765	13.8	1 400	22 800	38 500	23.3	12	0.23	60.1	58.6	69.9	73.2	55.5	54.5	74.5	75.5	1	0.6
5S-2LA-HSE011AD	55	90	18	1.1	0.6	18.1	8.90	1 840	910	16.4	1 670	20 500	34 500	26.1	16	0.37	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
5S-2LA-HSE012AD	60	95	18	1.1	0.6	18.9	9.85	1 930	1 000	18.1	1 850	19 200	32 300	27.2	17	0.40	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
5S-2LA-HSE013AD	65	100	18	1.1	0.6	19.2	10.4	1 960	1 060	19.0	1 940	18 000	30 300	28.4	18	0.40	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
5S-2LA-HSE014AD	70	110	20	1.1	0.6	23.4	13.0	2 390	1 330	24.0	2 440	16 500	27 800	31.1	24	0.60	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
5S-2LA-HSE015AD	75	115	20	1.1	0.6	25.0	14.7	2 550	1 500	27.0	2 760	15 600	26 300	32.3	25	0.64	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
5S-2LA-HSE016AD	80	125	22	1.1	0.6	28.6	16.9	2 910	1 720	31.0	3 150	14 500	24 400	35.1	34	0.86	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
5S-2LA-HSE017AD	85	130	22	1.1	0.6	28.9	17.6	2 950	1 790	32.5	3 300	13 800	23 300	36.2	35	0.90	101.8	99.9	113.2	117.4	92	89.5	123	125.5	1	0.6
5S-2LA-HSE018AD	90	140	24	1.5	1	33.5	20.6	3 400	2 100	38.0	3 850	12 900	21 700	39.0	45	1.18	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
5S-2LA-HSE019AD	95	145	24	1.5	1	34.0	21.4	3 450	2 190	39.5	4 000	12 400	20 800	40.2	47	1.23	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
5S-2LA-HSE020AD	100	150	24	1.5	1	35.0	23.0	3 600	2 350	42.5	4 300	11 900	20 000	41.3	49	1.28	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1
5S-2LA-HSE021AD	105	160	26	2	1	40.5	26.7	4 100	2 720	49.0	5 000	11 200	18 900	44.1	61	1.63	125.8	123.6	139.2	144.1	115	110.5	150	154.5	2	1
5S-2LA-HSE022AD	110	170	28	2	1	50.0	32.5	5 100	3 300	59.5	6 050	10 600	17 900	46.9	77	1.99	132.4	129.8	147.6	153.2	120	115.5	160	164.5	2	1
5S-2LA-HSE024AD	120	180	28	2	1	50.5	33.5	5 150	3 450	62.0	6 300	9 900	16 700	49.2	82	2.14	142.4	139.8	157.6	163.2	130	125.5	170	174.5	2	1
5S-2LA-HSE026AD	130	200	33	2	1	72.5	46.5	7 350	4 750	85.5	8 750	9 000	15 200	55.3	130	3.18	155.5	152.3	174.5	181.5	140	135.5	190	194.5	2	1
5S-2LA-HSE028AD	140	210	33	2	1	74.5	50.5	7 600	5 150	92.5	9 450	8 500	14 300	57.6	129	3.41	165.5	162.4	184.5	191.5	150	145.5	200	204.5	2	1
5S-2LA-HSE030AD	150	225	35	2.1	1.1	77.0	54.5	7 850	5 550	100	10 200	7 900	13 300	61.5	163	4.17	178.0	174.8	197.0	204.0	162	157	213	218	2	1
5S-2LA-HSE032AD	160	240	38	2.1	1.1	90.0	63.5	9 150	6 450	117	11 900	7 400	12 500	66.0	206	5.09	189.5	186.0	210.5	218.2	172	167	228	233	2	1
5S-2LA-HSE034AD	170	260	42	2.1	1.1	103	73.0	10 500	7 450	134	13 700	6 900	11 600	71.5	272	6.90	203.6	199.8	226.4	234.9	182	177	248	253	2	1

1) Minimum allowable value for corner radius dimension *r* or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

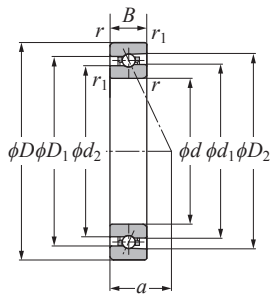
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

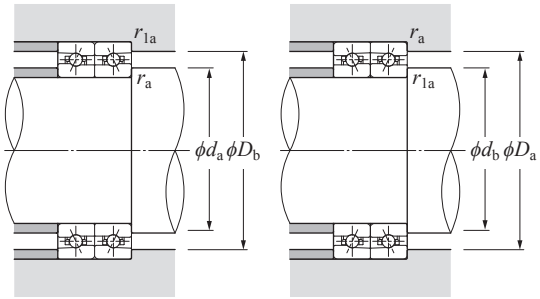
ULTAGE Ultra high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSF0 type



Contact angle 25° *d* 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN		static kgf		Allowable axial load kN	kgf	Allowable speed min⁻¹ oil lubrication	Load center mm	Internal free space cm³	Mass kg	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			*a*	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSF010AD	50	80	16	1	0.6	11.1	6.20	1 140	635	11.4	1 170	50 000	23.3	10	0.29	61.6	60.6	68.4	70.9	55.5	54.5	74.5	75.5	1	0.6
5S-2LA-HSF011AD	55	90	18	1.1	0.6	13.9	7.80	1 420	800	14.4	1 470	44 800	26.0	14	0.42	68.6	67.4	76.4	79.2	62	59.5	83	85.5	1	0.6
5S-2LA-HSF012AD	60	95	18	1.1	0.6	14.3	8.45	1 460	860	15.5	1 580	41 900	27.2	15	0.45	73.6	72.4	81.4	84.2	67	64.5	88	90.5	1	0.6
5S-2LA-HSF013AD	65	100	18	1.1	0.6	14.7	9.05	1 500	925	16.7	1 700	39 400	28.3	16	0.48	78.6	77.4	86.4	89.2	72	69.5	93	95.5	1	0.6
5S-2LA-HSF014AD	70	110	20	1.1	0.6	18.0	11.1	1 830	1 130	20.4	2 080	36 100	31.1	22	0.67	85.6	84.3	94.4	97.5	77	74.5	103	105.5	1	0.6
5S-2LA-HSF015AD	75	115	20	1.1	0.6	18.5	11.9	1 880	1 210	21.8	2 220	34 200	32.3	24	0.71	90.6	89.3	99.4	102.5	82	79.5	108	110.5	1	0.6
5S-2LA-HSF016AD	80	125	22	1.1	0.6	22.0	14.2	2 250	1 440	26.0	2 660	31 700	35.0	31	0.95	97.6	96.2	107.4	110.8	87	84.5	118	120.5	1	0.6
5S-2LA-HSF017AD	85	130	22	1.1	0.6	22.2	14.7	2 270	1 500	27.0	2 750	30 200	36.2	33	1.00	102.6	101.2	112.4	115.8	92	89.5	123	125.5	1	0.6
5S-2LA-HSF018AD	90	140	24	1.5	1	27.1	18.2	2 760	1 860	33.5	3 400	28 300	39.0	41	1.31	109.8	108.0	120.2	124.2	98.5	95.5	131.5	134.5	1.5	1
5S-2LA-HSF019AD	95	145	24	1.5	1	27.3	18.8	2 790	1 920	34.5	3 550	27 100	40.1	43	1.36	114.8	113.0	125.2	129.2	103.5	100.5	136.5	139.5	1.5	1
5S-2LA-HSF020AD	100	150	24	1.5	1	28.1	20.0	2 860	2 040	37.0	3 750	26 000	41.3	45	1.42	119.8	118.0	130.2	134.2	108.5	105.5	141.5	144.5	1.5	1

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

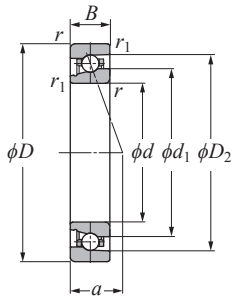
Main Spindle Bearings

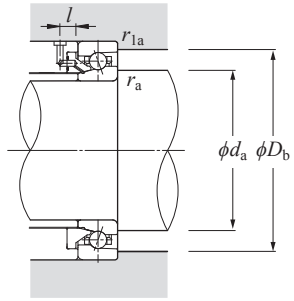
Angular Contact Ball Bearings for Radial Loads

Dimension Tables

NTN

ULTAGE Eco-friendly high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSL9U type





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

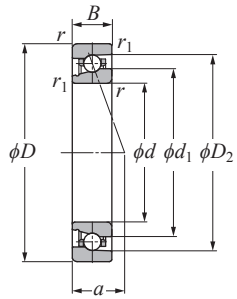
Contact angle 20° d 50–130 mm

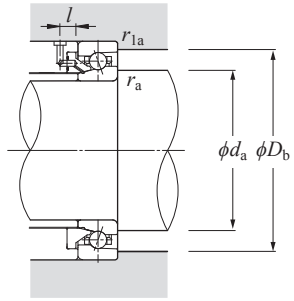
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1}	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		oil lubrication	a	Single-row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	l [2] min	
5S-2LA-HSL910U	50	72	12	0.6	0.3	11.8	5.50	1 210	560	8.55	875	46 100	17.2	0.11	57.6	66.8	54.5	69.5	0.6	0.3	8.5	5S-2LA-HSL910U
5S-2LA-HSL911U	55	80	13	1	0.6	14.7	6.85	1 500	700	10.6	1 090	41 700	18.9	0.16	63.6	74.1	60.5	75.5	1	0.6	8.5	5S-2LA-HSL911U
5S-2LA-HSL912U	60	85	13	1	0.6	15.3	7.50	1 560	765	11.6	1 190	38 800	19.8	0.17	68.6	79.1	65.5	80.5	1	0.6	8.5	5S-2LA-HSL912U
5S-2LA-HSL913U	65	90	13	1	0.6	15.4	7.85	1 570	800	12.2	1 250	36 300	20.7	0.17	73.6	84.0	70.5	85.5	1	0.6	8.5	5S-2LA-HSL913U
5S-2LA-HSL914U	70	100	16	1	0.6	22.6	11.2	2 310	1 140	17.4	1 780	33 100	23.6	0.29	80.1	93.2	75.5	95.5	1	0.6	8.5	5S-2LA-HSL914U
5S-2LA-HSL915U	75	105	16	1	0.6	23.5	12.2	2 390	1 240	19.0	1 940	31 300	24.5	0.31	85.1	98.2	80.5	100.5	1	0.6	9	5S-2LA-HSL915U
5S-2LA-HSL916U	80	110	16	1	0.6	23.7	12.7	2 420	1 290	19.8	2 020	29 600	25.4	0.32	90.1	103.2	85.5	105.5	1	0.6	9	5S-2LA-HSL916U
5S-2LA-HSL917U	85	120	18	1.1	0.6	32.0	16.8	3 300	1 710	26.1	2 670	27 400	27.8	0.45	96.8	112.3	92	115.5	1	0.6	9	5S-2LA-HSL917U
5S-2LA-HSL918U	90	125	18	1.1	0.6	33.5	18.1	3 400	1 850	28.3	2 890	26 200	28.7	0.48	101.8	117.3	97	120.5	1	0.6	9	5S-2LA-HSL918U
5S-2LA-HSL919U	95	130	18	1.1	0.6	34.0	18.9	3 450	1 930	29.4	3 000	25 000	29.6	0.50	106.8	122.3	102	125.5	1	0.6	9	5S-2LA-HSL919U
5S-2LA-HSL920U	100	140	20	1.1	0.6	39.5	22.1	4 000	2 260	34.0	3 500	23 400	32.0	0.69	113.8	130.6	107	135.5	1	0.6	9	5S-2LA-HSL920U
5S-2LA-HSL921U	105	145	20	1.1	0.6	40.0	23.0	4 050	2 350	35.5	3 650	22 500	32.9	0.72	118.8	135.6	112	140.5	1	0.6	9	5S-2LA-HSL921U
5S-2LA-HSL922U	110	150	20	1.1	0.6	40.0	23.9	4 100	2 430	37.0	3 800	21 600	33.8	0.75	123.8	140.6	117	145.5	1	0.6	9	5S-2LA-HSL922U
5S-2LA-HSL924U	120	165	22	1.1	0.6	51.5	30.5	5 250	3 100	47.5	4 850	19 700	37.1	1.01	135.4	154.7	127	160.5	1	0.6	9	5S-2LA-HSL924U
5S-2LA-HSL926U	130	180	24	1.5	1	64.0	38.0	6 500	3 850	58.5	6 000	18 100	40.4	1.32	146.9	168.9	138.5	174.5	1.5	1	9	5S-2LA-HSL926U

1) Minimum allowable value for corner radius dimension r or r_1.
2) For the details of spacer dimensions, please contact **NTN** Engineering.

Main Spindle Bearings

ULTAGE Eco-friendly high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSL9U type





Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

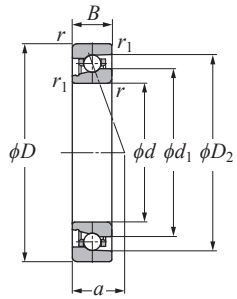
Contact angle 25° d 50–130 mm

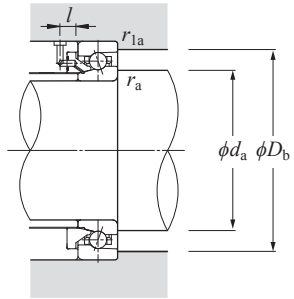
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1}	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		oil lubrication	a	Single-row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	l [2] min	
5S-2LA-HSL910UAD	50	72	12	0.6	0.3	11.4	5.30	1 170	545	9.75	995	41 000	20.3	0.11	57.6	66.7	54.5	69.5	0.6	0.3	8.5	5S-2LA-HSL910UAD
5S-2LA-HSL911UAD	55	80	13	1	0.6	14.3	6.65	1 450	680	12.1	1 240	37 000	22.4	0.16	63.6	74.1	60.5	75.5	1	0.6	8.5	5S-2LA-HSL911UAD
5S-2LA-HSL912UAD	60	85	13	1	0.6	14.8	7.25	1 510	740	13.3	1 360	34 500	23.5	0.17	68.6	79.0	65.5	80.5	1	0.6	8.5	5S-2LA-HSL912UAD
5S-2LA-HSL913UAD	65	90	13	1	0.6	14.9	7.60	1 520	775	13.9	1 420	32 300	24.7	0.17	73.6	84.0	70.5	85.5	1	0.6	8.5	5S-2LA-HSL913UAD
5S-2LA-HSL914UAD	70	100	16	1	0.6	21.9	10.8	2 230	1 100	19.9	2 030	29 400	28.0	0.29	80.1	93.2	75.5	95.5	1	0.6	8.5	5S-2LA-HSL914UAD
5S-2LA-HSL915UAD	75	105	16	1	0.6	22.7	11.8	2 310	1 200	21.5	2 200	27 800	29.1	0.31	85.1	98.2	80.5	100.5	1	0.6	9	5S-2LA-HSL915UAD
5S-2LA-HSL916UAD	80	110	16	1	0.6	23.0	12.3	2 340	1 250	22.5	2 300	26 300	30.3	0.32	90.1	103.2	85.5	105.5	1	0.6	9	5S-2LA-HSL916UAD
5S-2LA-HSL917UAD	85	120	18	1.1	0.6	31.0	16.2	3 150	1 660	29.4	3 000	24 400	33.1	0.45	96.8	112.3	92	115.5	1	0.6	9	5S-2LA-HSL917UAD
5S-2LA-HSL918UAD	90	125	18	1.1	0.6	32.5	17.6	3 300	1 790	31.5	3 250	23 300	34.2	0.48	101.8	117.3	97	120.5	1	0.6	9	5S-2LA-HSL918UAD
5S-2LA-HSL919UAD	95	130	18	1.1	0.6	32.5	18.3	3 350	1 870	33.0	3 400	22 200	35.4	0.50	106.8	122.3	102	125.5	1	0.6	9	5S-2LA-HSL919UAD
5S-2LA-HSL920UAD	100	140	20	1.1	0.6	38.0	21.4	3 850	2 190	39.0	4 000	20 800	38.2	0.69	113.8	130.6	107	135.5	1	0.6	9	5S-2LA-HSL920UAD
5S-2LA-HSL921UAD	105	145	20	1.1	0.6	38.5	22.3	3 900	2 270	40.5	4 150	20 000	39.3	0.72	118.8	135.6	112	140.5	1	0.6	9	5S-2LA-HSL921UAD
5S-2LA-HSL922UAD	110	150	20	1.1	0.6	39.0	23.1	3 950	2 360	42.0	4 300	19 200	40.5	0.75	123.8	140.6	117	145.5	1	0.6	9	5S-2LA-HSL922UAD
5S-2LA-HSL924UAD	120	165	22	1.1	0.6	50.0	29.6	5 100	3 000	54.0	5 550	17 500	44.4	1.01	135.4	154.7	127	160.5	1	0.6	9	5S-2LA-HSL924UAD
5S-2LA-HSL926UAD	130	180	24	1.5	1	61.5	36.5	6 300	3 750	67.0	6 850	16 100	48.4	1.32	146.9	168.8	138.5	174.5	1.5	1	9	5S-2LA-HSL926UAD

1) Minimum allowable value for corner radius dimension r or r_1.
2) For the details of spacer dimensions, please contact **NTN** Engineering.

