Koyo

High Ability
BALL BEARING SERIES

Angular Contact Ball Bearings for Machining Tools

JTEKT

JTEKT CORPORATION

CAT.NO. B2006E

Machining tools regularly improve in speed and efficiency in response to industrial demands for increased productivity and product machining efficiency. Consequently, bearings for machining tools are required to achieve the following performance levels.

- **Ultrafast rotation to reduce machining time**
- **Rapid acceleration/deceleration capability for improved efficiency**
- **High rigidity with low increase in temperature for high precision machining**

Moreover, environmental concerns are now a major issue, bringing into question the oil-and-air lubrication and oil mist lubrication usually used with high-speed spindles. As an alternative, grease lubrication is gaining attention as it does not spray oil into the air and ensures the environment is free of contamination.

In response to these needs, JTEKT has developed its High Ability bearing series. The newly developed bearings offer excellent high-speed performance and rapid acceleration and deceleration performance and allow grease lubrication for high-speed operations.

Contents

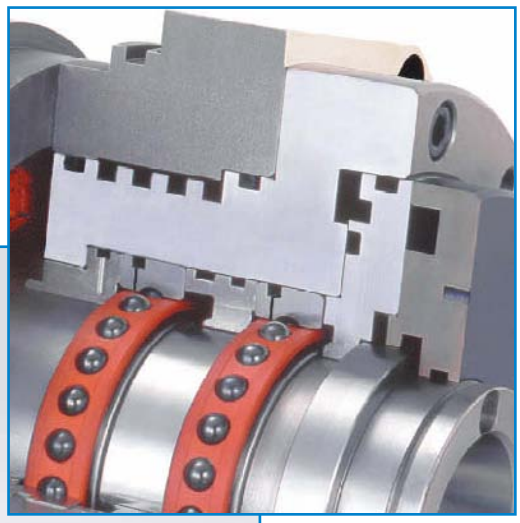
1. Features

1 **20 to 30% reduction in temperature increase**
(compared with Koyo's conventional products)
Koyo has conducted various tests and analyses and developed elaborate machining techniques to improve the performance of bearings used with machining tool spindles. The result is a substantial reduction in frictional heat generated in bearings rotating at a high speed.

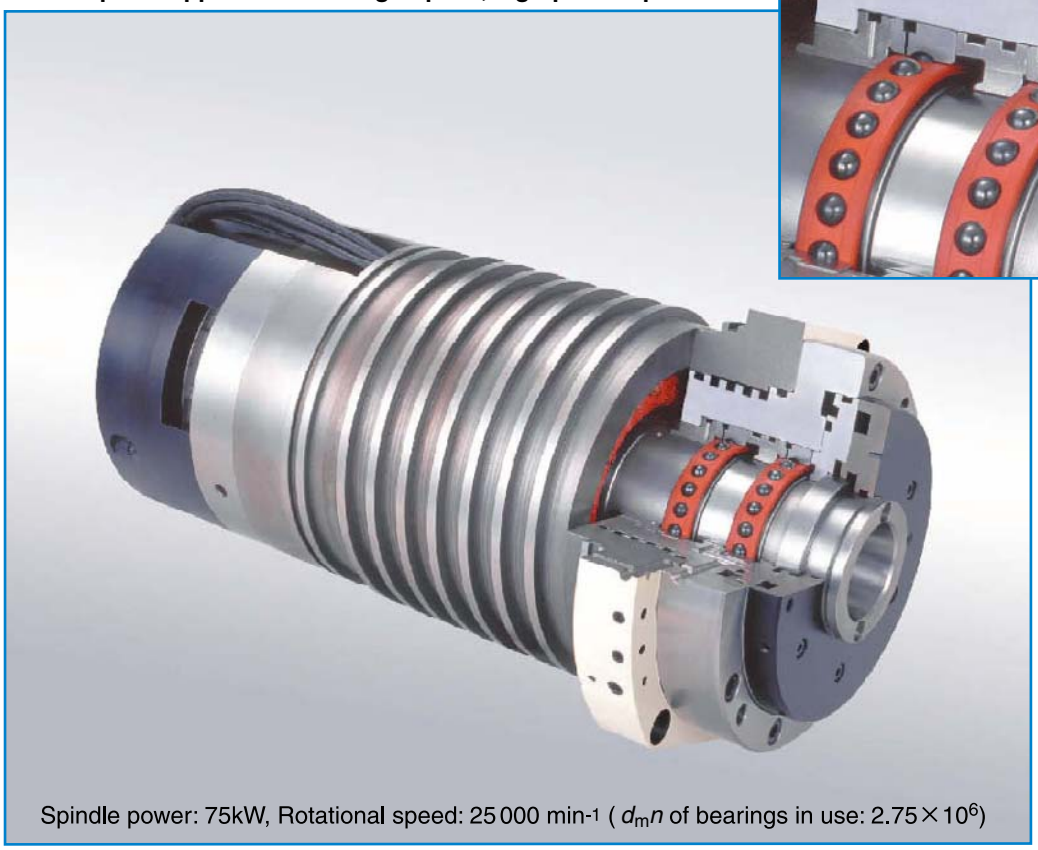
2 **1.2- to 1.5-fold increases in speed limits**
(compared with Koyo's conventional products)
Speed limits have been extended through re-designing for high-speed rotation and heat reduction. Use of ceramic balls as rolling elements enables additional high-speed rotation.