Main Spindle Bearings

ULTAGE Eco-friendly high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSL0 type





Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

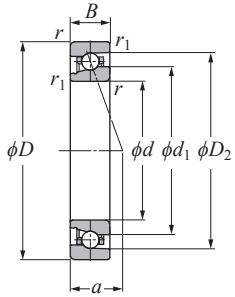
Contact angle 20° d 50–130 mm

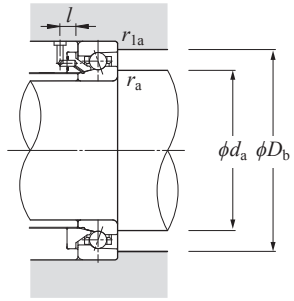
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1}	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		oil lubrication	a	Single-row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	l [2] min	
5S-2LA-HSL010	50	80	16	1	0.6	17.2	7.8	1 750	790	12.1	1 230	43 300	19.9	0.22	60.1	73.2	55.5	75.5	1	0.6	8.5	5S-2LA-HSL010
5S-2LA-HSL011	55	90	18	1.1	0.6	18.7	9.2	1 900	935	14.4	1 460	38 800	22.3	0.35	67.6	80.8	62	85.5	1	0.6	8.5	5S-2LA-HSL011
5S-2LA-HSL012	60	95	18	1.1	0.6	19.5	10.2	1 990	1 040	15.9	1 620	36 300	23.2	0.38	72.6	85.8	67	90.5	1	0.6	8.5	5S-2LA-HSL012
5S-2LA-HSL013	65	100	18	1.1	0.6	19.8	10.7	2 020	1 090	16.7	1 710	34 100	24.1	0.40	77.6	90.8	72	95.5	1	0.6	9	5S-2LA-HSL013
5S-2LA-HSL014	70	110	20	1.1	0.6	24.2	13.5	2 470	1 370	21.1	2 150	31 200	26.5	0.57	84.8	99.1	77	105.5	1	0.6	9	5S-2LA-HSL014
5S-2LA-HSL015	75	115	20	1.1	0.6	25.8	15.2	2 630	1 550	23.8	2 420	29 600	27.4	0.60	89.8	104.1	82	110.5	1	0.6	9	5S-2LA-HSL015
5S-2LA-HSL016	80	125	22	1.1	0.6	29.6	17.4	3 000	1 770	27.2	2 780	27 400	29.8	0.82	96.8	112.5	87	120.5	1	0.6	9	5S-2LA-HSL016
5S-2LA-HSL017	85	130	22	1.1	0.6	30.0	18.1	3 050	1 850	28.4	2 900	26 200	30.7	0.85	101.8	117.4	92	125.5	1	0.6	9	5S-2LA-HSL017
5S-2LA-HSL018	90	140	24	1.5	1	34.5	21.3	3 550	2 170	33.5	3 400	24 500	33.1	1.12	108.8	125.8	98.5	134.5	1.5	1	9	5S-2LA-HSL018
5S-2LA-HSL019	95	145	24	1.5	1	35.0	22.1	3 600	2 260	34.5	3 550	23 400	34.0	1.17	113.8	130.8	103.5	139.5	1.5	1	9	5S-2LA-HSL019
5S-2LA-HSL020	100	150	24	1.5	1	36.5	23.8	3 700	2 420	37.5	3 800	22 500	34.9	1.22	118.8	135.8	108.5	144.5	1.5	1	9	5S-2LA-HSL020
5S-2LA-HSL021	105	160	26	2	1	42.0	27.5	4 250	2 810	43.0	4 400	21 200	37.3	1.55	125.8	144.1	115	154.5	2	1	9	5S-2LA-HSL021
5S-2LA-HSL022	110	170	28	2	1	51.5	33.5	5 300	3 400	52.0	5 300	20 100	39.7	1.89	132.4	153.2	120	164.5	2	1	9	5S-2LA-HSL022
5S-2LA-HSL024	120	180	28	2	1	52.0	35.0	5 300	3 550	54.5	5 550	18 700	41.5	2.03	142.4	163.2	130	174.5	2	1	9	5S-2LA-HSL024
5S-2LA-HSL026	130	200	33	2	1	74.5	48.0	7 600	4 900	75.5	7 700	17 000	46.8	2.98	155.5	181.5	140	194.5	2	1	9	5S-2LA-HSL026

1) Minimum allowable value for corner radius dimension r or r_1.
2) For the details of spacer dimensions, please contact **NTN** Engineering.

Main Spindle Bearings

ULTAGE Eco-friendly high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSL0 type





Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

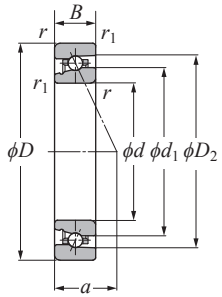
Contact angle 25° d 50–130 mm

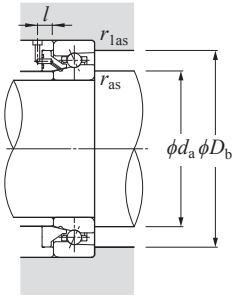
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} oil lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm				Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			a	Single-row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	l [2] min	
5S-2LA-HSL010AD	50	80	16	1	0.6	16.6	7.50	1 700	765	13.8	1 400	38 500	23.3	0.22	60.1	73.2	55.5	75.5	1	0.6	8.5	5S-2LA-HSL010AD
5S-2LA-HSL011AD	55	90	18	1.1	0.6	18.1	8.90	1 840	910	16.4	1 670	34 500	26.1	0.35	67.6	80.8	62	85.5	1	0.6	8.5	5S-2LA-HSL011AD
5S-2LA-HSL012AD	60	95	18	1.1	0.6	18.9	9.85	1 930	1 000	18.1	1 850	32 300	27.2	0.38	72.6	85.8	67	90.5	1	0.6	8.5	5S-2LA-HSL012AD
5S-2LA-HSL013AD	65	100	18	1.1	0.6	19.2	10.4	1 960	1 060	19.0	1 940	30 300	28.4	0.40	77.6	90.8	72	95.5	1	0.6	9	5S-2LA-HSL013AD
5S-2LA-HSL014AD	70	110	20	1.1	0.6	23.4	13.0	2 390	1 330	24.0	2 440	27 800	31.1	0.57	84.8	99.1	77	105.5	1	0.6	9	5S-2LA-HSL014AD
5S-2LA-HSL015AD	75	115	20	1.1	0.6	25.0	14.7	2 550	1 500	27.0	2 760	26 300	32.3	0.60	89.8	104.1	82	110.5	1	0.6	9	5S-2LA-HSL015AD
5S-2LA-HSL016AD	80	125	22	1.1	0.6	28.6	16.9	2 910	1 720	31.0	3 150	24 400	35.1	0.82	96.8	112.5	87	120.5	1	0.6	9	5S-2LA-HSL016AD
5S-2LA-HSL017AD	85	130	22	1.1	0.6	28.9	17.6	2 950	1 790	32.5	3 300	23 300	36.2	0.85	101.8	117.4	92	125.5	1	0.6	9	5S-2LA-HSL017AD
5S-2LA-HSL018AD	90	140	24	1.5	1	33.5	20.6	3 400	2 100	38.0	3 850	21 700	39.0	1.12	108.8	125.8	98.5	134.5	1.5	1	9	5S-2LA-HSL018AD
5S-2LA-HSL019AD	95	145	24	1.5	1	34.0	21.4	3 450	2 190	39.5	4 000	20 800	40.2	1.17	113.8	130.8	103.5	139.5	1.5	1	9	5S-2LA-HSL019AD
5S-2LA-HSL020AD	100	150	24	1.5	1	35.0	23.0	3 600	2 350	42.5	4 300	20 000	41.3	1.22	118.8	135.8	108.5	144.5	1.5	1	9	5S-2LA-HSL020AD
5S-2LA-HSL021AD	105	160	26	2	1	40.5	26.7	4 100	2 720	49.0	5 000	18 900	44.1	1.55	125.8	144.1	115	154.5	2	1	9	5S-2LA-HSL021AD
5S-2LA-HSL022AD	110	170	28	2	1	50.0	32.5	5 100	3 300	59.5	6 050	17 700	46.9	1.89	132.4	153.2	120	164.5	2	1	9	5S-2LA-HSL022AD
5S-2LA-HSL024AD	120	180	28	2	1	50.5	33.5	5 150	3 450	62.0	6 300	16 700	49.2	2.03	142.4	163.2	130	174.5	2	1	9	5S-2LA-HSL024AD
5S-2LA-HSL026AD	130	200	33	2	1	72.5	46.5	7 350	4 750	85.5	8 750	15 200	55.3	2.98	155.5	181.5	140	194.5	2	1	9	5S-2LA-HSL026AD

1) Minimum allowable value for corner radius dimension r or r_1.
2) For the details of spacer dimensions, please contact **NTN** Engineering.

Main Spindle Bearings

ULTAGE Eco-friendly ultra high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-HSFL0 type





Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

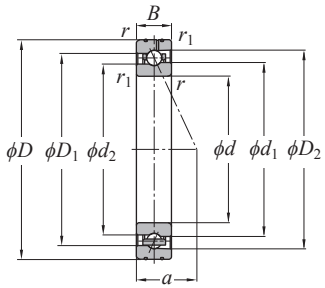
Contact angle 25° d 50–100 mm

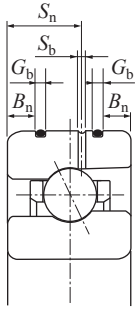
Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} oil lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			a	Single-row (approx.)	d_1	D_2	d_a min	D_b max	r_{as} max	r_{1as} max	l [2] min	
5S-2LA-HSFL010AD	50	80	16	1	0.6	11.1	6.20	1 140	635	11.4	1 170	50 000	23.3	0.27	61.6	70.9	55.5	75.5	1	0.6	8.5	5S-2LA-HSFL010AD
5S-2LA-HSFL011AD	55	90	18	1.1	0.6	13.9	7.80	1 420	800	14.4	1 470	44 800	26.0	0.40	68.6	79.2	62	85.5	1	0.6	8.5	5S-2LA-HSFL011AD
5S-2LA-HSFL012AD	60	95	18	1.1	0.6	14.3	8.45	1 460	860	15.5	1 580	41 900	27.2	0.43	73.6	84.2	67	90.5	1	0.6	8.5	5S-2LA-HSFL012AD
5S-2LA-HSFL013AD	65	100	18	1.1	0.6	14.7	9.05	1 500	925	16.7	1 700	39 400	28.3	0.46	78.6	89.2	72	95.5	1	0.6	9	5S-2LA-HSFL013AD
5S-2LA-HSFL014AD	70	110	20	1.1	0.6	18.0	11.1	1 830	1 130	20.4	2 080	36 100	31.1	0.64	85.6	97.5	77	105.5	1	0.6	9	5S-2LA-HSFL014AD
5S-2LA-HSFL015AD	75	115	20	1.1	0.6	18.5	11.9	1 880	1 210	21.8	2 220	34 200	32.3	0.68	90.6	102.5	82	110.5	1	0.6	9	5S-2LA-HSFL015AD
5S-2LA-HSFL016AD	80	125	22	1.1	0.6	22.0	14.2	2 250	1 440	26.0	2 660	31 700	35.0	0.91	97.6	110.8	87	120.5	1	0.6	9	5S-2LA-HSFL016AD
5S-2LA-HSFL017AD	85	130	22	1.1	0.6	22.2	14.7	2 270	1 500	27.0	2 750	30 200	36.2	0.95	102.6	115.8	92	125.5	1	0.6	9	5S-2LA-HSFL017AD
5S-2LA-HSFL018AD	90	140	24	1.5	1	27.1	18.2	2 760	1 860	33.5	3 400	28 300	39.0	1.25	109.8	124.2	98.5	134.5	1.5	1	9	5S-2LA-HSFL018AD
5S-2LA-HSFL019AD	95	145	24	1.5	1	27.3	18.8	2 790	1 920	34.5	3 550	27 100	40.1	1.30	114.8	129.2	103.5	139.5	1.5	1	9	5S-2LA-HSFL019AD
5S-2LA-HSFL020AD	100	150	24	1.5	1	28.1	20.0	2 860	2 040	37.0	3 750	26 000	41.3	1.36	119.8	134.2	108.5	144.5	1.5	1	9	5S-2LA-HSFL020AD

1) Minimum allowable value for corner radius dimension r or r_1.
2) For the details of spacer dimensions, please contact **NTN** Engineering.

Main Spindle Bearings

ULTAGE Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (ceramic ball spec.) 5S-2LA-HSEW9U type



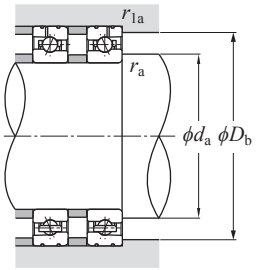


Enlarged view

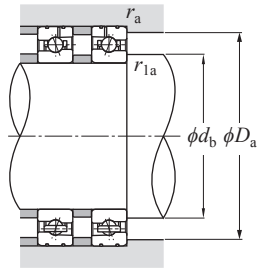
Contact angle 20° *d* 50–100 mm

Part number	Boundary dimensions mm									Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min⁻¹ oil lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	B_n	S_n	S_b	G_b	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		*a*			d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSEW910U	50	72	12	2.2	6.6	1.2	1.3	0.6	0.3	11.8	5.50	1 210	560	8.55	875	46 100	17.2	0.12	57.6	56.6	64.4	66.8	54.5	52.5	67.5	69.5	0.6	0.3
5S-2LA-HSEW911U	55	80	13	2.8	7.2	1.2	1.3	1	0.6	14.7	6.85	1 500	700	10.6	1 090	41 700	18.9	0.17	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
5S-2LA-HSEW912U	60	85	13	2.8	7.2	1.2	1.3	1	0.6	15.3	7.50	1 560	765	11.6	1 190	38 800	19.8	0.18	68.6	67.4	76.4	79.1	65.5	64.5	79.5	80.5	1	0.6
5S-2LA-HSEW913U	65	90	13	2.8	7.2	1.2	1.3	1	0.6	15.4	7.85	1 570	800	12.2	1 250	36 300	20.7	0.19	73.6	72.4	81.4	84.0	70.5	69.5	84.5	85.5	1	0.6
5S-2LA-HSEW914U	70	100	16	3.1	9.3	1.4	1.9	1	0.6	22.6	11.2	2 310	1 140	17.4	1 780	33 100	23.6	0.31	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
5S-2LA-HSEW915U	75	105	16	3.1	9.3	1.4	1.9	1	0.6	23.5	12.2	2 390	1 240	19.0	1 940	31 300	24.5	0.33	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
5S-2LA-HSEW916U	80	110	16	3.1	9.3	1.4	1.9	1	0.6	23.7	12.7	2 420	1 290	19.8	2 020	29 600	25.4	0.34	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
5S-2LA-HSEW917U	85	120	18	4	10.4	1.6	1.9	1.1	0.6	32.0	16.8	3 300	1 710	26.1	2 670	27 400	27.8	0.48	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
5S-2LA-HSEW918U	90	125	18	4	10.4	1.6	1.9	1.1	0.6	33.5	18.1	3 400	1 850	28.3	2 890	26 200	28.7	0.51	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
5S-2LA-HSEW919U	95	130	18	4	10.4	1.6	1.9	1.1	0.6	34.0	18.9	3 450	1 930	29.4	3 000	25 000	29.6	0.53	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
5S-2LA-HSEW920U	100	140	20	4	12	1.6	1.9	1.1	0.6	39.5	22.1	4 000	2 260	34.0	3 500	23 400	32.0	0.74	113.8	111.7	126.2	130.6	107	104.5	133	135.5	1	0.6

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)



Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

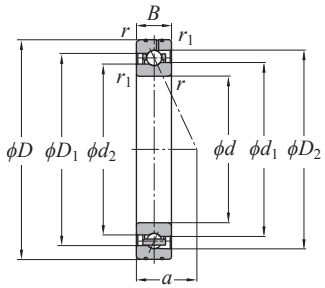
$P_{0r} = X_0 F_r + Y_0 F_a$

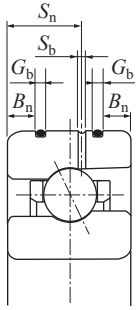
Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE **Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (ceramic ball spec.)**
5S-2LA-HSEW9U type





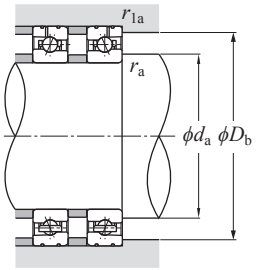
Enlarged view

Contact angle 25° *d* 50–100 mm

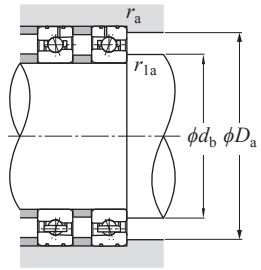
Part number	Boundary dimensions mm									Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1} oil lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	B_n	S_n	S_b	G_b	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_r	C_{0r}	(static)		*a*		d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSEW910UAD	50	72	12	2.2	6.6	1.2	1.3	0.6	0.3	11.4	5.30	1 170	545	9.75	995	41 000	20.3	0.12	57.6	56.6	64.4	66.7	54.5	52.5	67.5	69.5	0.6	0.3
5S-2LA-HSEW911UAD	55	80	13	2.8	7.2	1.2	1.3	1	0.6	14.3	6.65	1 450	680	12.1	1 240	37 000	22.4	0.17	63.6	62.4	71.4	74.1	60.5	59.5	74.5	75.5	1	0.6
5S-2LA-HSEW912UAD	60	85	13	2.8	7.2	1.2	1.3	1	0.6	14.8	7.25	1 510	740	13.3	1 360	34 500	23.5	0.18	68.6	67.4	76.4	79.0	65.5	64.5	79.5	80.5	1	0.6
5S-2LA-HSEW913UAD	65	90	13	2.8	7.2	1.2	1.3	1	0.6	14.9	7.60	1 520	775	13.9	1 420	32 300	24.7	0.19	73.6	72.4	81.4	84.0	70.5	69.5	84.5	85.5	1	0.6
5S-2LA-HSEW914UAD	70	100	16	3.1	9.3	1.4	1.9	1	0.6	21.9	10.8	2 230	1 100	19.9	2 030	29 400	28.0	0.31	80.1	78.6	89.8	93.2	75.5	74.5	94.5	95.5	1	0.6
5S-2LA-HSEW915UAD	75	105	16	3.1	9.3	1.4	1.9	1	0.6	22.7	11.8	2 310	1 200	21.5	2 200	27 800	29.1	0.33	85.1	83.6	94.8	98.2	80.5	79.5	99.5	100.5	1	0.6
5S-2LA-HSEW916UAD	80	110	16	3.1	9.3	1.4	1.9	1	0.6	23.0	12.3	2 340	1 250	22.5	2 300	26 300	30.3	0.34	90.1	88.6	99.8	103.2	85.5	84.5	104.5	105.5	1	0.6
5S-2LA-HSEW917UAD	85	120	18	4	10.4	1.6	1.9	1.1	0.6	31.0	16.2	3 150	1 660	29.4	3 000	24 400	33.1	0.48	96.8	94.9	108.2	112.3	92	89.5	113	115.5	1	0.6
5S-2LA-HSEW918UAD	90	125	18	4	10.4	1.6	1.9	1.1	0.6	32.5	17.6	3 300	1 790	31.5	3 250	23 300	34.2	0.51	101.8	99.9	113.2	117.3	97	94.5	118	120.5	1	0.6
5S-2LA-HSEW919UAD	95	130	18	4	10.4	1.6	1.9	1.1	0.6	32.5	18.3	3 350	1 870	33.0	3 400	22 200	35.4	0.53	106.8	104.9	118.2	122.3	102	99.5	123	125.5	1	0.6
5S-2LA-HSEW920UAD	100	140	20	4	12	1.6	1.9	1.1	0.6	38.0	21.4	3 850	2 190	39.0	4 000	20 800	38.2	0.74	113.8	111.7	126.2	130.6	107	104.5	133	135.5	1	0.6

1) Minimum allowable value for corner radius dimension *r* or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)



Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

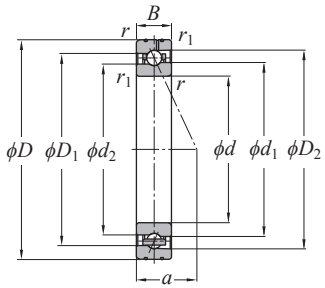
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

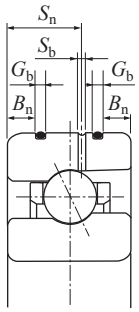
Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (ceramic ball spec.) 5S-2LA-HSEW0 type