3 **Improved high-speed performance achieved by position preloading**
Low increases in temperature during operation ensure reduced changes in preload. Preload can be given by position preloading even at high speeds, which has been hitherto unavailable with conventional systems. The result is high-precision machining with stability.

4 **Conventional bearings easily replaced**
Dimensions of High Ability bearings conform to ISO standards. Replacement of conventional bearings with High Ability bearings requires minimal geometry changes of the present spindle or housing.



■ **Example of application to a high-speed, high-power spindle**



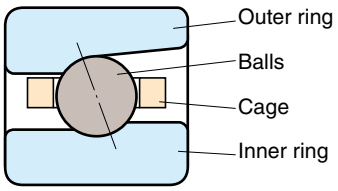
Spindle power: 75kW, Rotational speed: 25 000 min-1 ($d_m n$ of bearings in use: 2.75×10^6)

2. Construction

There are four types of High Ability bearings.

Type R

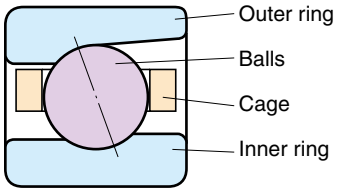
● **Standard High Ability bearing**



This bearing has the same dimensions as conventional products. The limiting speed has been improved by raceways machined to optimal geometry for high-speed rotation. Balls are available in steel or ceramics.

Type C

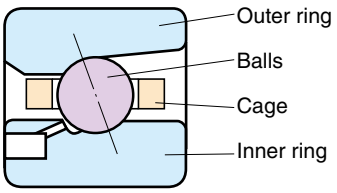
● **High Ability bearing with high load rating**



An increased load rating has been achieved by increasing the size of the ball. The ball is ceramics to ensure high-speed performance.

Type D

● **Oil-and-air lubrication through inner ring**

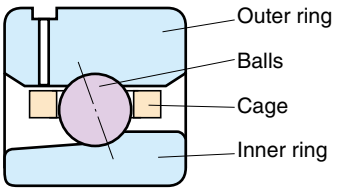


Type D is designed to supply oil to the ball via an oiling groove and nozzle provided in one side of the inner ring. Ceramic balls are used.

* Type D has been developed jointly with Mitsui Seiki Co., Ltd.

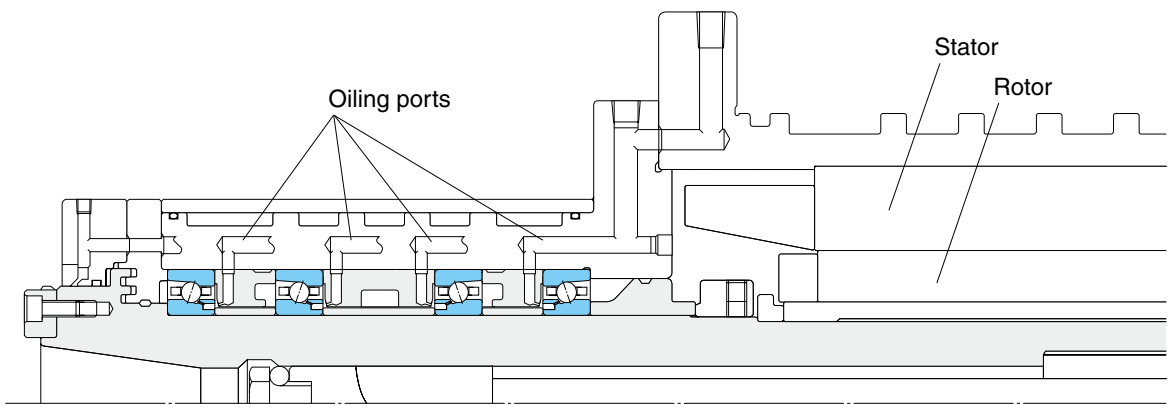
Type F

● **Oil-and-air lubrication through outer ring**



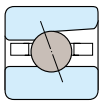
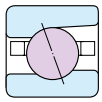
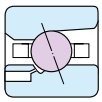
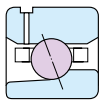
An oiling groove and nozzle are provided in the outer ring for reliable lubrication of the guide way on the cage and the rolling contact surface of the ball. Type F is optimal for ultrafast rotation. Ceramic balls are used.

■ **Example of mounting on a built-in motor spindle**



3. Types and Bearing Numbers

(1) High Ability bearing types and principal applications

Type	Specification			Remarks
	Bearing dimension series	Contact angle	Material of rolling element	
Type R 	10 19	15° 20° 30°	**Steel or ceramics**	High-speed, high-rigidity type
Type C 	10 19	15° 20°	**ceramics**	High-speed, high load-rating type
Type D 	10	20°	**ceramics**	Ultrafast, low-noise type for oil-and-air lubrication
Type F 	10 19	20°	**ceramics**	Extremely ultrafast type for oil-and-air lubrication

(2) Bearing number nomenclature

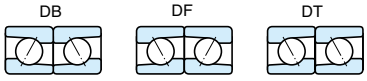
Example

3NC HA R 013 CA -5 DB CS5

Internal clearance
5 : Denotes a medium value of clearances of 5μm.
CY : preload (negative clearance)
CS : clearance

Combination symbol

Typical examples of combination symbol



Cage guide -5 : ball guided
No symbol : outer ring guided

Contact angle C : 15°
CA : 20°
No symbol : 30°

Bore diameter number, 13: Denotes a bearing bore diameter of 5 mm x 13=65mm.

Dimension series, 9: dimension series 19
0: dimension series 10

High Ability bearing type, R, C, D, or F. See table above for details.

High Ability ball bearing series

Ceramic balls

4. Performance

The temperature of an operating bearing increases due to frictional heat produced within the bearing. This increase in temperature imposes a certain speed limit when the bearing is required to rotate at high speed.

The reason being that the bearing operation discontinues due to seizure caused by temperature increases above a certain temperature. Consequently, increases in bearing temperature during operation can serve as a measure in regard to speed limit.

High Ability bearings exhibit their maximum performance when used in pairs or when more than two units are combined and when preload is given by position preloading. Shown below is the operating performance of High Ability bearings with preload given by position preloading.

(1) High-speed performance of Types R and C

Fig.1 compares relationships between rotational speed and increases in bearing temperature of Types R and C and conventional high-precision bearings.

High Ability bearings exhibit smaller temperature increases and higher speed limits than conventional bearings whether grease lubrication or oil-and-air lubrication is applied.