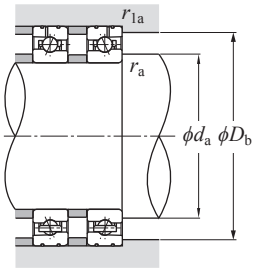


Enlarged view

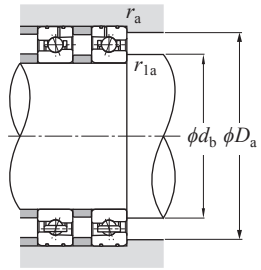
Contact angle 20° *d* 50–100 mm

Part number	Boundary dimensions mm									Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min⁻¹ oil lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	B_n	S_n	S_b	G_b	$r_{s\,min}$[1]	$r_{1s\,min}$[1]	C_r	C_{0r}	C_r	C_{0r}	(static)			*a*		d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSEW010	50	80	16	3.4	9.3	1.4	1.3	1	0.6	17.2	7.75	1 750	790	12.1	1 230	43 300	19.9	0.23	60.1	58.6	69.9	73.2	55.5	54.5	74.5	75.5	1	0.6
5S-2LA-HSEW011	55	90	18	4.3	9.7	1.4	1.9	1.1	0.6	18.7	9.20	1 900	935	14.4	1 460	38 800	22.3	0.37	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
5S-2LA-HSEW012	60	95	18	4.3	9.7	1.4	1.9	1.1	0.6	19.5	10.2	1 990	1 040	15.9	1 620	36 300	23.2	0.40	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
5S-2LA-HSEW013	65	100	18	4	10.4	1.6	1.9	1.1	0.6	19.8	10.7	2 020	1 090	16.7	1 710	34 100	24.1	0.42	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
5S-2LA-HSEW014	70	110	20	4	11.6	1.6	1.9	1.1	0.6	24.2	13.5	2 470	1 370	21.1	2 150	31 200	26.5	0.60	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
5S-2LA-HSEW015	75	115	20	4	11.6	1.6	2.4	1.1	0.6	25.8	15.2	2 630	1 550	23.8	2 420	29 600	27.4	0.64	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
5S-2LA-HSEW016	80	125	22	4.7	12.2	1.6	2.4	1.1	0.6	29.6	17.4	3 000	1 770	27.2	2 780	27 400	29.8	0.86	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
5S-2LA-HSEW017	85	130	22	4.7	12.2	1.6	2.4	1.1	0.6	30.0	18.1	3 050	1 850	28.4	2 900	26 200	30.7	0.90	101.8	99.9	113.2	117.4	92	89.5	123	125.5	1	0.6
5S-2LA-HSEW018	90	140	24	5.5	14.5	1.6	1.9	1.5	1	34.5	21.3	3 550	2 170	33.5	3 400	24 500	33.1	1.18	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
5S-2LA-HSEW019	95	145	24	5.5	14.5	1.6	2.4	1.5	1	35.0	22.1	3 600	2 260	34.5	3 550	23 400	34.0	1.23	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
5S-2LA-HSEW020	100	150	24	5.5	14.5	1.6	1.9	1.5	1	36.5	23.8	3 700	2 420	37.5	3 800	22 500	34.9	1.28	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)



Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

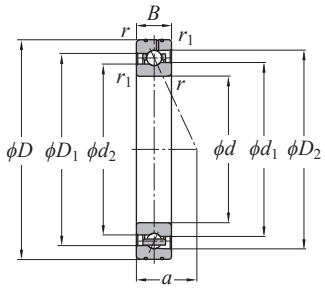
$P_{0r} = X_0 F_r + Y_0 F_a$

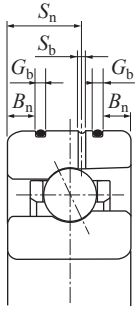
Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Air-oil lubricated high speed angular contact ball bearings with re-lubricating hole on the outer ring (ceramic ball spec.) 5S-2LA-HSEW0 type



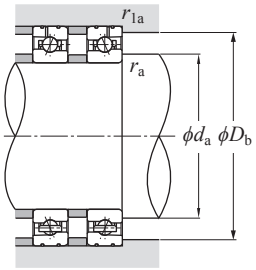


Enlarged view

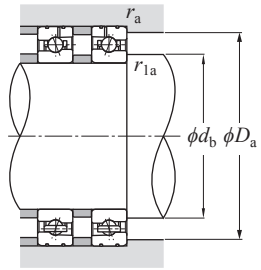
Contact angle 25° *d* 50–100 mm

Part number	Boundary dimensions mm									Basic load ratings dynamic kN		static kN		dynamic kgf		static kgf		Allowable axial load kN	kgf	Allowable speed min⁻¹ oil lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm				Abutment and fillet dimensions mm					
	d	*D*	*B*	B_n	S_n	S_b	G_b	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)		*a*		d_1	d_2	D_1	D_2	d_a min	d_b min	D_a max	D_b max	r_{as} max	r_{1as} max
5S-2LA-HSEW010AD	50	80	16	3.4	9.3	1.4	1.3	1	0.6	16.6	7.50	1 700	765	13.8	1 400					38 500	23.3	0.23	60.1	58.6	69.9	73.2	55.5	54.5	74.5	75.5	1	0.6
5S-2LA-HSEW011AD	55	90	18	4.3	9.7	1.4	1.9	1.1	0.6	18.1	8.90	1 840	910	16.4	1 670					34 500	26.1	0.37	67.6	66.2	77.4	80.8	62	59.5	83	85.5	1	0.6
5S-2LA-HSEW012AD	60	95	18	4.3	9.7	1.4	1.9	1.1	0.6	18.9	9.85	1 930	1 000	18.1	1 850					32 300	27.2	0.40	72.6	71.2	82.4	85.8	67	64.5	88	90.5	1	0.6
5S-2LA-HSEW013AD	65	100	18	4	10.4	1.6	1.9	1.1	0.6	19.2	10.4	1 960	1 060	19.0	1 940					30 300	28.4	0.40	77.6	76.2	87.4	90.8	72	69.5	93	95.5	1	0.6
5S-2LA-HSEW014AD	70	110	20	4	11.6	1.6	1.9	1.1	0.6	23.4	13.0	2 390	1 330	24.0	2 440					27 800	31.1	0.60	84.8	83.0	95.2	99.1	77	74.5	103	105.5	1	0.6
5S-2LA-HSEW015AD	75	115	20	4	11.6	1.6	2.4	1.1	0.6	25.0	14.7	2 550	1 500	27.0	2 760					26 300	32.3	0.64	89.8	88.0	100.2	104.1	82	79.5	108	110.5	1	0.6
5S-2LA-HSEW016AD	80	125	22	4.7	12.2	1.6	2.4	1.1	0.6	28.6	16.9	2 910	1 720	31.0	3 150					24 400	35.1	0.86	96.8	94.9	108.2	112.5	87	84.5	118	120.5	1	0.6
5S-2LA-HSEW017AD	85	130	22	4.7	12.2	1.6	2.4	1.1	0.6	28.9	17.6	2 950	1 790	32.5	3 300					23 300	36.2	0.90	101.8	99.9	113.2	117.4	92	89.5	123	125.5	1	0.6
5S-2LA-HSEW018AD	90	140	24	5.5	14.5	1.6	1.9	1.5	1	33.5	20.6	3 400	2 100	38.0	3 850					21 700	39.0	1.18	108.8	106.7	121.2	125.8	98.5	95.5	131.5	134.5	1.5	1
5S-2LA-HSEW019AD	95	145	24	5.5	14.5	1.6	2.4	1.5	1	34.0	21.4	3 450	2 190	39.5	4 000					20 800	40.2	1.23	113.8	111.7	126.2	130.8	103.5	100.5	136.5	139.5	1.5	1
5S-2LA-HSEW020AD	100	150	24	5.5	14.5	1.6	1.9	1.5	1	35.0	23.0	3 600	2 350	42.5	4 300					20 000	41.3	1.28	118.8	116.7	131.2	135.8	108.5	105.5	141.5	144.5	1.5	1

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)



Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

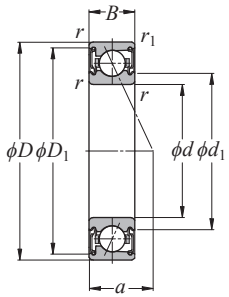
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

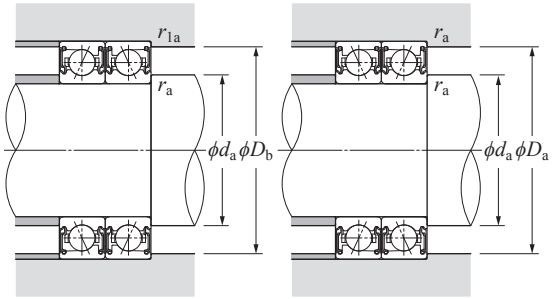
ULTAGE Grease-lubricated sealed standard angular contact ball bearings (steel ball spec.) 79 LLB type



Contact angle 15° *d* 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN		static kN		dynamic kgf		static kgf		Allowable axial load kN (static)	kgf (static)	Factor	Allowable speed min^{-1} grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	r_{smin} 1)	r_{1smin} 1)	C_r	C_{0r}	C_r	C_{0r}	C_r	C_{0r}	C_r	C_{0r}			f_0		*a*		d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7900CDLLB	10	22	6	0.3	0.15	3.35	1.52	340	155	1.91	194					14.1	75 700	5.2	0.010	12.9	19.7	12.5	19.7	20.8	0.3	0.15	7900CDLLB
7901CDLLB	12	24	6	0.3	0.15	3.70	1.86	380	189	2.34	239					14.7	67 300	5.4	0.012	15.2	21.7	14.5	21.7	22.8	0.3	0.15	7901CDLLB
7902CDLLB	15	28	7	0.3	0.15	5.55	2.86	570	292	3.60	370					14.5	56 300	6.4	0.017	18.5	26.0	17.5	26.0	26.8	0.3	0.15	7902CDLLB
7903CDLLB	17	30	7	0.3	0.15	5.85	3.15	595	320	4.00	405					14.8	51 500	6.7	0.019	20.2	28.0	19.5	28.0	28.8	0.3	0.15	7903CDLLB
7904CDLLB	20	37	9	0.3	0.15	8.10	4.55	825	465	5.75	590					14.9	42 500	8.4	0.039	23.9	33.9	22.5	34.5	35.8	0.3	0.15	7904CDLLB
7905CDLLB	25	42	9	0.3	0.15	9.05	5.75	925	585	7.30	745					15.5	36 100	9.0	0.046	29.1	38.9	27.5	39.5	40.8	0.3	0.15	7905CDLLB
7906CDLLB	30	47	9	0.3	0.15	9.55	6.60	975	675	8.40	860					15.9	31 400	9.7	0.053	34.6	43.9	32.5	44.5	45.8	0.3	0.15	7906CDLLB
7907CDLLB	35	55	10	0.6	0.3	13.0	9.50	1 330	970	12.1	1 230					15.9	26 900	11.1	0.081	40.2	51.2	39.5	51.2	52.5	0.6	0.3	7907CDLLB
7908CDLLB	40	62	12	0.6	0.3	19.5	13.8	1 980	1 400	17.5	1 780					15.5	23 700	12.9	0.11	45.3	58.8	44.5	58.8	59.5	0.6	0.3	7908CDLLB
7909CDLLB	45	68	12	0.6	0.3	20.6	15.6	2 100	1 590	19.8	2 020					15.8	21 400	13.6	0.13	50.8	64.3	49.5	64.3	65.5	0.6	0.3	7909CDLLB
7910CDLLB	50	72	12	0.6	0.3	17.6	14.7	1 800	1 490	18.6	1 900					16.4	20 000	14.2	0.14	55.2	67.5	54.5	67.5	69.5	0.6	0.3	7910CDLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	*e*	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

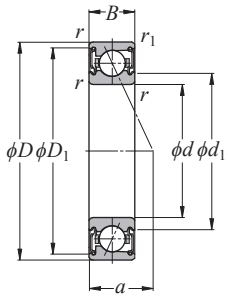
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Grease-lubricated sealed standard angular contact ball bearings (steel ball spec.) 79 LLB type

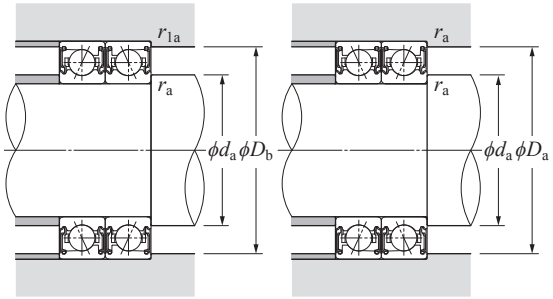


Contact angle 25° *d* 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	r_{smin}[1]	r_{1smin}[1]	C_r	C_{0r}	C_r	C_{0r}	(static)			a	Single-row (approx.)	d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7900ADLLB	10	22	6	0.3	0.15	3.20	1.45	325	148	2.20	225	65 600	6.8	0.010	12.9	19.7	12.5	19.7	20.8	0.3	0.15	7900ADLLB
7901ADLLB	12	24	6	0.3	0.15	3.55	1.77	360	181	2.61	267	58 300	7.2	0.012	15.2	21.7	14.5	21.7	22.8	0.3	0.15	7901ADLLB
7902ADLLB	15	28	7	0.3	0.15	5.30	2.74	540	279	4.40	450	48 800	8.6	0.017	18.5	26.0	17.5	26.0	26.8	0.3	0.15	7902ADLLB
7903ADLLB	17	30	7	0.3	0.15	5.55	3.00	565	305	4.75	485	44 700	9.0	0.019	20.2	28.0	19.5	28.0	28.8	0.3	0.15	7903ADLLB
7904ADLLB	20	37	9	0.3	0.15	7.70	4.35	785	445	6.35	645	36 800	11.2	0.039	23.9	33.9	22.5	34.5	35.8	0.3	0.15	7904ADLLB
7905ADLLB	25	42	9	0.3	0.15	8.60	5.50	875	560	7.75	790	31 300	12.4	0.046	29.1	38.9	27.5	39.5	40.8	0.3	0.15	7905ADLLB
7906ADLLB	30	47	9	0.3	0.15	9.00	6.30	920	640	8.65	885	27 300	13.5	0.053	34.6	43.9	32.5	44.5	45.8	0.3	0.15	7906ADLLB
7907ADLLB	35	55	10	0.6	0.3	12.3	9.00	1 260	920	13.1	1 340	23 300	15.6	0.081	40.2	51.2	39.5	51.2	52.5	0.6	0.3	7907ADLLB
7908ADLLB	40	62	12	0.6	0.3	18.4	13.1	1 880	1 330	19.3	1 960	20 600	18.0	0.11	45.3	58.8	44.5	58.8	59.5	0.6	0.3	7908ADLLB
7909ADLLB	45	68	12	0.6	0.3	19.5	14.8	1 980	1 510	21.5	2 190	18 600	19.3	0.13	50.8	64.3	49.5	64.3	65.5	0.6	0.3	7909ADLLB
7910ADLLB	50	72	12	0.6	0.3	16.6	13.9	1 700	1 420	13.6	1 380	17 400	20.2	0.14	55.2	67.5	54.5	67.5	69.5	0.6	0.3	7910ADLLB

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

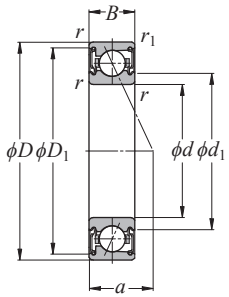
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

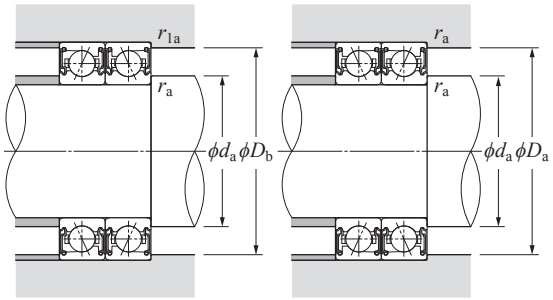
ULTAGE Grease-lubricated sealed standard angular contact ball bearings (steel ball spec.) 70 LLB type



Contact angle 15° d 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	r_{smin} 1)	r_{1smin} 1)	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0		a	Single-row (approx.)	d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7000CDLLB	10	26	8	0.3	0.15	5.90	2.49	600	254	3.10	315	12.6	67 300	6.4	0.018	14.5	23.4	12.5	23.5	24.8	0.3	0.15	7000CDLLB
7001CDLLB	12	28	8	0.3	0.15	6.40	2.90	655	296	3.65	370	13.2	60 600	6.7	0.022	16.5	25.4	14.5	25.5	26.8	0.3	0.15	7001CDLLB
7002CDLLB	15	32	9	0.3	0.15	6.90	3.40	705	345	4.25	435	14.0	51 500	7.7	0.032	19.5	28.8	17.5	29.5	30.8	0.3	0.15	7002CDLLB
7003CDLLB	17	35	10	0.3	0.15	9.10	4.50	930	460	5.70	580	13.8	46 600	8.5	0.040	21.3	32.2	19.5	32.5	33.8	0.3	0.15	7003CDLLB
7004CDLLB	20	42	12	0.6	0.3	11.6	6.00	1 180	610	7.55	770	14.0	39 100	10.2	0.070	26.0	38.0	24.5	38.0	39.5	0.6	0.3	7004CDLLB
7005CDLLB	25	47	12	0.6	0.3	13.6	8.00	1 390	815	10.1	1 030	14.7	33 600	10.9	0.083	30.4	43.1	29.5	43.1	44.5	0.6	0.3	7005CDLLB
7006CDLLB	30	55	13	1	0.6	16.8	10.3	1 710	1 050	13.0	1 320	14.9	28 500	12.2	0.11	36.4	50.4	35.5	50.4	50.5	1	0.6	7006CDLLB
7007CDLLB	35	62	14	1	0.6	21.2	13.7	2 160	1 390	17.3	1 760	15.0	25 000	13.6	0.16	41.9	57.2	40.5	57.2	57.5	1	0.6	7007CDLLB
7008CDLLB	40	68	15	1	0.6	22.8	15.9	2 320	1 620	20.1	2 050	15.4	22 400	14.8	0.19	47.9	62.7	45.5	62.7	63.5	1	0.6	7008CDLLB
7009CDLLB	45	75	16	1	0.6	30.5	21.1	3 100	2 160	26.7	2 730	15.1	20 200	16.1	0.24	53.0	70.3	50.5	70.3	70.5	1	0.6	7009CDLLB
7010CDLLB	50	80	16	1	0.6	31.5	22.9	3 250	2 330	29.0	2 960	15.4	18 600	16.8	0.26	58.0	75.3	55.5	75.3	75.5	1	0.6	7010CDLLB

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

Static equivalent radial load

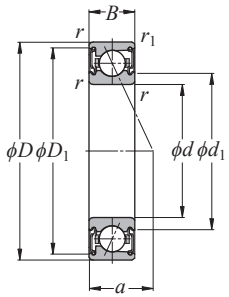
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Grease-lubricated sealed standard angular contact ball bearings (steel ball spec.) 70 LLB type