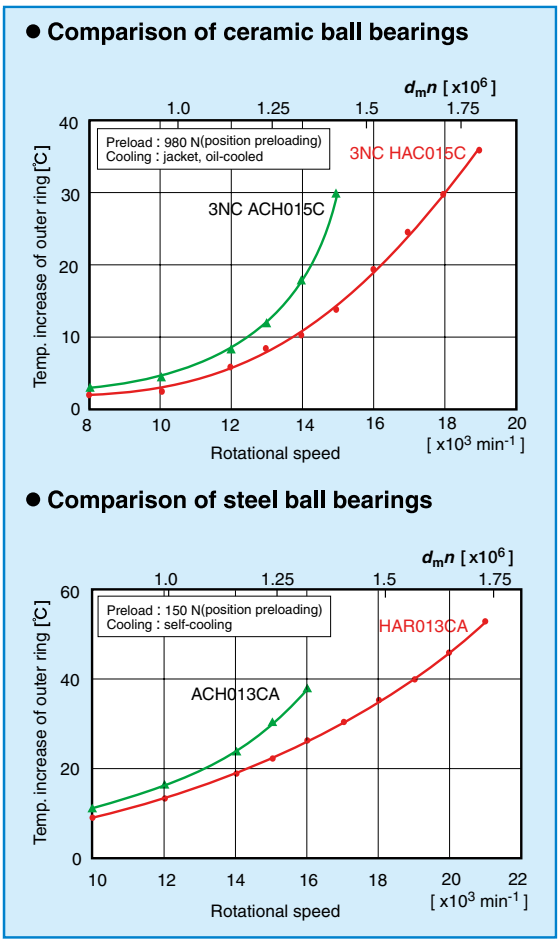


Fig. 1 Comparison of Increases in Bearing Temp. with Oil-and-air Lubrication

High Ability bearings also allow the possible change in lubrication of the spindle from oil-and-air to grease.

Fig.2 shows an evaluation example.

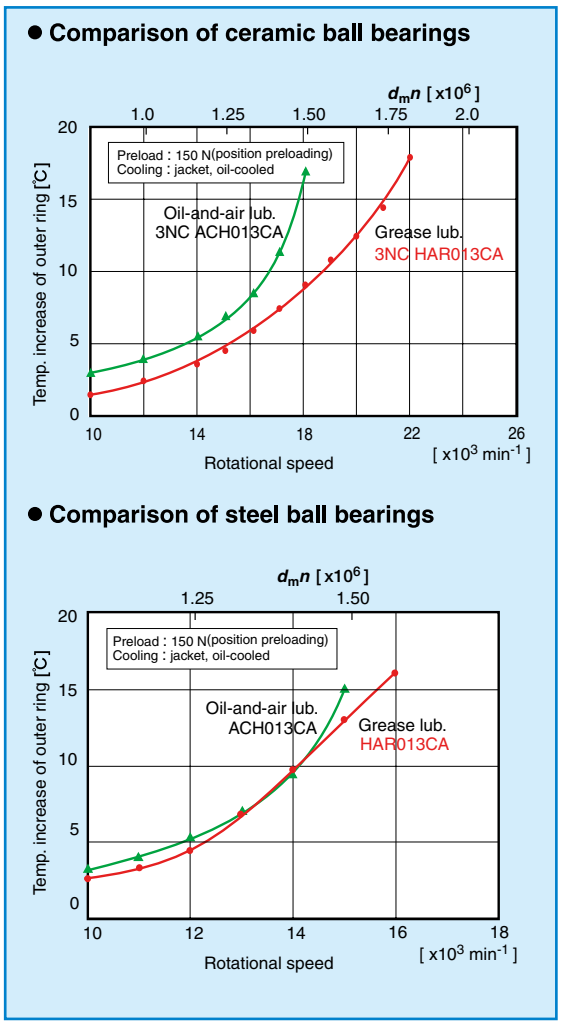


Fig. 2 Comparison of High-speed Performance Achieved by Grease Lubrication

Type R high ability bearing and grease lubrication exhibits better high-speed performance than conventional bearings using oil-and-air lubrication.

If steel balls are used, Type R with grease lubrication exhibits high-speed performance equal to or better than conventional bearings with oil-and-air lubrication.