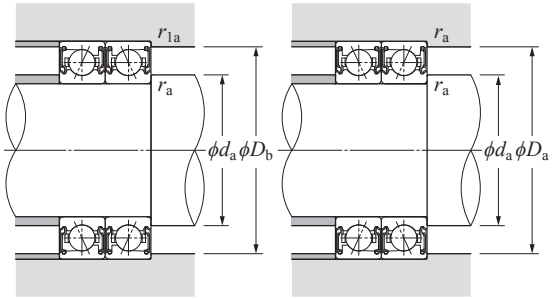


Contact angle 25° *d* 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN		dynamic kgf		Allowable axial load static kN	static kgf	Allowable speed min^{-1} grease lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	r_{smin}[1]	r_{1smin}[1]	C_r	C_{0r}	C_r	C_{0r}	(static)			a	Single-row (approx.)	d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
7000ADLLB	10	26	8	0.3	0.15	5.70	2.41	580	245	3.85	395	58 300	8.3	0.018	14.5	23.4	12.5	23.5	24.8	0.3	0.15	7000ADLLB
7001ADLLB	12	28	8	0.3	0.15	6.20	2.79	630	285	4.50	455	52 500	8.7	0.022	16.5	25.4	14.5	25.5	26.8	0.3	0.15	7001ADLLB
7002ADLLB	15	32	9	0.3	0.15	6.60	3.25	675	330	4.95	505	44 700	10.0	0.032	19.5	28.8	17.5	29.5	30.8	0.3	0.15	7002ADLLB
7003ADLLB	17	35	10	0.3	0.15	8.75	4.35	890	445	6.95	710	40 400	11.1	0.040	21.3	32.2	19.5	32.5	33.8	0.3	0.15	7003ADLLB
7004ADLLB	20	42	12	0.6	0.3	11.1	5.75	1 130	585	8.80	900	33 900	13.3	0.070	26.0	38.0	24.5	38.0	39.5	0.6	0.3	7004ADLLB
7005ADLLB	25	47	12	0.6	0.3	13.0	7.65	1 320	780	11.3	1 150	29 200	14.5	0.083	30.4	43.1	29.5	43.1	44.5	0.6	0.3	7005ADLLB
7006ADLLB	30	55	13	1	0.6	16.0	9.80	1 630	995	14.9	1 520	24 700	16.5	0.11	36.4	50.4	35.5	50.4	50.5	1	0.6	7006ADLLB
7007ADLLB	35	62	14	1	0.6	20.1	13.0	2 050	1 330	20.4	2 080	21 600	18.4	0.16	41.9	57.2	40.5	57.2	57.5	1	0.6	7007ADLLB
7008ADLLB	40	68	15	1	0.6	21.6	15.1	2 200	1 540	23.2	2 370	19 400	20.2	0.19	47.9	62.7	45.5	62.7	63.5	1	0.6	7008ADLLB
7009ADLLB	45	75	16	1	0.6	29.1	20.1	2 970	2 050	31.0	3 150	17 500	22.1	0.24	53.0	70.3	50.5	70.3	70.5	1	0.6	7009ADLLB
7010ADLLB	50	80	16	1	0.6	30.0	21.8	3 050	2 220	33.0	3 350	16 200	23.3	0.26	58.0	75.3	55.5	75.3	75.5	1	0.6	7010ADLLB

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

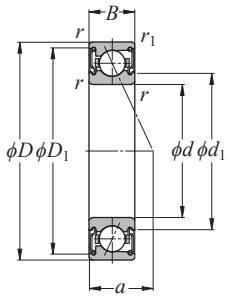
Main Spindle Bearings

Angular Contact Ball Bearings for Radial Loads

Dimension Tables

NTN

ULTAGE **Grease-lubricated sealed standard angular contact ball bearings (ceramic ball spec.)**
5S-79 LLB type

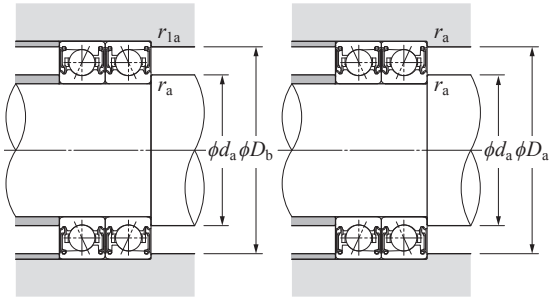


Contact angle 15° d 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN		static kN		Allowable axial load kN		Factor	Allowable speed min^{-1}	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	r_{smin}[1]	r_{1smin}[1]	C_r	C_{0r}	C_r kgf	C_{0r} kgf	(static)	kgf	f_0	grease lubrication	a	Single-row (approx.)	d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7900CDLLB	10	22	6	0.3	0.15	3.35	1.05	340	107	1.19	121	9.8	89 800	5.2	0.009	12.9	19.7	12.5	19.7	20.8	0.3	0.15	5S-7900CDLLB
5S-7901CDLLB	12	24	6	0.3	0.15	3.70	1.29	380	131	1.46	149	10.2	79 800	5.4	0.011	15.2	21.7	14.5	21.7	22.8	0.3	0.15	5S-7901CDLLB
5S-7902CDLLB	15	28	7	0.3	0.15	5.55	1.98	570	202	2.25	230	10.0	66 800	6.4	0.015	18.5	26.0	17.5	26.0	26.8	0.3	0.15	5S-7902CDLLB
5S-7903CDLLB	17	30	7	0.3	0.15	5.85	2.19	595	223	2.49	254	10.3	61 100	6.7	0.017	20.2	28.0	19.5	28.0	28.8	0.3	0.15	5S-7903CDLLB
5S-7904CDLLB	20	37	9	0.3	0.15	8.10	3.15	825	325	3.60	365	10.3	50 400	8.4	0.036	23.9	33.9	22.5	34.5	35.8	0.3	0.15	5S-7904CDLLB
5S-7905CDLLB	25	42	9	0.3	0.15	9.05	4.00	925	405	4.55	465	10.7	42 900	9.0	0.042	29.1	38.9	27.5	39.5	40.8	0.3	0.15	5S-7905CDLLB
5S-7906CDLLB	30	47	9	0.3	0.15	9.55	4.60	975	470	5.25	535	11.0	37 300	9.7	0.048	34.6	43.9	32.5	44.5	45.8	0.3	0.15	5S-7906CDLLB
5S-7907CDLLB	35	55	10	0.6	0.3	13.0	6.60	1 330	670	7.55	770	11.0	31 900	11.1	0.073	40.2	51.2	39.5	51.2	52.5	0.6	0.3	5S-7907CDLLB
5S-7908CDLLB	40	62	12	0.6	0.3	19.5	9.55	1 980	975	10.9	1 110	10.8	28 200	12.9	0.099	45.3	58.8	44.5	58.8	59.5	0.6	0.3	5S-7908CDLLB
5S-7909CDLLB	45	68	12	0.6	0.3	20.6	10.8	2 100	1 100	12.4	1 260	11.0	24 100	13.6	0.12	50.8	64.3	49.5	64.3	65.5	0.6	0.3	5S-7909CDLLB
5S-7910CDLLB	50	72	12	0.6	0.3	17.6	10.2	1 800	1 040	11.7	1 190	11.3	22 500	14.2	0.12	55.2	67.5	54.5	67.5	69.5	0.6	0.3	5S-7910CDLLB

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	Single row / Tandem $F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	Back-to-back / Face-to-face $F_a/F_r > e$ X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

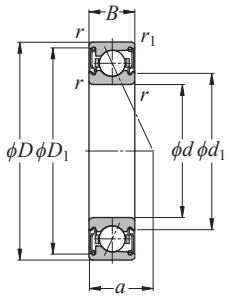
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

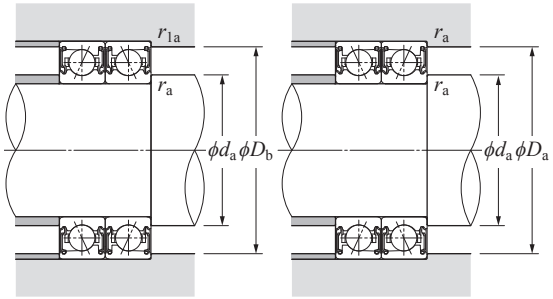
ULTAGE Grease-lubricated sealed standard angular contact ball bearings (ceramic ball spec.) 5S-79 LLB type



Contact angle 25° *d* 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	r_{smin} [1]	r_{1smin} [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			*a*	Single-row (approx.)	d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7900ADLLB	10	22	6	0.3	0.15	3.20	1.01	325	103	1.52	155	79 700	6.8	0.009	12.9	19.7	12.5	19.7	20.8	0.3	0.15	5S-7900ADLLB
5S-7901ADLLB	12	24	6	0.3	0.15	3.55	1.23	360	125	1.86	189	70 800	7.2	0.011	15.2	21.7	14.5	21.7	22.8	0.3	0.15	5S-7901ADLLB
5S-7902ADLLB	15	28	7	0.3	0.15	5.30	1.90	540	193	2.86	292	59 300	8.6	0.015	18.5	26.0	17.5	26.0	26.8	0.3	0.15	5S-7902ADLLB
5S-7903ADLLB	17	30	7	0.3	0.15	5.55	2.09	565	213	3.15	320	54 300	9.0	0.017	20.2	28.0	19.5	28.0	28.8	0.3	0.15	5S-7903ADLLB
5S-7904ADLLB	20	37	9	0.3	0.15	7.70	3.00	785	310	4.55	465	44 700	11.2	0.036	23.9	33.9	22.5	34.5	35.8	0.3	0.15	5S-7904ADLLB
5S-7905ADLLB	25	42	9	0.3	0.15	8.60	3.80	875	385	5.75	585	38 100	12.4	0.042	29.1	38.9	27.5	39.5	40.8	0.3	0.15	5S-7905ADLLB
5S-7906ADLLB	30	47	9	0.3	0.15	9.00	4.35	920	445	6.60	670	33 100	13.5	0.048	34.6	43.9	32.5	44.5	45.8	0.3	0.15	5S-7906ADLLB
5S-7907ADLLB	35	55	10	0.6	0.3	12.3	6.25	1 260	635	9.45	965	28 300	15.6	0.073	40.2	51.2	39.5	51.2	52.5	0.6	0.3	5S-7907ADLLB
5S-7908ADLLB	40	62	12	0.6	0.3	18.4	9.05	1 880	925	13.7	1 400	25 000	18.0	0.099	45.3	58.8	44.5	58.8	59.5	0.6	0.3	5S-7908ADLLB
5S-7909ADLLB	45	68	12	0.6	0.3	19.5	10.3	1 980	1 050	15.6	1 590	21 400	19.3	0.12	50.8	64.3	49.5	64.3	65.5	0.6	0.3	5S-7909ADLLB
5S-7910ADLLB	50	72	12	0.6	0.3	16.6	9.60	1 700	980	14.6	1 490	20 000	20.2	0.12	55.2	67.5	54.5	67.5	69.5	0.6	0.3	5S-7910ADLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

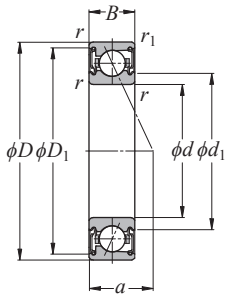
Main Spindle Bearings

Angular Contact Ball Bearings for Radial Loads

Dimension Tables

NTN

ULTAGE Grease-lubricated sealed standard angular contact ball bearings (ceramic ball spec.) 5S-70 LLB type

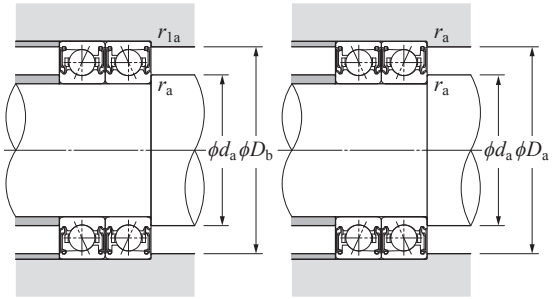


Contact angle 15° d 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	r_{smin} [1]	r_{1smin} [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0		a	Single-row (approx.)	d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7000CDLLB	10	26	8	0.3	0.15	5.90	1.73	600	176	1.93	197	8.8	80 600	6.4	0.014	14.5	23.4	12.5	23.5	24.8	0.3	0.15	5S-7000CDLLB
5S-7001CDLLB	12	28	8	0.3	0.15	6.40	2.01	655	205	2.26	231	9.2	72 600	6.7	0.020	16.5	25.4	14.5	25.5	26.8	0.3	0.15	5S-7001CDLLB
5S-7002CDLLB	15	32	9	0.3	0.15	6.90	2.35	705	239	2.66	271	9.7	61 800	7.7	0.029	19.5	28.8	17.5	29.5	30.8	0.3	0.15	5S-7002CDLLB
5S-7003CDLLB	17	35	10	0.3	0.15	9.10	3.15	930	320	3.55	360	9.6	55 800	8.5	0.035	21.3	32.2	19.5	32.5	33.8	0.3	0.15	5S-7003CDLLB
5S-7004CDLLB	20	42	12	0.6	0.3	11.6	4.15	1 180	425	4.70	480	9.7	46 800	10.2	0.064	26.0	38.0	24.5	38.0	39.5	0.6	0.3	5S-7004CDLLB
5S-7005CDLLB	25	47	12	0.6	0.3	13.6	5.55	1 390	565	6.30	640	10.2	40 300	10.9	0.075	30.4	43.1	29.5	43.1	44.5	0.6	0.3	5S-7005CDLLB
5S-7006CDLLB	30	55	13	1	0.6	16.8	7.10	1 710	725	8.10	825	10.3	34 100	12.2	0.096	36.4	50.4	35.5	50.4	50.5	1	0.6	5S-7006CDLLB
5S-7007CDLLB	35	62	14	1	0.6	21.2	9.45	2 160	965	10.8	1 100	10.4	29 900	13.6	0.14	41.9	57.2	40.5	57.2	57.5	1	0.6	5S-7007CDLLB
5S-7008CDLLB	40	68	15	1	0.6	22.8	11.0	2 320	1 120	12.6	1 280	10.6	26 900	14.8	0.17	47.9	62.7	45.5	62.7	63.5	1	0.6	5S-7008CDLLB
5S-7009CDLLB	45	75	16	1	0.6	30.5	14.6	3 100	1 490	16.7	1 700	10.4	23 300	16.1	0.21	53.0	70.3	50.5	70.3	70.5	1	0.6	5S-7009CDLLB
5S-7010CDLLB	50	80	16	1	0.6	31.5	15.9	3 250	1 620	18.1	1 850	10.6	21 500	16.8	0.23	58.0	75.3	55.5	75.3	75.5	1	0.6	5S-7010CDLLB

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.38				1.47		1.65		2.39
0.357	0.4				1.4		1.57		2.28
0.714	0.43				1.3		1.46		2.11
1.07	0.46				1.23		1.38		2
1.43	0.47	1	0	0.44	1.19	1	1.34	0.72	1.93
2.14	0.5				1.12		1.26		1.82
3.57	0.55				1.02		1.14		1.66
5.35	0.56				1		1.12		1.63
7.14	0.56				1		1.12		1.63

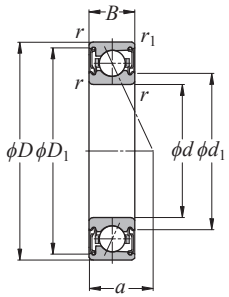
Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.46	1	0.92

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

ULTAGE Grease-lubricated sealed standard angular contact ball bearings (ceramic ball spec.) 5S-70 LLB type

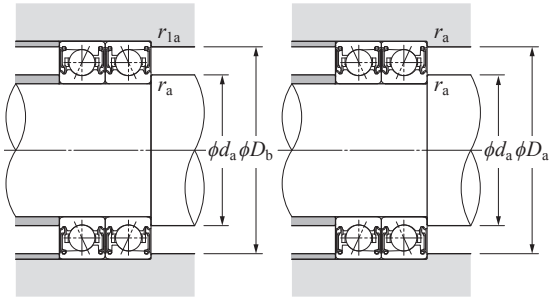


Contact angle 25° d 10–50 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN		static kN		dynamic kgf		static kgf		Allowable axial load kN	kgf	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm		Abutment and fillet dimensions mm					Part number
	d	D	B	r_{smin} [1]	r_{1smin} [1]	C_r		C_{0r}		C_r		C_{0r}		(static)		a			d_1	D_1	d_a min	D_a max	D_b max	r_{as} max	r_{1as} max	
5S-7000ADLLB	10	26	8	0.3	0.15	5.70		1.67		580		170		2.51	256	70 600	8.3	0.014	14.5	23.4	12.5	23.5	24.8	0.3	0.15	5S-7000ADLLB
5S-7001ADLLB	12	28	8	0.3	0.15	6.20		1.93		630		197		2.92	297	63 500	8.7	0.020	16.5	25.4	14.5	25.5	26.8	0.3	0.15	5S-7001ADLLB
5S-7002ADLLB	15	32	9	0.3	0.15	6.60		2.25		675		229		3.40	345	54 000	10.0	0.029	19.5	28.8	17.5	29.5	30.8	0.3	0.15	5S-7002ADLLB
5S-7003ADLLB	17	35	10	0.3	0.15	8.75		3.00		890		305		4.55	465	48 800	11.1	0.035	21.3	32.2	19.5	32.5	33.8	0.3	0.15	5S-7003ADLLB
5S-7004ADLLB	20	42	12	0.6	0.3	11.1		4.00		1 130		405		6.00	615	41 000	13.3	0.064	26.0	38.0	24.5	38.0	39.5	0.6	0.3	5S-7004ADLLB
5S-7005ADLLB	25	47	12	0.6	0.3	13.0		5.30		1 320		540		8.00	815	35 300	14.5	0.075	30.4	43.1	29.5	43.1	44.5	0.6	0.3	5S-7005ADLLB
5S-7006ADLLB	30	55	13	1	0.6	16.0		6.80		1 630		690		10.2	1 040	29 900	16.5	0.096	36.4	50.4	35.5	50.4	50.5	1	0.6	5S-7006ADLLB
5S-7007ADLLB	35	62	14	1	0.6	20.1		9.00		2 050		920		13.6	1 390	26 200	18.4	0.14	41.9	57.2	40.5	57.2	57.5	1	0.6	5S-7007ADLLB
5S-7008ADLLB	40	68	15	1	0.6	21.6		10.5		2 200		1 070		15.8	1 620	23 500	20.2	0.17	47.9	62.7	45.5	62.7	63.5	1	0.6	5S-7008ADLLB
5S-7009ADLLB	45	75	16	1	0.6	29.1		14.0		2 970		1 420		21.1	2 150	20 300	22.1	0.21	53.0	70.3	50.5	70.3	70.5	1	0.6	5S-7009ADLLB
5S-7010ADLLB	50	80	16	1	0.6	30.0		15.1		3 050		1 540		22.8	2 330	18 800	23.3	0.23	58.0	75.3	55.5	75.3	75.5	1	0.6	5S-7010ADLLB

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

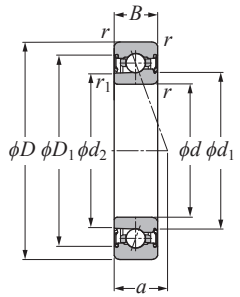
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

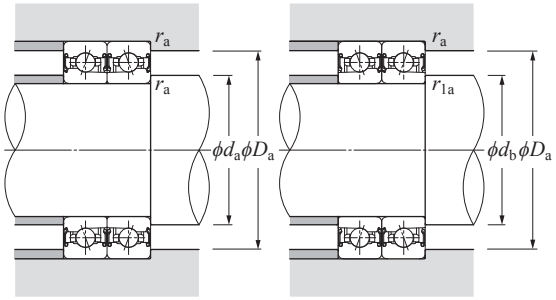
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (steel ball spec.) 2LA-BNS9 LLB type



Contact angle 15° *d* 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Factor	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)	f_0		*a*	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
2LA-BNS910CLLB	50	72	12	0.6	0.3	8.95	7.30	915	745	10.7	1 090	11.1	21 800	14.2	0.14	56.9	56.0	65.0	54.5	52.5	67.5	0.6	0.3	2LA-BNS910CLLB
2LA-BNS911CLLB	55	80	13	1	0.6	11.4	9.20	1 170	940	13.5	1 380	11.0	19 700	15.6	0.19	62.6	61.7	72.1	60.5	59.5	74.5	1	0.6	2LA-BNS911CLLB
2LA-BNS912CLLB	60	85	13	1	0.6	11.8	9.95	1 200	1 010	14.6	1 490	11.1	18 300	16.3	0.21	67.6	66.7	77.1	65.5	64.5	79.5	1	0.6	2LA-BNS912CLLB
2LA-BNS913CLLB	65	90	13	1	0.6	12.1	10.7	1 230	1 090	15.7	1 600	11.2	17 200	16.9	0.22	72.6	71.7	82.1	70.5	69.5	84.5	1	0.6	2LA-BNS913CLLB
2LA-BNS914CLLB	70	100	16	1	0.6	15.2	13.5	1 550	1 370	19.8	2 020	11.1	15 600	19.5	0.38	79.2	78.3	90.2	75.5	74.5	94.5	1	0.6	2LA-BNS914CLLB
2LA-BNS915CLLB	75	105	16	1	0.6	15.6	14.4	1 590	1 470	21.2	2 170	11.2	14 800	20.1	0.39	84.2	83.3	95.2	80.5	79.5	99.5	1	0.6	2LA-BNS915CLLB
2LA-BNS916CLLB	80	110	16	1	0.6	16.0	15.4	1 630	1 570	22.6	2 310	11.3	14 000	20.8	0.41	89.2	88.3	100.2	85.5	84.5	104.5	1	0.6	2LA-BNS916CLLB
2LA-BNS917CLLB	85	120	18	1.1	0.6	19.3	18.3	1 960	1 860	26.9	2 740	11.2	13 000	22.8	0.59	96.0	95.0	108.6	92	89.5	113	1	0.6	2LA-BNS917CLLB
2LA-BNS918CLLB	90	125	18	1.1	0.6	19.8	19.5	2 020	1 980	28.7	2 920	11.3	12 400	23.5	0.62	100.9	100.0	113.6	97	94.5	118	1	0.6	2LA-BNS918CLLB
2LA-BNS919CLLB	95	130	18	1.1	0.6	20.3	20.6	2 070	2 110	30.5	3 100	11.3	11 800	24.2	0.65	105.9	105.0	118.6	102	99.5	123	1	0.6	2LA-BNS919CLLB
2LA-BNS920CLLB	100	140	20	1.1	0.6	28.5	28.0	2 910	2 850	41.0	4 200	11.2	11 100	26.2	0.87	111.9	110.9	127.3	107	104.5	133	1	0.6	2LA-BNS920CLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	*e*	Single row / Tandem $F_a/F_r \le e$ X	Single row / Tandem $F_a/F_r \le e$ Y	Single row / Tandem $F_a/F_r > e$ X	Single row / Tandem $F_a/F_r > e$ Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Back-to-back / Face-to-face $F_a/F_r \le e$ Y	Back-to-back / Face-to-face $F_a/F_r > e$ X	Back-to-back / Face-to-face $F_a/F_r > e$ Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

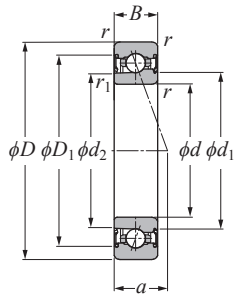
$P_{0r} = X_0 F_r + Y_0 F_a$

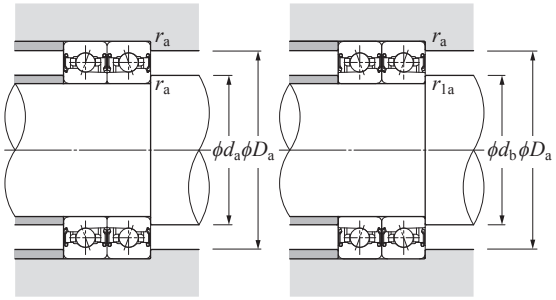
Single row / Tandem X_0	Single row / Tandem Y_0	Back-to-back / Face-to-face X_0	Back-to-back / Face-to-face Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (steel ball spec.) 2LA-BNS9 LLB type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

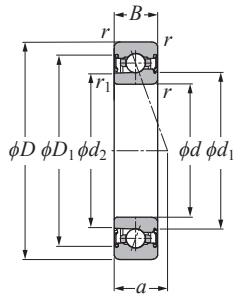
Contact angle 20° d 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	Load center mm	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		a		Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
2LA-BNS910LLB	50	72	12	0.6	0.3	8.75	7.10	890	725	11.9	1 220	23 100	17.2	0.14	56.9	56.0	65.0	54.5	52.5	67.5	0.6	0.3	2LA-BNS910LLB
2LA-BNS911LLB	55	80	13	1	0.6	11.2	9.00	1 140	915	15.1	1 540	20 800	18.9	0.19	62.6	61.7	72.1	60.5	59.5	74.5	1	0.6	2LA-BNS911LLB
2LA-BNS912LLB	60	85	13	1	0.6	11.5	9.70	1 170	990	16.3	1 660	19 400	19.8	0.21	67.6	66.7	77.1	65.5	64.5	79.5	1	0.6	2LA-BNS912LLB
2LA-BNS913LLB	65	90	13	1	0.6	11.8	10.4	1 200	1 060	17.5	1 790	18 200	20.7	0.22	72.6	71.7	82.1	70.5	69.5	84.5	1	0.6	2LA-BNS913LLB
2LA-BNS914LLB	70	100	16	1	0.6	14.8	13.1	1 510	1 340	22.1	2 250	16 600	23.6	0.38	79.2	78.3	90.2	75.5	74.5	94.5	1	0.6	2LA-BNS914LLB
2LA-BNS915LLB	75	105	16	1	0.6	15.2	14.1	1 550	1 430	23.6	2 410	15 600	24.5	0.39	84.2	83.3	95.2	80.5	79.5	99.5	1	0.6	2LA-BNS915LLB
2LA-BNS916LLB	80	110	16	1	0.6	15.6	15.0	1 590	1 530	25.2	2 570	14 800	25.4	0.41	89.2	88.3	100.2	85.5	84.5	104.5	1	0.6	2LA-BNS916LLB
2LA-BNS917LLB	85	120	18	1.1	0.6	18.8	17.8	1 910	1 820	29.9	3 050	13 700	27.8	0.59	96.0	95.0	108.6	92	89.5	113	1	0.6	2LA-BNS917LLB
2LA-BNS918LLB	90	125	18	1.1	0.6	19.3	19.0	1 960	1 930	32.0	3 250	13 100	28.7	0.62	100.9	100.0	113.6	97	94.5	118	1	0.6	2LA-BNS918LLB
2LA-BNS919LLB	95	130	18	1.1	0.6	19.7	20.1	2 010	2 050	34.0	3 450	12 500	29.6	0.65	105.9	105.0	118.6	102	99.5	123	1	0.6	2LA-BNS919LLB
2LA-BNS920LLB	100	140	20	1.1	0.6	27.8	27.3	2 830	2 780	46.0	4 700	11 700	32.0	0.87	111.9	110.9	127.3	107	104.5	133	1	0.6	2LA-BNS920LLB

1) Minimum allowable value for corner radius dimension r or r_1.

Main Spindle Bearings

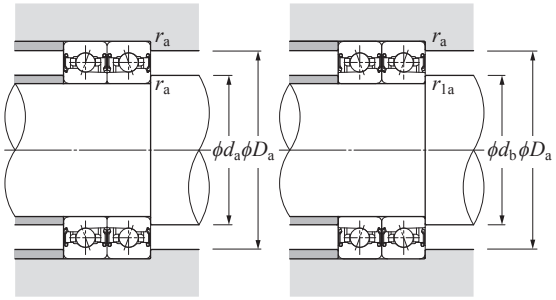
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (steel ball spec.) 2LA-BNS9 LLB type



Contact angle 25° *d* 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)		*a*		d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
2LA-BNS910ADLLB	50	72	12	0.6	0.3	8.45	6.90	860	700	12.4	1 270	20 500	20.3	0.14	56.9	56.0	65.0	54.5	52.5	67.5	0.6	0.3	2LA-BNS910ADLLB
2LA-BNS911ADLLB	55	80	13	1	0.6	10.8	8.70	1 100	885	16.8	1 710	18 500	22.3	0.19	62.6	61.7	72.1	60.5	59.5	74.5	1	0.6	2LA-BNS911ADLLB
2LA-BNS912ADLLB	60	85	13	1	0.6	11.1	9.40	1 130	960	18.1	1 850	17 200	23.5	0.21	67.6	66.7	77.1	65.5	64.5	79.5	1	0.6	2LA-BNS912ADLLB
2LA-BNS913ADLLB	65	90	13	1	0.6	11.4	10.1	1 160	1 030	19.5	1 990	16 100	24.7	0.22	72.6	71.7	82.1	70.5	69.5	84.5	1	0.6	2LA-BNS913ADLLB
2LA-BNS914ADLLB	70	100	16	1	0.6	14.3	12.7	1 460	1 300	24.6	2 500	14 700	27.9	0.38	79.2	78.3	90.2	75.5	74.5	94.5	1	0.6	2LA-BNS914ADLLB
2LA-BNS915ADLLB	75	105	16	1	0.6	14.7	13.6	1 500	1 390	26.3	2 680	13 900	29.1	0.39	84.2	83.3	95.2	80.5	79.5	99.5	1	0.6	2LA-BNS915ADLLB
2LA-BNS916ADLLB	80	110	16	1	0.6	15.1	14.5	1 540	1 480	28.0	2 860	13 200	30.3	0.41	89.2	88.3	100.2	85.5	84.5	104.5	1	0.6	2LA-BNS916ADLLB
2LA-BNS917ADLLB	85	120	18	1.1	0.6	18.1	17.2	1 850	1 760	33.5	3 400	12 200	33.0	0.59	96.0	95.0	108.6	92	89.5	113	1	0.6	2LA-BNS917ADLLB
2LA-BNS918ADLLB	90	125	18	1.1	0.6	18.6	18.4	1 900	1 870	35.5	3 600	11 600	34.2	0.62	100.9	100.0	113.6	97	94.5	118	1	0.6	2LA-BNS918ADLLB
2LA-BNS919ADLLB	95	130	18	1.1	0.6	19.1	19.5	1 940	1 990	37.5	3 850	11 100	35.4	0.65	105.9	105.0	118.6	102	99.5	123	1	0.6	2LA-BNS919ADLLB
2LA-BNS920ADLLB	100	140	20	1.1	0.6	26.8	26.4	2 730	2 690	51.0	5 200	10 400	38.1	0.87	111.9	110.9	127.3	107	104.5	133	1	0.6	2LA-BNS920ADLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

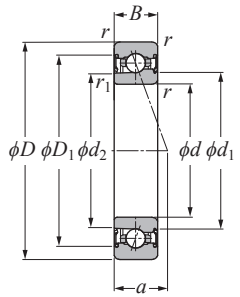
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

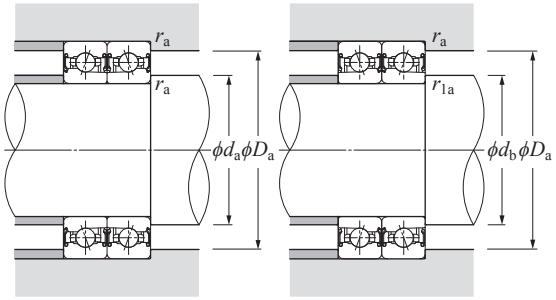
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (steel ball spec.) 2LA-BNS0 LLB type



Contact angle 15° *d* 45–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0		*a*		d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
2LA-BNS009CLLB	45	75	16	1	0.6	13.1	9.15	1 340	930	13.4	1 370	10.7	22 200	16.1	0.26	54.1	53.3	65.0	50.5	49.5	69.5	1	0.6	2LA-BNS009CLLB
2LA-BNS010CLLB	50	80	16	1	0.6	16.3	11.5	1 670	1 170	16.8	1 720	10.6	20 500	16.8	0.28	58.4	57.5	70.5	55.5	54.5	74.5	1	0.6	2LA-BNS010CLLB
2LA-BNS011CLLB	55	90	18	1.1	0.6	19.1	13.6	1 950	1 380	19.9	2 030	10.6	18 300	18.8	0.41	65.2	64.1	78.7	62	59.5	83	1	0.6	2LA-BNS011CLLB
2LA-BNS012CLLB	60	95	18	1.1	0.6	20.0	15.0	2 040	1 530	22.0	2 240	10.7	17 200	19.5	0.44	70.1	69.1	83.5	67	64.5	88	1	0.6	2LA-BNS012CLLB
2LA-BNS013CLLB	65	100	18	1.1	0.6	20.3	15.8	2 070	1 610	23.2	2 360	10.8	16 100	20.1	0.47	75.2	74.2	88.2	72	69.5	93	1	0.6	2LA-BNS013CLLB
2LA-BNS014CLLB	70	110	20	1.1	0.6	24.9	19.9	2 540	2 030	29.2	2 980	10.8	14 800	22.2	0.66	81.9	80.8	96.8	77	74.5	103	1	0.6	2LA-BNS014CLLB
2LA-BNS015CLLB	75	115	20	1.1	0.6	26.5	22.4	2 700	2 290	33.0	3 350	10.9	14 000	22.8	0.69	86.8	85.8	102.2	82	79.5	108	1	0.6	2LA-BNS015CLLB
2LA-BNS016CLLB	80	125	22	1.1	0.6	30.5	25.7	3 100	2 620	38.0	3 850	10.9	13 000	24.8	0.94	93.7	92.5	110.2	87	84.5	118	1	0.6	2LA-BNS016CLLB
2LA-BNS017CLLB	85	130	22	1.1	0.6	30.5	26.8	3 150	2 740	39.5	4 000	10.9	12 400	25.5	0.98	98.6	97.5	115.4	92	89.5	123	1	0.6	2LA-BNS017CLLB
2LA-BNS018CLLB	90	140	24	1.5	1	35.5	31.5	3 650	3 200	46.0	4 700	10.9	11 600	27.5	1.29	105.3	104.1	123.2	98.5	95.5	131.5	1.5	1	2LA-BNS018CLLB
2LA-BNS019CLLB	95	145	24	1.5	1	36.0	32.5	3 700	3 350	48.0	4 900	11.0	11 100	28.2	1.34	110.4	109.1	128.1	103.5	100.5	136.5	1.5	1	2LA-BNS019CLLB
2LA-BNS020CLLB	100	150	24	1.5	1	37.5	35.0	3 800	3 600	51.5	5 250	11.0	10 600	28.9	1.40	115.4	114.2	132.7	108.5	105.5	141.5	1.5	1	2LA-BNS020CLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	*e*	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

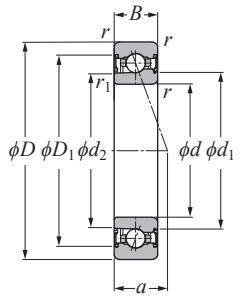
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

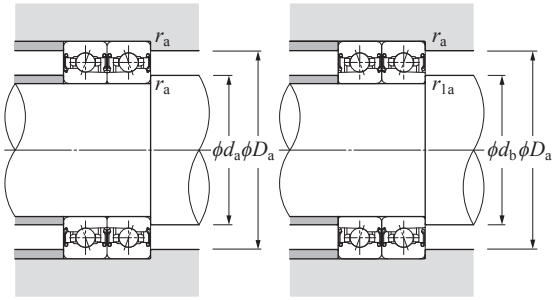
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (steel ball spec.) 2LA-BNS0 LLB type



Contact angle 20° *d* 45–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min⁻¹	Load center mm	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		grease lubrication	*a*	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
2LA-BNS009LLB	45	75	16	1	0.6	12.8	8.95	1 300	910	15.0	1 530	23 500	19.0	0.26	54.1	53.3	65.0	50.5	49.5	69.5	1	0.6	2LA-BNS009LLB
2LA-BNS010LLB	50	80	16	1	0.6	15.9	11.2	1 620	1 150	18.8	1 920	21 600	19.9	0.28	58.4	57.5	70.5	55.5	54.5	74.5	1	0.6	2LA-BNS010LLB
2LA-BNS011LLB	55	90	18	1.1	0.6	18.7	13.3	1 900	1 350	22.2	2 260	19 400	22.3	0.41	65.2	64.2	78.7	62	59.5	83	1	0.6	2LA-BNS011LLB
2LA-BNS012LLB	60	95	18	1.1	0.6	19.5	14.7	1 990	1 490	24.6	2 500	18 200	23.2	0.44	70.1	69.2	83.5	67	64.5	88	1	0.6	2LA-BNS012LLB
2LA-BNS013LLB	65	100	18	1.1	0.6	19.8	15.4	2 020	1 570	25.9	2 640	17 100	24.1	0.47	75.2	74.2	88.2	72	69.5	93	1	0.6	2LA-BNS013LLB
2LA-BNS014LLB	70	110	20	1.1	0.6	24.2	19.4	2 470	1 980	32.5	3 300	15 600	26.5	0.66	81.9	80.8	96.8	77	74.5	103	1	0.6	2LA-BNS014LLB
2LA-BNS015LLB	75	115	20	1.1	0.6	25.8	21.9	2 630	2 230	36.5	3 750	14 800	27.4	0.69	86.8	85.8	102.2	82	79.5	108	1	0.6	2LA-BNS015LLB
2LA-BNS016LLB	80	125	22	1.1	0.6	29.6	25.1	3 000	2 560	42.0	4 300	13 700	29.8	0.94	93.7	92.5	110.2	87	84.5	118	1	0.6	2LA-BNS016LLB
2LA-BNS017LLB	85	130	22	1.1	0.6	30.0	26.2	3 050	2 670	44.0	4 500	13 100	30.7	0.98	98.6	97.5	115.4	92	89.5	123	1	0.6	2LA-BNS017LLB
2LA-BNS018LLB	90	140	24	1.5	1	34.5	30.5	3 550	3 150	51.5	5 250	12 200	33.1	1.29	105.3	104.2	123.2	98.5	95.5	131.5	1.5	1	2LA-BNS018LLB
2LA-BNS019LLB	95	145	24	1.5	1	35.0	32.0	3 600	3 250	53.5	5 450	11 700	34.0	1.34	110.4	109.2	128.1	103.5	100.5	136.5	1.5	1	2LA-BNS019LLB
2LA-BNS020LLB	100	150	24	1.5	1	36.5	34.5	3 700	3 500	57.5	5 850	11 300	34.9	1.40	115.4	114.2	132.7	108.5	105.5	141.5	1.5	1	2LA-BNS020LLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.57	1	0	0.43	1	1	1.09	0.7	1.63

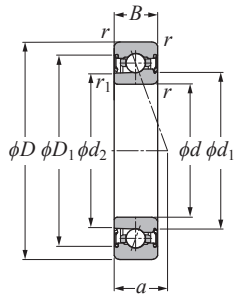
Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

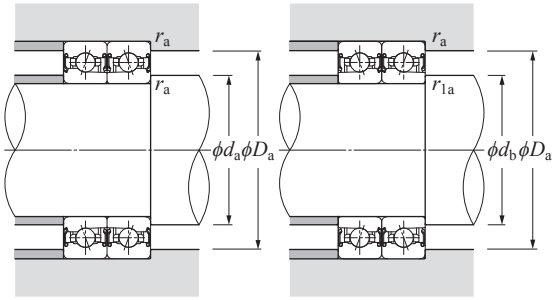
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (steel ball spec.) 2LA-BNS0 LLB type