(2) High-speed performance of Type D

High Ability Type D bearings are designed for oil-and-air lubrication. Their inner rings have an oiling groove to ensure lubrication on the rolling contact surface for improved lubrication reliability.

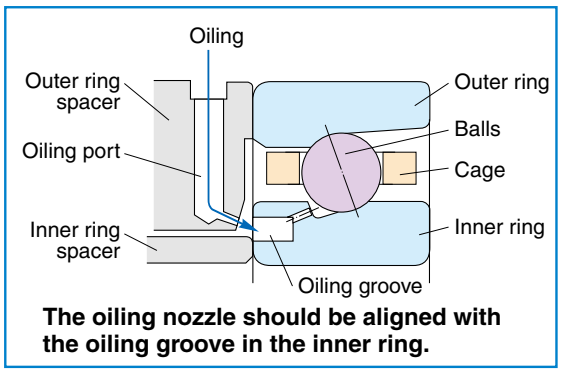


Fig. 3 Lubrication Method for Type D

Fig.4 compares the high-speed performance of Types D and R.

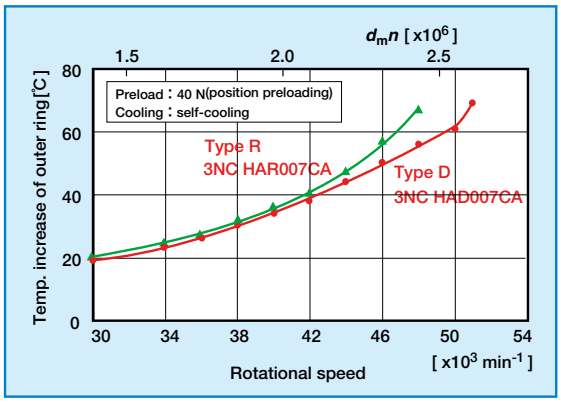


Fig. 4 Comparison of Increases in the Bearing Temp. of Types R and D

Furthermore, Type D bearings generate only a slight noise during rotation and are therefore also effective for noise reduction of spindle units (Fig. 5).

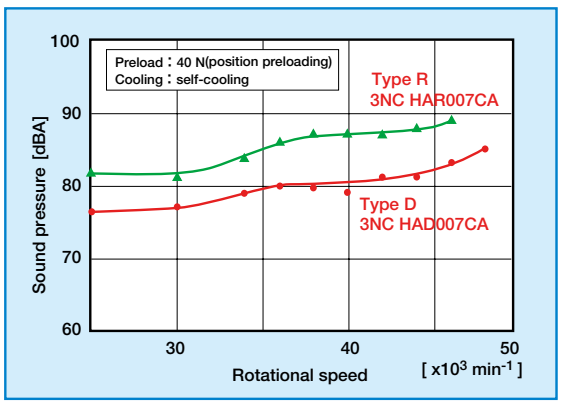


Fig. 5 Comparison of Noise by Types R and D

(3) High-speed performance of Type F

The oiling port in Type F is provided at its outer ring to ensure improved lubrication reliability on the guide ways of the cage. High Ability bearings of Type F deliver the best high-speed performance.

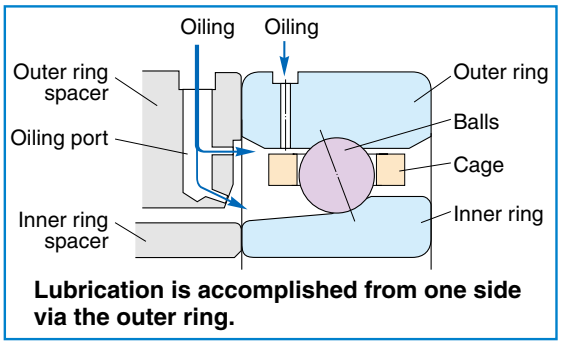


Fig. 6 Lubrication method used in Type F

Figure 7 shows an evaluation example of the Type F bearing operated with a preload given by constant pressure preloading. The maximum rotational speed achieved in this test, or 54 000 min^{-1}, equals 3.3×10^6 in d_mn value.