Contact angle 25° *d* 45–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)	(static)		*a*		d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
2LA-BNS009ADLLB	45	75	16	1	0.6	12.4	8.65	1 260	885	16.7	1 700	20 800	22.1	0.26	54.1	53.3	65.0	50.5	49.5	69.5	1	0.6	2LA-BNS009ADLLB
2LA-BNS010ADLLB	50	80	16	1	0.6	15.4	10.9	1 570	1 110	21.0	2 140	19 200	23.3	0.28	58.4	57.6	70.5	55.5	54.5	74.5	1	0.6	2LA-BNS010ADLLB
2LA-BNS011ADLLB	55	90	18	1.1	0.6	18.1	12.9	1 840	1 310	24.8	2 530	17 200	26.0	0.41	65.2	64.2	78.7	62	59.5	83	1	0.6	2LA-BNS011ADLLB
2LA-BNS012ADLLB	60	95	18	1.1	0.6	18.9	14.2	1 930	1 450	27.4	2 800	16 100	27.2	0.44	70.1	69.2	83.5	67	64.5	88	1	0.6	2LA-BNS012ADLLB
2LA-BNS013ADLLB	65	100	18	1.1	0.6	19.2	14.9	1 960	1 520	28.9	2 940	15 200	28.4	0.47	75.2	74.2	88.2	72	69.5	93	1	0.6	2LA-BNS013ADLLB
2LA-BNS014ADLLB	70	110	20	1.1	0.6	23.4	18.8	2 390	1 920	36.5	3 700	13 900	31.1	0.66	81.9	80.8	96.8	77	74.5	103	1	0.6	2LA-BNS014ADLLB
2LA-BNS015ADLLB	75	115	20	1.1	0.6	25.0	21.2	2 550	2 160	41.0	4 200	13 200	32.3	0.69	86.8	85.9	102.2	82	79.5	108	1	0.6	2LA-BNS015ADLLB
2LA-BNS016ADLLB	80	125	22	1.1	0.6	28.6	24.3	2 910	2 480	47.0	4 800	12 200	35.1	0.94	93.7	92.6	110.2	87	84.5	118	1	0.6	2LA-BNS016ADLLB
2LA-BNS017ADLLB	85	130	22	1.1	0.6	29.0	25.4	2 950	2 590	49.0	5 000	11 600	36.2	0.98	98.6	97.6	115.4	92	89.5	123	1	0.6	2LA-BNS017ADLLB
2LA-BNS018ADLLB	90	140	24	1.5	1	33.5	29.7	3 400	3 050	57.5	5 850	10 900	39.0	1.29	105.3	104.2	123.2	98.5	95.5	131.5	1.5	1	2LA-BNS018ADLLB
2LA-BNS019ADLLB	95	145	24	1.5	1	34.0	31.0	3 450	3 150	60.0	6 100	10 400	40.2	1.34	110.4	109.2	128.1	103.5	100.5	136.5	1.5	1	2LA-BNS019ADLLB
2LA-BNS020ADLLB	100	150	24	1.5	1	35.0	33.0	3 600	3 400	64.0	6 550	10 000	41.3	1.40	115.4	114.2	132.7	108.5	105.5	141.5	1.5	1	2LA-BNS020ADLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

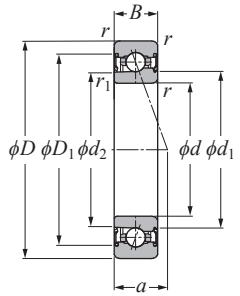
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

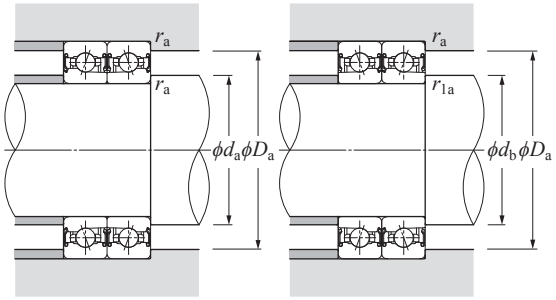
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (ceramic ball spec.)
5S-2LA-BNS9 LLB type



Contact angle 15° *d* 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min⁻¹	Load center mm	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0	grease lubrication	a	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-2LA-BNS910CLLB	50	72	12	0.6	0.3	8.95	5.05	915	515	6.80	690	7.7	25 600	14.2	0.14	56.9	56.0	65.0	54.5	52.5	67.5	0.6	0.3	5S-2LA-BNS910CLLB
5S-2LA-BNS911CLLB	55	80	13	1	0.6	11.4	6.40	1 170	650	8.55	870	7.6	23 100	15.6	0.18	62.6	61.7	72.1	60.5	59.5	74.5	1	0.6	5S-2LA-BNS911CLLB
5S-2LA-BNS912CLLB	60	85	13	1	0.6	11.8	6.90	1 200	705	9.25	945	7.7	21 500	16.3	0.20	67.6	66.7	77.1	65.5	64.5	79.5	1	0.6	5S-2LA-BNS912CLLB
5S-2LA-BNS913CLLB	65	90	13	1	0.6	12.1	7.40	1 230	755	9.95	1 010	7.8	20 100	16.9	0.21	72.6	71.7	82.1	70.5	69.5	84.5	1	0.6	5S-2LA-BNS913CLLB
5S-2LA-BNS914CLLB	70	100	16	1	0.6	15.2	9.35	1 550	950	12.5	1 280	7.7	18 300	19.5	0.36	79.2	78.3	90.2	75.5	74.5	94.5	1	0.6	5S-2LA-BNS914CLLB
5S-2LA-BNS915CLLB	75	105	16	1	0.6	15.6	10.0	1 590	1 020	13.4	1 370	7.8	17 300	20.1	0.37	84.2	83.3	95.2	80.5	79.5	99.5	1	0.6	5S-2LA-BNS915CLLB
5S-2LA-BNS916CLLB	80	110	16	1	0.6	16.0	10.6	1 630	1 090	14.3	1 460	7.8	16 400	20.8	0.39	89.2	88.3	100.2	85.5	84.5	104.5	1	0.6	5S-2LA-BNS916CLLB
5S-2LA-BNS917CLLB	85	120	18	1.1	0.6	19.3	12.7	1 960	1 290	17.0	1 730	7.8	15 200	22.8	0.57	96.0	95.0	108.6	92	89.5	113	1	0.6	5S-2LA-BNS917CLLB
5S-2LA-BNS918CLLB	90	125	18	1.1	0.6	19.8	13.5	2 020	1 370	18.1	1 850	7.8	14 500	23.5	0.59	100.9	100.0	113.6	97	94.5	118	1	0.6	5S-2LA-BNS918CLLB
5S-2LA-BNS919CLLB	95	130	18	1.1	0.6	20.3	14.3	2 070	1 460	19.2	1 960	7.8	13 900	24.2	0.62	105.9	105.0	118.6	102	99.5	123	1	0.6	5S-2LA-BNS919CLLB
5S-2LA-BNS920CLLB	100	140	20	1.1	0.6	28.5	19.4	2 910	1 980	26.0	2 650	7.7	13 000	26.2	0.82	111.9	110.9	127.3	107	104.5	133	1	0.6	5S-2LA-BNS920CLLB

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

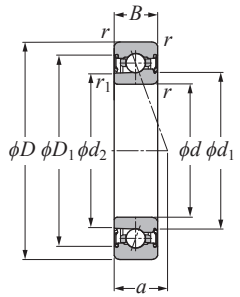
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

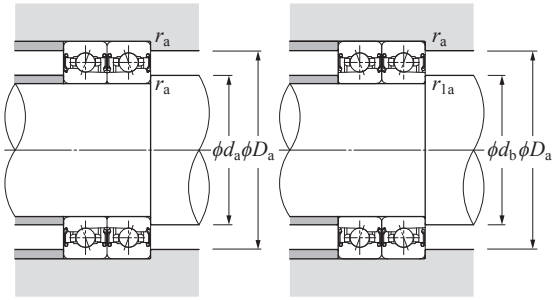
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (ceramic ball spec.)
5S-2LA-BNS9 LLB type



Contact angle 20° *d* 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	Basic load ratings static kN	Basic load ratings dynamic kgf	Basic load ratings static kgf	Allowable axial load kN	Allowable axial load kgf	Allowable speed min^{-1}	Load center mm	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		grease lubrication	a	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-2LA-BNS910LLB	50	72	12	0.6	0.3	8.75	4.95	890	505	7.75	790	28 200	17.2	0.14	56.9	56.0	65.0	54.5	52.5	67.5	0.6	0.3	5S-2LA-BNS910LLB
5S-2LA-BNS911LLB	55	80	13	1	0.6	11.2	6.25	1 140	635	9.75	995	25 500	18.9	0.18	62.6	61.7	72.1	60.5	59.5	74.5	1	0.6	5S-2LA-BNS911LLB
5S-2LA-BNS912LLB	60	85	13	1	0.6	11.5	6.70	1 170	685	10.5	1 080	23 700	19.8	0.20	67.6	66.7	77.1	65.5	64.5	79.5	1	0.6	5S-2LA-BNS912LLB
5S-2LA-BNS913LLB	65	90	13	1	0.6	11.8	7.20	1 200	735	11.3	1 160	22 200	20.7	0.21	72.6	71.7	82.1	70.5	69.5	84.5	1	0.6	5S-2LA-BNS913LLB
5S-2LA-BNS914LLB	70	100	16	1	0.6	14.8	9.10	1 510	930	14.3	1 460	20 200	23.6	0.36	79.2	78.3	90.2	75.5	74.5	94.5	1	0.6	5S-2LA-BNS914LLB
5S-2LA-BNS915LLB	75	105	16	1	0.6	15.2	9.75	1 550	995	15.3	1 560	19 100	24.5	0.37	84.2	83.3	95.2	80.5	79.5	99.5	1	0.6	5S-2LA-BNS915LLB
5S-2LA-BNS916LLB	80	110	16	1	0.6	15.6	10.4	1 590	1 060	16.3	1 660	18 100	25.4	0.39	89.2	88.3	100.2	85.5	84.5	104.5	1	0.6	5S-2LA-BNS916LLB
5S-2LA-BNS917LLB	85	120	18	1.1	0.6	18.8	12.3	1 910	1 260	19.4	1 980	16 800	27.8	0.57	96.0	95.0	108.6	92	89.5	113	1	0.6	5S-2LA-BNS917LLB
5S-2LA-BNS918LLB	90	125	18	1.1	0.6	19.3	13.1	1 960	1 340	20.6	2 100	16 000	28.7	0.59	100.9	100.0	113.6	97	94.5	118	1	0.6	5S-2LA-BNS918LLB
5S-2LA-BNS919LLB	95	130	18	1.1	0.6	19.7	14.0	2 010	1 420	21.9	2 230	15 300	29.6	0.62	105.9	105.0	118.6	102	99.5	123	1	0.6	5S-2LA-BNS919LLB
5S-2LA-BNS920LLB	100	140	20	1.1	0.6	27.8	18.9	2 830	1 930	29.7	3 050	14 300	32.0	0.82	111.9	110.9	127.3	107	104.5	133	1	0.6	5S-2LA-BNS920LLB

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

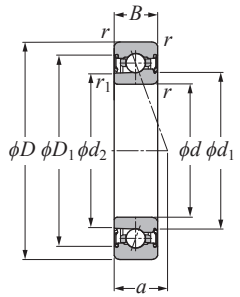
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

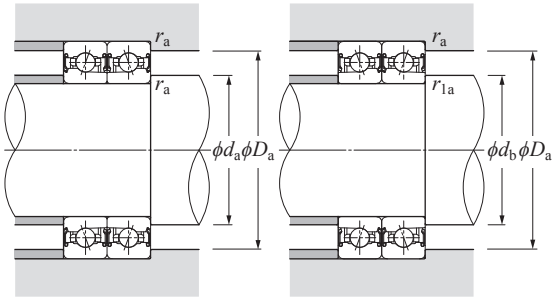
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-BNS9 LLB type



Contact angle 25° *d* 50–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			a		d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-2LA-BNS910ADLLB	50	72	12	0.6	0.3	8.45	4.75	860	485	8.80	895	25 600	20.3	0.14	56.9	56.0	65.0	54.5	52.5	67.5	0.6	0.3	5S-2LA-BNS910ADLLB
5S-2LA-BNS911ADLLB	55	80	13	1	0.6	10.8	6.05	1 100	615	11.1	1 130	23 200	22.3	0.18	62.6	61.7	72.1	60.5	59.5	74.5	1	0.6	5S-2LA-BNS911ADLLB
5S-2LA-BNS912ADLLB	60	85	13	1	0.6	11.1	6.50	1 130	665	12.0	1 220	21 600	23.5	0.20	67.6	66.7	77.1	65.5	64.5	79.5	1	0.6	5S-2LA-BNS912ADLLB
5S-2LA-BNS913ADLLB	65	90	13	1	0.6	11.4	7.00	1 160	715	12.9	1 310	20 200	24.7	0.21	72.6	71.7	82.1	70.5	69.5	84.5	1	0.6	5S-2LA-BNS913ADLLB
5S-2LA-BNS914ADLLB	70	100	16	1	0.6	14.3	8.80	1 460	900	16.2	1 650	18 400	27.9	0.36	79.2	78.3	90.2	75.5	74.5	94.5	1	0.6	5S-2LA-BNS914ADLLB
5S-2LA-BNS915ADLLB	75	105	16	1	0.6	14.7	9.45	1 500	960	17.3	1 770	17 400	29.1	0.37	84.2	83.3	95.2	80.5	79.5	99.5	1	0.6	5S-2LA-BNS915ADLLB
5S-2LA-BNS916ADLLB	80	110	16	1	0.6	15.1	10.0	1 540	1 020	18.5	1 890	16 500	30.3	0.39	89.2	88.3	100.2	85.5	84.5	104.5	1	0.6	5S-2LA-BNS916ADLLB
5S-2LA-BNS917ADLLB	85	120	18	1.1	0.6	18.1	11.9	1 850	1 220	22.0	2 240	15 300	33.0	0.57	96.0	95.0	108.6	92	89.5	113	1	0.6	5S-2LA-BNS917ADLLB
5S-2LA-BNS918ADLLB	90	125	18	1.1	0.6	18.6	12.7	1 900	1 300	23.4	2 390	14 500	34.2	0.59	100.9	100.0	113.6	97	94.5	118	1	0.6	5S-2LA-BNS918ADLLB
5S-2LA-BNS919ADLLB	95	130	18	1.1	0.6	19.1	13.5	1 940	1 380	24.8	2 530	13 900	35.4	0.62	105.9	105.0	118.6	102	99.5	123	1	0.6	5S-2LA-BNS919ADLLB
5S-2LA-BNS920ADLLB	100	140	20	1.1	0.6	26.8	18.3	2 730	1 870	33.5	3 450	13 000	38.1	0.82	111.9	110.9	127.3	107	104.5	133	1	0.6	5S-2LA-BNS920ADLLB

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load

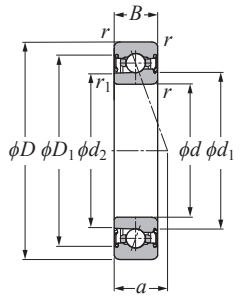
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

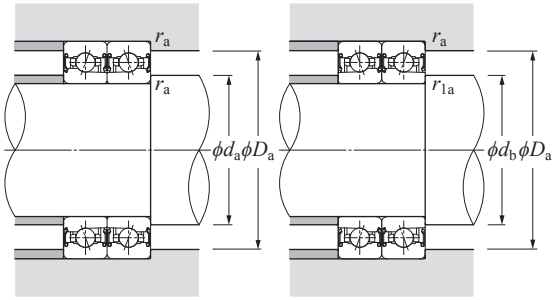
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (ceramic ball spec.)
5S-2LA-BNS0 LLB type



Contact angle 15° *d* 45–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min⁻¹	Load center mm	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0	grease lubrication	*a*	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-2LA-BNS009CLLB	45	75	16	1	0.6	13.1	6.35	1 340	645	8.45	860	7.4	26 000	16.1	0.25	54.1	53.3	65.0	50.5	49.5	69.5	1	0.6	5S-2LA-BNS009CLLB
5S-2LA-BNS010CLLB	50	80	16	1	0.6	16.3	7.95	1 670	815	10.6	1 080	7.4	24 000	16.8	0.26	58.4	57.5	70.5	55.5	54.5	74.5	1	0.6	5S-2LA-BNS010CLLB
5S-2LA-BNS011CLLB	55	90	18	1.1	0.6	19.1	9.40	1 950	960	12.5	1 280	7.4	21 500	18.8	0.38	65.2	64.1	78.7	62	59.5	83	1	0.6	5S-2LA-BNS011CLLB
5S-2LA-BNS012CLLB	60	95	18	1.1	0.6	20.0	10.4	2 040	1 060	13.9	1 420	7.4	20 100	19.5	0.41	70.1	69.1	83.5	67	64.5	88	1	0.6	5S-2LA-BNS012CLLB
5S-2LA-BNS013CLLB	65	100	18	1.1	0.6	20.3	10.9	2 070	1 120	14.6	1 490	7.5	18 900	20.1	0.44	75.2	74.2	88.2	72	69.5	93	1	0.6	5S-2LA-BNS013CLLB
5S-2LA-BNS014CLLB	70	110	20	1.1	0.6	24.9	13.8	2 540	1 410	18.4	1 880	7.5	17 300	22.2	0.62	81.9	80.8	96.8	77	74.5	103	1	0.6	5S-2LA-BNS014CLLB
5S-2LA-BNS015CLLB	75	115	20	1.1	0.6	26.5	15.5	2 700	1 590	20.8	2 120	7.5	16 400	22.8	0.65	86.8	85.8	102.2	82	79.5	108	1	0.6	5S-2LA-BNS015CLLB
5S-2LA-BNS016CLLB	80	125	22	1.1	0.6	30.5	17.8	3 100	1 820	23.8	2 430	7.5	15 200	24.8	0.88	93.7	92.5	110.2	87	84.5	118	1	0.6	5S-2LA-BNS016CLLB
5S-2LA-BNS017CLLB	85	130	22	1.1	0.6	30.5	18.6	3 150	1 900	24.9	2 540	7.6	14 500	25.5	0.93	98.6	97.5	115.4	92	89.5	123	1	0.6	5S-2LA-BNS017CLLB
5S-2LA-BNS018CLLB	90	140	24	1.5	1	35.5	21.8	3 650	2 220	29.2	2 970	7.6	13 600	27.5	1.22	105.3	104.1	123.2	98.5	95.5	131.5	1.5	1	5S-2LA-BNS018CLLB
5S-2LA-BNS019CLLB	95	145	24	1.5	1	36.0	22.7	3 700	2 310	30.5	3 100	7.6	13 000	28.2	1.27	110.4	109.1	128.1	103.5	100.5	136.5	1.5	1	5S-2LA-BNS019CLLB
5S-2LA-BNS020CLLB	100	150	24	1.5	1	37.5	24.4	3 800	2 480	32.5	3 350	7.6	12 500	28.9	1.32	115.4	114.2	132.7	108.5	105.5	141.5	1.5	1	5S-2LA-BNS020CLLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	*e*	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

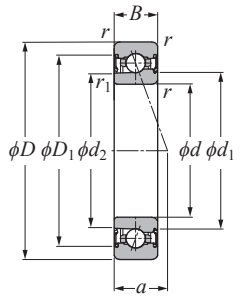
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

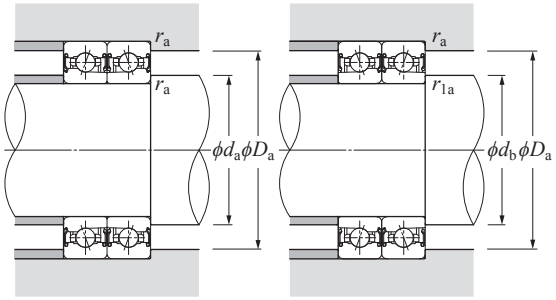
ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (ceramic ball spec.) 5S-2LA-BNS0 LLB type



Contact angle 20° *d* 45–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min⁻¹ grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	*D*	*B*	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			*a*		d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-2LA-BNS009LLB	45	75	16	1	0.6	12.8	6.20	1 300	630	9.70	985	28 700	19.0	0.25	54.1	53.3	65.0	50.5	49.5	69.5	1	0.6	5S-2LA-BNS009LLB
5S-2LA-BNS010LLB	50	80	16	1	0.6	15.9	7.80	1 620	795	12.2	1 240	26 500	19.9	0.26	58.4	57.5	70.5	55.5	54.5	74.5	1	0.6	5S-2LA-BNS010LLB
5S-2LA-BNS011LLB	55	90	18	1.1	0.6	18.7	9.20	1 900	935	14.4	1 460	23 700	22.3	0.38	65.2	64.2	78.7	62	59.5	83	1	0.6	5S-2LA-BNS011LLB
5S-2LA-BNS012LLB	60	95	18	1.1	0.6	19.5	10.2	1 990	1 040	15.9	1 620	22 200	23.2	0.41	70.1	69.2	83.5	67	64.5	88	1	0.6	5S-2LA-BNS012LLB
5S-2LA-BNS013LLB	65	100	18	1.1	0.6	19.8	10.7	2 020	1 090	16.7	1 710	20 800	24.1	0.44	75.2	74.2	88.2	72	69.5	93	1	0.6	5S-2LA-BNS013LLB
5S-2LA-BNS014LLB	70	110	20	1.1	0.6	24.2	13.5	2 470	1 370	21.1	2 150	19 100	26.5	0.62	81.9	80.8	96.8	77	74.5	103	1	0.6	5S-2LA-BNS014LLB
5S-2LA-BNS015LLB	75	115	20	1.1	0.6	25.8	15.2	2 630	1 550	23.8	2 420	18 100	27.4	0.65	86.8	85.8	102.2	82	79.5	108	1	0.6	5S-2LA-BNS015LLB
5S-2LA-BNS016LLB	80	125	22	1.1	0.6	29.6	17.4	3 000	1 770	27.2	2 780	16 800	29.8	0.88	93.7	92.5	110.2	87	84.5	118	1	0.6	5S-2LA-BNS016LLB
5S-2LA-BNS017LLB	85	130	22	1.1	0.6	30.0	18.1	3 050	1 850	28.4	2 900	16 000	30.7	0.93	98.6	97.5	115.4	92	89.5	123	1	0.6	5S-2LA-BNS017LLB
5S-2LA-BNS018LLB	90	140	24	1.5	1	34.5	21.3	3 550	2 170	33.5	3 400	15 000	33.1	1.22	105.3	104.2	123.2	98.5	95.5	131.5	1.5	1	5S-2LA-BNS018LLB
5S-2LA-BNS019LLB	95	145	24	1.5	1	35.0	22.1	3 600	2 260	34.5	3 550	14 300	34.0	1.27	110.4	109.2	128.1	103.5	100.5	136.5	1.5	1	5S-2LA-BNS019LLB
5S-2LA-BNS020LLB	100	150	24	1.5	1	36.5	23.8	3 700	2 420	37.5	3 800	13 800	34.9	1.32	115.4	114.2	132.7	108.5	105.5	141.5	1.5	1	5S-2LA-BNS020LLB

1) Minimum allowable value for corner radius dimension *r* or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
0.57	1	0	0.43	1	1	1.09	0.7	1.63

Static equivalent radial load

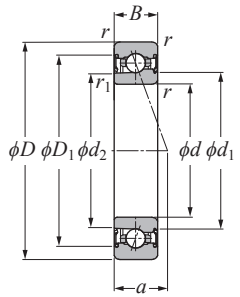
$P_{0r} = X_0 F_r + Y_0 F_a$

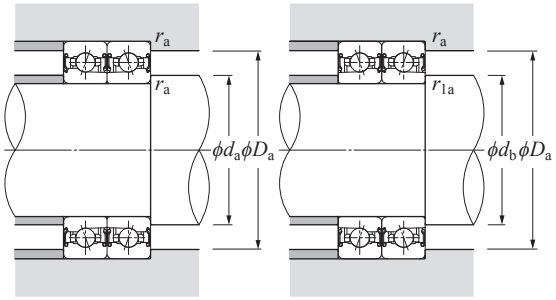
Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.42	1	0.84

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

ULTAGE Grease-lubricated sealed high speed angular contact ball bearings (ceramic ball spec.)
5S-2LA-BNS0 LLB type





Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

e	Single row / Tandem				Back-to-back / Face-to-face			
	$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
	X	Y	X	Y	X	Y	X	Y
0.68	1	0	0.41	0.87	1	0.92	0.67	1.41

Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.5	0.38	1	0.76

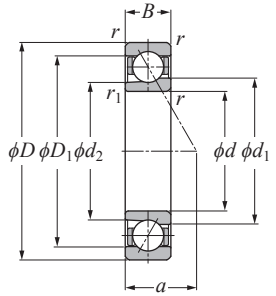
When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Contact angle 25° d 45–100 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Allowable speed min^{-1} grease lubrication	Load center mm	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)			a		d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-2LA-BNS009ADLLB	45	75	16	1	0.6	12.4	6.00	1 260	610	11.0	1 120	26 100	22.1	0.25	54.1	53.3	65.0	50.5	49.5	69.5	1	0.6	5S-2LA-BNS009ADLLB
5S-2LA-BNS010ADLLB	50	80	16	1	0.6	15.4	7.55	1 570	770	13.9	1 410	24 100	23.3	0.26	58.4	57.6	70.5	55.5	54.5	74.5	1	0.6	5S-2LA-BNS010ADLLB
5S-2LA-BNS011ADLLB	55	90	18	1.1	0.6	18.1	8.90	1 840	910	16.4	1 670	21 600	26.0	0.38	65.2	64.2	78.7	62	59.5	83	1	0.6	5S-2LA-BNS011ADLLB
5S-2LA-BNS012ADLLB	60	95	18	1.1	0.6	18.9	9.85	1 930	1 000	18.1	1 840	20 200	27.2	0.41	70.1	69.2	83.5	67	64.5	88	1	0.6	5S-2LA-BNS012ADLLB
5S-2LA-BNS013ADLLB	65	100	18	1.1	0.6	19.2	10.4	1 960	1 060	19.0	1 940	19 000	28.4	0.44	75.2	74.2	88.2	72	69.5	93	1	0.6	5S-2LA-BNS013ADLLB
5S-2LA-BNS014ADLLB	70	110	20	1.1	0.6	23.4	13.0	2 390	1 330	24.0	2 440	17 400	31.1	0.62	81.9	80.8	96.8	77	74.5	103	1	0.6	5S-2LA-BNS014ADLLB
5S-2LA-BNS015ADLLB	75	115	20	1.1	0.6	25.0	14.7	2 550	1 500	27.0	2 760	16 500	32.3	0.65	86.8	85.9	102.2	82	79.5	108	1	0.6	5S-2LA-BNS015ADLLB
5S-2LA-BNS016ADLLB	80	125	22	1.1	0.6	28.6	16.9	2 910	1 720	31.0	3 150	15 300	35.1	0.88	93.7	92.6	110.2	87	84.5	118	1	0.6	5S-2LA-BNS016ADLLB
5S-2LA-BNS017ADLLB	85	130	22	1.1	0.6	29.0	17.6	2 950	1 790	32.5	3 300	14 500	36.2	0.93	98.6	97.6	115.4	92	89.5	123	1	0.6	5S-2LA-BNS017ADLLB
5S-2LA-BNS018ADLLB	90	140	24	1.5	1	33.5	20.6	3 400	2 100	38.0	3 850	13 600	39.0	1.22	105.3	104.2	123.2	98.5	95.5	131.5	1.5	1	5S-2LA-BNS018ADLLB
5S-2LA-BNS019ADLLB	95	145	24	1.5	1	34.0	21.4	3 450	2 190	39.5	4 000	13 000	40.2	1.27	110.4	109.2	128.1	103.5	100.5	136.5	1.5	1	5S-2LA-BNS019ADLLB
5S-2LA-BNS020ADLLB	100	150	24	1.5	1	35.0	23.0	3 600	2 350	42.5	4 300	12 500	41.3	1.32	115.4	114.2	132.7	108.5	105.5	141.5	1.5	1	5S-2LA-BNS020ADLLB

1) Minimum allowable value for corner radius dimension r or r_1.

Angular contact ball bearings for grinding machines / motors (steel ball spec.)
BNT9 type

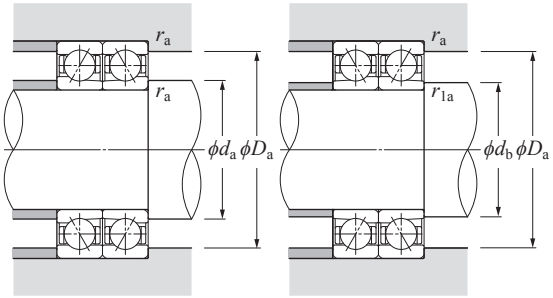


Contact angle 15° d 10–65 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3 Single-row (approx.)	Mass kg Single-row (approx.)	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a			d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
BNT900	10	22	6	0.3	0.15	2.55	0.995	260	101	1.43	146	9.3	62 200	125 600	5.2	0.3	0.010	14.0	12.7	18.0	12.2	11.2	20	0.3	0.15	BNT900
BNT901	12	24	6	0.3	0.15	2.70	1.12	275	114	1.76	180	9.6	55 300	111 700	5.4	0.4	0.011	16.0	14.7	20.0	14.2	13.2	22	0.3	0.15	BNT901
BNT902	15	28	7	0.3	0.15	4.10	1.75	415	179	2.54	259	9.5	46 300	93 500	6.4	0.6	0.016	19.0	17.4	24.0	17.2	16.2	26	0.3	0.15	BNT902
BNT903	17	30	7	0.3	0.15	4.30	1.95	440	199	2.82	288	9.7	42 300	85 500	6.7	0.8	0.017	21.0	19.4	26.0	19.2	18.2	28	0.3	0.15	BNT903
BNT904	20	37	9	0.3	0.15	6.20	2.99	630	305	4.35	440	9.7	34 900	70 500	8.4	1.4	0.037	25.5	23.5	31.4	22.5	21.5	34.5	0.3	0.15	BNT904
BNT905	25	42	9	0.3	0.15	6.65	3.55	675	360	5.15	525	10.1	29 700	60 000	9.0	1.7	0.043	30.5	28.5	36.5	27.5	26.5	39.5	0.3	0.15	BNT905
BNT906	30	47	9	0.3	0.15	7.05	4.10	715	420	6.00	610	10.4	25 800	52 200	9.7	1.9	0.049	35.5	33.5	41.5	32.5	31.5	44.5	0.3	0.15	BNT906
BNT907	35	55	10	0.6	0.3	11.1	6.30	1 140	645	9.20	940	10.1	21 000	42 400	11.1	2.8	0.073	41.2	38.5	48.8	39.5	37.5	50.5	0.6	0.3	BNT907
BNT908	40	62	12	0.6	0.3	11.8	7.30	1 210	740	10.6	1 080	10.4	18 500	37 500	12.9	4.5	0.11	47.0	44.4	55.0	44.5	42.5	57.5	0.6	0.3	BNT908
BNT909	45	68	12	0.6	0.3	14.7	9.20	1 490	935	13.4	1 370	10.4	16 700	33 800	13.6	5.2	0.13	52.1	49.1	60.9	49.5	48	63.5	0.6	0.3	BNT909
BNT910	50	72	12	0.6	0.3	15.5	10.3	1 580	1 060	15.1	1 540	10.5	15 500	31 300	14.2	6.2	0.13	56.6	53.6	65.4	54.5	52.5	67.5	0.6	0.3	BNT910
BNT911	55	80	13	1	0.6	16.2	11.6	1 650	1 180	17.0	1 730	10.7	13 800	27 600	15.6	7.8	0.18	63.2	60.1	71.8	60.5	59.5	74.5	1	0.6	BNT911
BNT912	60	85	13	1	0.6	16.9	12.8	1 730	1 300	18.7	1 910	10.8	12 800	25 700	16.3	8.3	0.20	68.1	65.1	76.9	65.5	64.5	79.5	1	0.6	BNT912
BNT913	65	90	13	1	0.6	17.1	13.4	1 750	1 370	19.7	2 010	10.9	12 000	24 000	17.0	8.9	0.21	73.1	70.1	81.9	70.5	69.5	84.5	1	0.6	BNT913

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

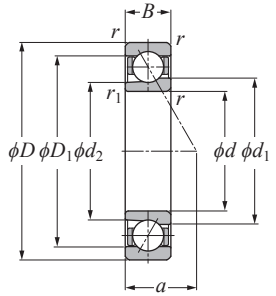
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

Angular contact ball bearings for grinding machines / motors (steel ball spec.)
BNT0 type

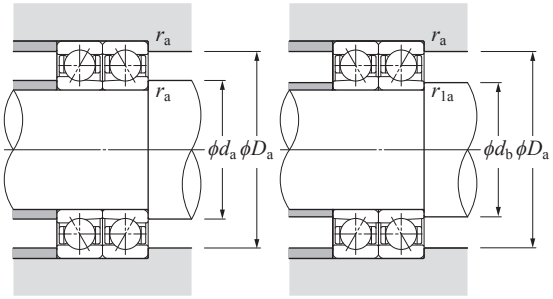


Contact angle 15° d 10–70 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
BNT000	10	26	8	0.3	0.15	4.15	1.45	425	148	2.07	211	8.3	60 300	120 100	6.5	0.9	0.015	14.6	13.0	21.0	12.5	11.2	23.5	0.3	0.15	BNT000
BNT001	12	28	8	0.3	0.15	4.60	1.73	470	176	2.48	253	8.8	52 700	104 900	6.8	1.0	0.020	17.4	15.6	23.5	14.5	13.2	25.5	0.3	0.15	BNT001
BNT002	15	32	9	0.3	0.15	5.30	2.22	540	226	3.20	325	9.2	46 000	91 500	7.7	1.3	0.029	20.4	18.5	26.5	17.5	16.2	29.5	0.3	0.15	BNT002
BNT003	17	35	10	0.3	0.15	6.55	2.70	665	275	3.90	395	9.0	41 500	82 700	8.5	1.8	0.033	22.2	20.2	29.6	19.5	18.2	32.5	0.3	0.15	BNT003
BNT004	20	42	12	0.6	0.3	8.90	3.95	905	405	5.70	580	9.2	34 300	68 300	10.3	3.0	0.057	27.4	24.9	35.5	24.5	22.5	37.5	0.6	0.3	BNT004
BNT005	25	47	12	0.6	0.3	9.90	4.85	1 010	495	7.05	720	9.6	30 000	59 700	10.9	3.5	0.067	31.8	29.4	40.6	29.5	27.5	42.5	0.6	0.3	BNT005
BNT006	30	55	13	1	0.6	12.8	6.75	1 310	685	9.75	995	9.8	25 100	50 000	12.3	4.3	0.11	38.4	35.5	47.8	35.5	34.5	49.5	1	0.6	BNT006
BNT007	35	62	14	1	0.6	16.2	8.95	1 650	910	13.0	1 320	9.8	20 100	40 200	13.6	6.5	0.15	43.4	40.2	53.8	40.5	39.5	56.5	1	0.6	BNT007
BNT008	40	68	15	1	0.6	17.4	10.4	1 780	1 060	15.1	1 540	10.0	18 100	36 100	14.8	8.0	0.18	48.8	45.7	59.4	45.5	44.5	62.5	1	0.6	BNT008
BNT009	45	75	16	1	0.6	20.7	12.6	2 110	1 280	18.4	1 870	10.1	16 300	32 500	16.1	9.6	0.23	54.2	50.9	65.6	50.5	49.5	69.5	1	0.6	BNT009
BNT010	50	80	16	1	0.6	22.0	14.3	2 240	1 460	20.9	2 130	10.2	15 000	30 000	16.8	11	0.26	59.6	55.9	70.2	55.5	54.5	74.5	1	0.6	BNT010
BNT011	55	90	18	1.1	0.6	28.9	18.7	2 950	1 910	27.3	2 780	10.1	13 200	26 400	18.8	16	0.38	66.1	61.8	79.1	62	59.5	83	1	0.6	BNT011
BNT012	60	95	18	1.1	0.6	29.7	20.0	3 050	2 040	29.2	2 980	10.3	12 300	24 700	19.5	19	0.40	71.1	66.8	84.1	67	64.5	88	1	0.6	BNT012
BNT013	65	100	18	1.1	0.6	31.5	22.4	3 200	2 290	32.5	3 350	10.4	11 600	23 200	20.2	20	0.42	75.2	71.8	89.8	72	69.5	93	1	0.6	BNT013
BNT014	70	110	20	1.1	0.6	39.5	28.1	4 050	2 870	41.0	4 200	10.3	10 600	21 300	22.2	27	0.56	82.3	77.7	97.9	77	74.5	103	1	0.6	BNT014

1) Minimum allowable value for corner radius dimension r or r_1.