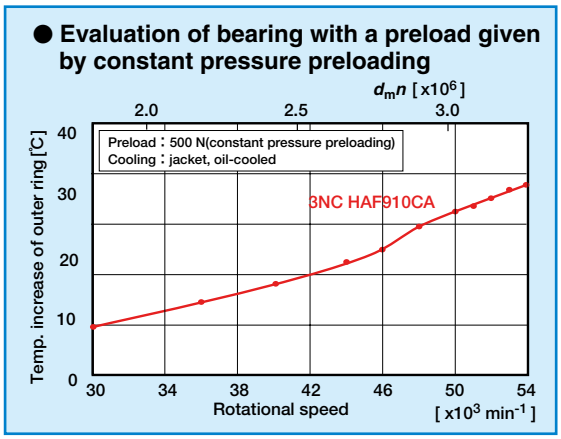


Fig. 7 Temp. Increases in Type F Bearing

The oiling port in the outer ring provides sufficient lubrication to achieve a substantial reduction of friction on guide ways of the cage. This lubrication method ensures excellent stability against rapid acceleration or deceleration during operation.

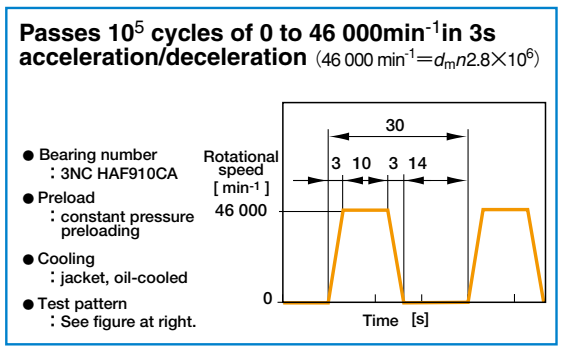


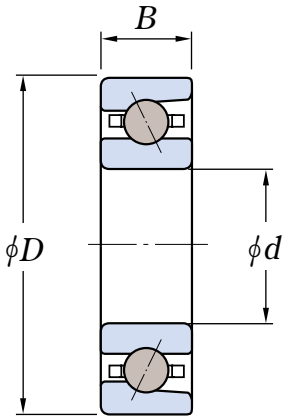
Fig. 8 Operating Pattern of Type F Involving Rapid Acceleration and Deceleration

Dimension table

Type R

Steel balls

d 30 – 70mm



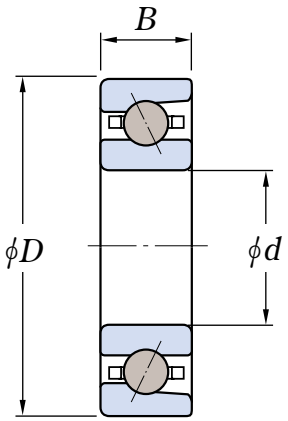
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	*D*	*B*		C	Co	Grease lub.	Oil-and-air lub.
30	55	13	**HAR006C**	8.70	4.85	26 000	40 000
			HAR006CA	8.55	4.75	25 000	38 000
			HAR006	8.00	4.45	18 000	24 000
35	62	14	**HAR007C**	9.25	5.55	23 000	35 000
			HAR007CA	9.05	5.40	22 000	33 000
			HAR007	8.45	5.05	15 000	21 000
40	62	12	**HAR908C**	6.35	4.05	22 000	33 000
			HAR908CA	6.20	3.95	21 000	31 000
			HAR908	5.75	3.70	15 000	20 000
	68	15	**HAR008C**	9.70	6.20	20 000	31 000
			HAR008CA	9.50	6.05	19 000	30 000
			HAR008	8.85	5.65	14 000	19 000
45	68	12	**HAR909C**	6.80	4.70	19 000	30 000
			HAR909CA	6.65	4.55	19 000	28 000
			HAR909	6.15	4.25	13 000	18 000
	75	16	**HAR009C**	10.9	7.10	18 000	28 000
			HAR009CA	10.6	6.95	18 000	27 000
			HAR009	9.90	6.45	13 000	17 000
50	72	12	**HAR910C**	9.10	6.30	18 000	28 000
			HAR910CA	8.90	6.15	17 000	26 000
			HAR910	8.25	5.75	12 000	16 000
	80	16	**HAR010C**	11.4	7.85	17 000	26 000
			HAR010CA	11.1	7.65	16 000	25 000
			HAR010	10.4	7.15	12 000	15 000
55	80	13	**HAR911C**	10.1	7.65	16 000	25 000
			HAR911CA	9.85	7.50	16 000	24 000
			HAR911	9.15	6.95	11 000	15 000
	90	18	**HAR011C**	14.1	9.90	15 000	23 000
			HAR011CA	13.7	9.70	14 000	22 000
			HAR011	12.8	9.00	10 000	14 000
60	85	13	**HAR912C**	9.95	7.75	15 000	23 000
			HAR912CA	9.70	7.55	14 000	22 000
			HAR912	9.00	7.00	10 000	14 000
	95	18	**HAR012C**	14.7	10.8	14 000	22 000
			HAR012CA	14.3	10.6	14 000	21 000
			HAR012	13.4	9.85	10 000	13 000
65	90	13	**HAR913C**	11.8	9.45	14 000	22 000
			HAR913CA	11.5	9.25	14 000	21 000
			HAR913	10.7	8.55	9 700	13 000
	100	18	**HAR013C**	15.3	11.8	13 000	21 000
			HAR013CA	14.9	11.5	13 000	19 000
			HAR013	13.9	10.7	9 100	12 000
70	100	16	**HAR914C**	12.9	10.5	13 000	20 000
			HAR914CA	12.6	10.2	12 000	19 000
			HAR914	11.7	9.45	8 800	12 000
	110	20	**HAR014C**	20.7	15.5	12 000	19 000
			HAR014CA	20.2	15.1	12 000	18 000
			HAR014	18.9	14.1	8 300	11 000

Dimension table

Type R

Steel balls

d 75 – 110mm



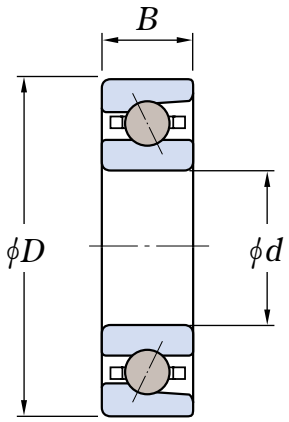
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	*D*	*B*		C	C0	Grease lub.	Oil-and-air lub.
75	105	16	**HAR915C**	13.3	11.2	12 000	19 000
			HAR915CA	12.9	10.9	12 000	18 000
			HAR915	12.0	10.1	8 300	11 000
	115	20	**HAR015C**	21.1	16.2	12 000	18 000
			HAR015CA	20.6	15.8	11 000	17 000
			HAR015	19.2	14.7	7 900	11 000
80	110	16	**HAR916C**	13.6	11.9	12 000	18 000
			HAR916CA	13.3	11.6	11 000	17 000
			HAR916	12.3	10.8	7 900	11 000
	125	22	**HAR016C**	24.7	19.2	10 000	16 000
			HAR016CA	24.1	18.8	9 700	15 000
			HAR016	22.5	17.5	7 000	9 300
85	120	18	**HAR917C**	16.3	14.2	10 000	16 000
			HAR917CA	15.9	13.8	9 700	15 000
			HAR917	14.8	12.8	7 000	9 300
	130	22	**HAR017C**	25.1	20.1	9 700	15 000
			HAR017CA	24.5	19.6	9 300	14 000
			HAR017	22.8	18.3	6 600	8 800
90	125	18	**HAR918C**	16.8	15.1	9 700	15 000
			HAR918CA	16.4	14.7	9 300	14 000
			HAR918	15.2	13.7	6 600	8 800
	140	24	**HAR018C**	32.8	26.1	9 100	14 000
			HAR018CA	32.0	25.4	8 700	13 000
			HAR018	29.8	23.7	6 200	8 300
95	130	18	**HAR919C**	17.3	16.0	9 300	14 000
			HAR919CA	16.9	15.6	8 900	14 000
			HAR919	15.6	14.5	6 300	8 400
	145	24	**HAR019C**	33.4	27.2	8 700	13 000
			HAR019CA	32.6	26.6	8 300	13 000
			HAR019	30.4	24.7	5 900	7 900
100	140	20	**HAR920C**	24.2	21.7	8 700	13 000
			HAR920CA	23.6	21.2	8 300	13 000
			HAR920	21.9	19.7	5 900	7 900
	150	24	**HAR020C**	34.0	28.4	8 400	13 000
			HAR020CA	33.2	27.7	8 000	12 000
			HAR020	30.9	25.8	5 700	7 600
105	145	20	**HAR921C**	24.9	23.1	8 400	13 000
			HAR921CA	24.3	22.5	8 000	12 000
			HAR921	22.5	20.9	5 700	7 600
	160	26	**HAR021C**	38.6	32.5	7 900	12 000
			HAR021CA	37.6	31.7	7 500	11 000
			HAR021	35.0	29.5	5 400	7 200
110	150	20	**HAR922C**	25.1	23.8	8 000	12 000
			HAR922CA	24.5	23.2	7 700	12 000
			HAR922	22.8	21.6	5 500	7 300
	170	28	**HAR022C**	43.4	37.0	7 500	12 000
			HAR022CA	42.4	36.1	7 100	11 000
			HAR022	39.4	33.6	5 100	6 800