Angular Contact Ball Bearings for Radial Loads Dimension Tables NTN



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

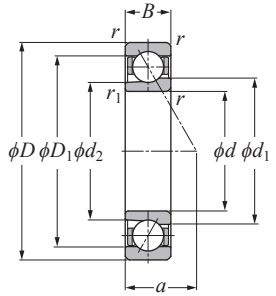
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

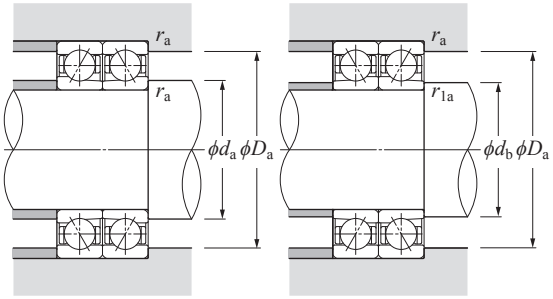
Angular contact ball bearings for grinding machines / motors (steel ball spec.)
BNT2 type



Contact angle 15° d 10–80 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ 1)	$r_{1s\,min}$ 1)	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
BNT200	10	30	9	0.6	0.3	4.60	1.71	465	175	2.46	250	8.7	53 300	106 800	7.2	1.1	0.019	17.0	15.0	23.0	14.5	12.5	25.5	0.6	0.3	BNT200
BNT201	12	32	10	0.6	0.3	6.00	2.28	610	232	3.25	330	8.5	48 400	97 000	8.0	1.5	0.025	18.4	16.2	26.0	16.5	14.5	27.5	0.6	0.3	BNT201
BNT202	15	35	11	0.6	0.3	7.60	2.97	775	300	4.25	430	8.5	42 600	85 400	8.9	2.2	0.035	20.8	18.4	29.4	19.5	17.5	30.5	0.6	0.3	BNT202
BNT203	17	40	12	0.6	0.3	9.45	3.80	965	385	5.40	555	8.5	37 000	74 100	9.9	2.9	0.054	24.2	21.4	33.6	21.5	19.5	35.5	0.6	0.3	BNT203
BNT204	20	47	14	1	0.6	12.4	5.35	1 260	545	7.70	785	8.8	30 900	61 900	11.7	4.6	0.092	29.4	26.2	39.4	25.5	24.5	41.5	1	0.6	BNT204
BNT205	25	52	15	1	0.6	14.1	6.70	1 430	685	9.70	990	9.2	27 300	54 700	12.8	6.1	0.13	33.8	30.7	44.2	30.5	29.5	46.5	1	0.6	BNT205
BNT206	30	62	16	1	0.6	19.5	9.65	1 990	985	13.9	1 420	9.2	22 900	45 900	14.3	8.3	0.20	40.6	36.6	52.6	35.5	34.5	56.5	1	0.6	BNT206
BNT207	35	72	17	1.1	0.6	25.7	13.1	2 620	1 330	18.8	1 920	9.1	18 100	36 000	15.8	10	0.29	46.8	42.0	60.6	42	39.5	65	1	0.6	BNT207
BNT208	40	80	18	1.1	0.6	31.0	16.5	3 150	1 680	23.8	2 430	9.3	16 200	32 100	17.2	13	0.38	53.0	47.7	67.0	47	44.5	73	1	0.6	BNT208
BNT209	45	85	19	1.1	0.6	34.5	18.9	3 500	1 920	27.3	2 780	9.3	14 900	29 600	18.3	16	0.44	57.3	51.9	73.0	52	49.5	78	1	0.6	BNT209
BNT210	50	90	20	1.1	0.6	36.5	20.8	3 700	2 120	30.0	3 050	9.5	13 900	27 500	19.5	20	0.46	62.2	56.8	78.0	57	54.5	83	1	0.6	BNT210
BNT211	55	100	21	1.5	1	45.0	26.2	4 550	2 670	38.0	3 850	9.5	12 300	24 400	21.0	25	0.61	69.0	62.8	86.4	63.5	60.5	91.5	1.5	1	BNT211
BNT212	60	110	22	1.5	1	54.0	32.5	5 550	3 300	47.0	4 800	9.5	11 000	21 800	22.8	32	0.78	77.0	70.2	96.4	68.5	65.5	101.5	1.5	1	BNT212
BNT213	65	120	23	1.5	1	59.0	36.0	6 050	3 650	52.0	5 300	9.5	10 300	20 400	24.1	37	1.01	82.5	75.3	102.5	73.5	70.5	111.5	1.5	1	BNT213
BNT214	70	125	24	1.5	1	64.5	39.5	6 550	4 000	57.0	5 800	9.6	9 700	19 400	25.2	47	1.08	87.0	79.5	108.0	78.5	75.5	116.5	1.5	1	BNT214
BNT215	75	130	25	1.5	1	67.0	43.0	6 850	4 400	62.5	6 350	9.7	9 200	18 300	26.6	54	1.17	93.0	85.5	114.5	83.5	80.5	121.5	1.5	1	BNT215
BNT216	80	140	26	2	1	78.5	50.5	8 000	5 150	73.5	7 500	9.7	8 600	17 200	27.9	58	1.45	98.1	90.4	122.0	90	85.5	130	2	1	BNT216

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

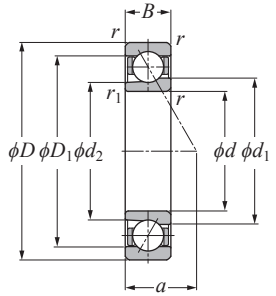
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

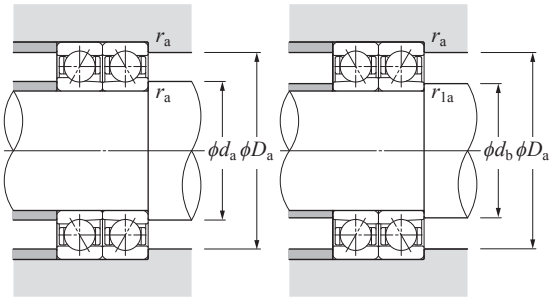
Angular contact ball bearings for grinding machines / motors (ceramic ball spec.)
5S-BNT9 type



Contact angle 15° *d* 10–65 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-BNT900	10	22	6	0.3	0.15	2.55	0.69	260	70	0.905	92	6.4	72 500	145 600	5.2	0.3	0.009	14.0	12.7	18.0	12.2	11.2	20	0.3	0.15	**5S-BNT900**
5S-BNT901	12	24	6	0.3	0.15	2.70	0.78	275	79	1.11	113	6.7	64 400	129 400	5.4	0.4	0.010	16.0	14.7	20.0	14.2	13.2	22	0.3	0.15	**5S-BNT901**
5S-BNT902	15	28	7	0.3	0.15	4.10	1.22	415	124	1.60	163	6.6	54 000	108 400	6.4	0.6	0.014	19.0	17.4	24.0	17.2	16.2	26	0.3	0.15	**5S-BNT902**
5S-BNT903	17	30	7	0.3	0.15	4.30	1.35	440	138	1.78	182	6.7	49 400	99 100	6.7	0.8	0.015	21.0	19.4	26.0	19.2	18.2	28	0.3	0.15	**5S-BNT903**
5S-BNT904	20	37	9	0.3	0.15	6.20	2.07	630	211	2.74	279	6.8	40 700	81 800	8.4	1.4	0.033	25.5	23.5	31.4	22.5	21.5	34.5	0.3	0.15	**5S-BNT904**
5S-BNT905	25	42	9	0.3	0.15	6.65	2.46	675	251	3.25	330	7.0	34 600	69 600	9.0	1.7	0.039	30.5	28.5	36.5	27.5	26.5	39.5	0.3	0.15	**5S-BNT905**
5S-BNT906	30	47	9	0.3	0.15	7.05	2.84	715	290	3.80	385	7.2	30 100	60 500	9.7	1.9	0.044	35.5	33.5	41.5	32.5	31.5	44.5	0.3	0.15	**5S-BNT906**
5S-BNT907	35	55	10	0.6	0.3	11.1	4.40	1 140	445	5.80	590	7.0	24 400	49 300	11.1	2.8	0.063	41.2	38.5	48.8	39.5	37.5	50.5	0.6	0.3	**5S-BNT907**
5S-BNT908	40	62	12	0.6	0.3	11.8	5.05	1 210	515	6.70	685	7.2	21 600	43 500	12.9	4.5	0.100	47.0	44.4	55.0	44.5	42.5	57.5	0.6	0.3	**5S-BNT908**
5S-BNT909	45	68	12	0.6	0.3	14.7	6.35	1 490	650	8.45	865	7.2	19 500	39 300	13.6	5.2	0.110	52.1	49.1	60.9	49.5	48	63.5	0.6	0.3	**5S-BNT909**
5S-BNT910	50	72	12	0.6	0.3	15.5	7.15	1 580	730	9.55	975	7.3	18 000	36 400	14.2	6.2	0.110	56.6	53.6	65.4	54.5	52.5	67.5	0.6	0.3	**5S-BNT910**
5S-BNT911	55	80	13	1	0.6	16.2	8.00	1 650	820	10.7	1 090	7.4	16 000	32 000	15.6	7.8	0.160	63.2	60.1	71.8	60.5	59.5	74.5	1	0.6	**5S-BNT911**
5S-BNT912	60	85	13	1	0.6	16.9	8.85	1 730	900	11.8	1 200	7.5	14 900	29 800	16.3	8.3	0.170	68.1	65.1	76.9	65.5	64.5	79.5	1	0.6	**5S-BNT912**
5S-BNT913	65	90	13	1	0.6	17.1	9.30	1 750	945	12.4	1 270	7.5	13 900	27 900	17.0	8.9	0.190	73.1	70.1	81.9	70.5	69.5	84.5	1	0.6	**5S-BNT913**

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$i \cdot f_0 \cdot F_a / C_{0r}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

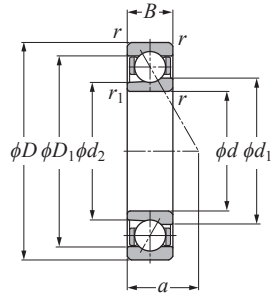
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem X_0	Y_0	Back-to-back / Face-to-face X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

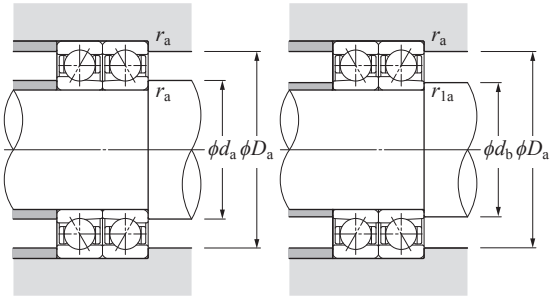
Angular contact ball bearings for grinding machines / motors (ceramic ball spec.)
5S-BNT0 type



Contact angle 15° *d* 10–70 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-BNT000	10	26	8	0.3	0.15	4.15	1.01	425	103	1.31	133	5.7	70 100	140 200	6.5	0.9	0.013	14.6	13.0	21.0	12.5	11.2	23.5	0.3	0.15	5S-BNT000
5S-BNT001	12	28	8	0.3	0.15	4.60	1.20	470	122	1.57	160	6.1	61 200	122 400	6.8	1.0	0.018	17.4	15.6	23.5	14.5	13.2	25.5	0.3	0.15	5S-BNT001
5S-BNT002	15	32	9	0.3	0.15	5.30	1.54	540	157	2.02	206	6.4	53 400	106 800	7.7	1.3	0.026	20.4	18.5	26.5	17.5	16.2	29.5	0.3	0.15	5S-BNT002
5S-BNT003	17	35	10	0.3	0.15	6.55	1.87	665	191	2.45	250	6.3	48 300	96 500	8.5	1.8	0.029	22.2	20.2	29.6	19.5	18.2	32.5	0.3	0.15	5S-BNT003
5S-BNT004	20	42	12	0.6	0.3	8.90	2.74	905	279	3.60	365	6.4	39 800	79 700	10.3	3.0	0.050	27.4	24.9	35.5	24.5	22.5	37.5	0.6	0.3	5S-BNT004
5S-BNT005	25	47	12	0.6	0.3	9.90	3.35	1 010	345	4.45	455	6.7	34 900	69 700	10.9	3.5	0.060	31.8	29.4	40.6	29.5	27.5	42.5	0.6	0.3	5S-BNT005
5S-BNT006	30	55	13	1	0.6	12.8	4.65	1 310	475	6.15	630	6.8	29 200	58 400	12.3	4.3	0.10	38.4	35.5	47.8	35.5	34.5	49.5	1	0.6	5S-BNT006
5S-BNT007	35	62	14	1	0.6	16.2	6.20	1 650	630	8.20	835	6.8	23 500	46 900	13.6	6.5	0.13	43.4	40.2	53.8	40.5	39.5	56.5	1	0.6	5S-BNT007
5S-BNT008	40	68	15	1	0.6	17.4	7.20	1 780	735	9.55	975	7.0	21 100	42 100	14.8	8.0	0.16	48.8	45.7	59.4	45.5	44.5	62.5	1	0.6	5S-BNT008
5S-BNT009	45	75	16	1	0.6	20.7	8.75	2 110	890	11.6	1 180	7.0	19 000	37 900	16.1	9.6	0.21	54.2	50.9	65.6	50.5	49.5	69.5	1	0.6	5S-BNT009
5S-BNT010	50	80	16	1	0.6	22.0	9.90	2 240	1 010	13.2	1 340	7.1	17 500	35 000	16.8	11	0.24	59.6	55.9	70.2	55.5	54.5	74.5	1	0.6	5S-BNT010
5S-BNT011	55	90	18	1.1	0.6	28.9	13.0	2 950	1 320	17.2	1 760	7.0	15 500	31 000	18.8	16	0.35	66.1	61.8	79.1	62	59.5	83	1	0.6	5S-BNT011
5S-BNT012	60	95	18	1.1	0.6	29.7	13.9	3 050	1 420	18.4	1 880	7.1	14 500	29 000	19.5	19	0.36	71.1	66.8	84.1	67	64.5	88	1	0.6	5S-BNT012
5S-BNT013	65	100	18	1.1	0.6	31.5	15.5	3 200	1 580	20.7	2 110	7.2	13 600	27 300	20.2	20	0.37	75.2	71.8	89.8	72	69.5	93	1	0.6	5S-BNT013
5S-BNT014	70	110	20	1.1	0.6	39.5	19.5	4 050	1 990	25.9	2 640	7.1	12 500	25 000	22.2	27	0.50	82.3	77.7	97.9	77	74.5	103	1	0.6	5S-BNT014

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB) Face-to-face (DF)

Dynamic equivalent radial load
$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	e	Single row / Tandem $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y	Back-to-back / Face-to-face $F_a/F_r \le e$ X	Y	$F_a/F_r > e$ X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

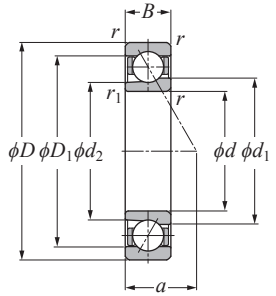
Static equivalent radial load
$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings

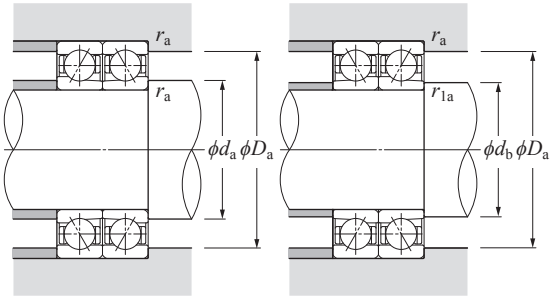
Angular contact ball bearings for grinding machines / motors (ceramic ball spec.)
5S BNT2 type



Contact angle 15° *d* 10–80 mm

Part number	Boundary dimensions mm					Basic load ratings dynamic kN	static kN	dynamic kgf	static kgf	Allowable axial load kN	kgf	Factor	Allowable speed min^{-1} grease lubrication	oil lubrication	Load center mm	Internal free space cm^3	Mass kg	Reference dimensions mm			Abutment and fillet dimensions mm					Part number
	d	D	B	$r_{s\,min}$ [1]	$r_{1s\,min}$ [1]	C_r	C_{0r}	C_r	C_{0r}	(static)		f_0			a	Single-row (approx.)	Single-row (approx.)	d_1	d_2	D_1	d_a min	d_b min	D_a max	r_{as} max	r_{1as} max	
5S-BNT200	10	30	9	0.6	0.3	4.60	1.19	465	121	1.55	158	6.0	63 000	126 000	7.2	1.1	0.017	17.0	15.0	23.0	14.5	12.5	25.5	0.6	0.3	5S-BNT200
5S-BNT201	12	32	10	0.6	0.3	6.00	1.58	610	161	2.05	209	5.9	57 300	114 500	8.0	1.5	0.021	18.4	16.2	26.0	16.5	14.5	27.5	0.6	0.3	5S-BNT201
5S-BNT202	15	35	11	0.6	0.3	7.60	2.05	775	210	2.67	272	5.9	50 400	100 800	8.9	2.2	0.030	20.8	18.4	29.4	19.5	17.5	30.5	0.6	0.3	5S-BNT202
5S-BNT203	17	40	12	0.6	0.3	9.45	2.63	965	268	3.40	350	5.9	43 800	87 500	9.9	2.9	0.046	24.2	21.4	33.6	21.5	19.5	35.5	0.6	0.3	5S-BNT203
5S-BNT204	20	47	14	1	0.6	12.4	3.70	1 260	380	4.85	495	6.1	36 500	73 000	11.7	4.6	0.080	29.4	26.2	39.4	25.5	24.5	41.5	1	0.6	5S-BNT204
5S-BNT205	25	52	15	1	0.6	14.1	4.65	1 430	475	6.10	625	6.4	32 300	64 600	12.8	6.1	0.11	33.8	30.7	44.2	30.5	29.5	46.5	1	0.6	5S-BNT205
5S-BNT206	30	62	16	1	0.6	19.5	6.70	1 990	680	8.80	895	6.4	27 100	54 200	14.3	8.3	0.18	40.6	36.6	52.6	35.5	34.5	56.5	1	0.6	5S-BNT206
5S-BNT207	35	72	17	1.1	0.6	25.7	9.05	2 620	925	11.9	1 210	6.3	21 300	42 500	15.8	10	0.25	46.8	42.0	60.6	42	39.5	65	1	0.6	5S-BNT207
5S-BNT208	40	80	18	1.1	0.6	31.0	11.4	3 150	1 170	15.0	1 530	6.4	19 000	37 900	17.2	13	0.33	53.0	47.7	67.0	47	44.5	73	1	0.6	5S-BNT208
5S-BNT209	45	85	19	1.1	0.6	34.5	13.1	3 500	1 330	17.2	1 750	6.5	17 500	35 000	18.3	16	0.37	57.3	51.9	73.0	52	49.5	78	1	0.6	5S-BNT209
5S-BNT210	50	90	20	1.1	0.6	36.5	14.4	3 700	1 470	19.0	1 940	6.6	16 300	32 500	19.5	20	0.39	62.2	56.8	78.0	57	54.5	83	1	0.6	5S-BNT210
5S-BNT211	55	100	21	1.5	1	45.0	18.1	4 550	1 850	23.9	2 440	6.6	14 500	28 900	21.0	25	0.52	69.0	62.8	86.4	63.5	60.5	91.5	1.5	1	5S-BNT211
5S-BNT212	60	110	22	1.5	1	54.0	22.4	5 550	2 290	29.5	3 000	6.6	12 900	25 900	22.8	32	0.65	77.0	70.2	96.4	68.5	65.5	101.5	1.5	1	5S-BNT212
5S-BNT213	65	120	23	1.5	1	59.0	24.9	6 050	2 530	33.0	3 350	6.6	12 100	24 200	24.1	37	0.86	82.5	75.3	102.5	73.5	70.5	111.5	1.5	1	5S-BNT213
5S-BNT214	70	125	24	1.5	1	64.5	27.3	6 550	2 790	36.0	3 650	6.6	11 500	23 000	25.2	47	0.91	87.0	79.5	108.0	78.5	75.5	116.5	1.5	1	5S-BNT214
5S-BNT215	75	130	25	1.5	1	67.0	29.8	6 850	3 050	39.5	4 000	6.7	10 800	21 600	26.6	54	0.98	93.0	85.5	114.5	83.5	80.5	121.5	1.5	1	5S-BNT215
5S-BNT216	80	140	26	2	1	78.5	35.0	8 000	3 600	46.5	4 750	6.7	10 200	20 400	27.9	58	1.21	98.1	90.4	122.0	90	85.5	130	2	1	5S-BNT216

1) Minimum allowable value for corner radius dimension r or r_1.



Back-to-back (DB)

Face-to-face (DF)

Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{i \cdot f_0 \cdot F_a}{C_{0r}}$	e	Single row / Tandem				Back-to-back / Face-to-face			
		$F_a/F_r \le e$		$F_a/F_r > e$		$F_a/F_r \le e$		$F_a/F_r > e$	
		X	Y	X	Y	X	Y	X	Y
0.178	0.35				1.57		1.76		2.56
0.357	0.36				1.53		1.71		2.48
0.714	0.38				1.46		1.64		2.38
1.07	0.4				1.42		1.59		2.31
1.43	0.41	1	0	0.44	1.38	1	1.55	0.72	2.25
2.14	0.43				1.33		1.49		2.16
3.57	0.44				1.25		1.4		2.03
5.35	0.47				1.18		1.32		1.92
7.14	0.49				1.13		1.26		1.83

Static equivalent radial load

$P_{0r} = X_0 F_r + Y_0 F_a$

Single row / Tandem		Back-to-back / Face-to-face	
X_0	Y_0	X_0	Y_0
0.52	0.54	1.04	1.08

When $P_{0r} < F_r$ with single-row or tandem arrangement, $P_{0r} = F_r$.

Main Spindle Bearings