Dimension table

Type R

Steel balls

d 120 – 170mm



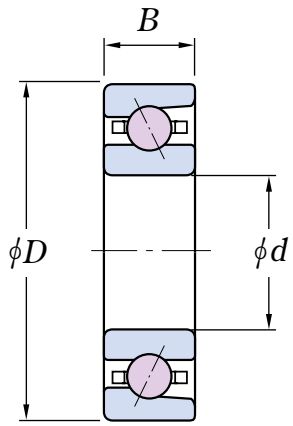
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	*D*	*B*		C	Co	Grease lub.	Oil-and-air lub.
120	165	22	**HAR924C**	29.4	28.4	7 300	11 000
			HAR924CA	28.6	27.7	7 000	11 000
			HAR924	26.6	25.7	5 000	6 700
	180	28	**HAR024C**	44.9	39.9	7 000	11 000
			HAR024CA	43.8	39.0	6 700	10 000
			HAR024	40.7	36.2	4 800	6 300
130	180	24	**HAR926C**	35.1	35.1	6 700	10 000
			HAR926CA	34.2	34.3	6 400	9 800
			HAR926	31.7	31.8	4 600	6 100
	200	33	**HAR026C**	56.3	48.4	6 300	9 800
			HAR026CA	55.0	47.2	6 000	9 200
			HAR026	51.2	43.9	4 300	5 800
140	190	24	**HAR928C**	35.2	36.2	6 300	9 800
			HAR928CA	34.3	35.3	6 000	9 200
			HAR928	31.8	32.8	4 300	5 800
	210	33	**HAR028C**	61.3	56.2	6 000	9 200
			HAR028CA	59.9	54.8	5 700	8 700
			HAR028	55.7	51.0	4 100	5 400
150	210	28	**HAR930C**	48.9	48.9	5 800	9 000
			HAR930CA	47.7	47.6	5 500	8 400
			HAR930	44.3	44.2	4 000	5 300
	225	35	**HAR030C**	72.2	66.1	5 300	8 200
			HAR030CA	70.5	64.5	5 000	7 700
			HAR030	65.6	60.0	3 600	4 800
160	220	28	**HAR932C**	50.2	51.8	5 200	8 100
			HAR932CA	48.9	50.5	5 000	7 600
			HAR932	45.4	46.9	3 600	4 700
	240	38	**HAR032C**	78.3	72.7	5 000	7 700
			HAR032CA	76.4	71.0	4 700	7 200
			HAR032	71.1	66.0	3 400	4 500
170	230	28	**HAR934C**	51.4	54.8	5 000	7 700
			HAR934CA	50.1	53.4	4 700	7 200
			HAR934	46.4	49.6	3 400	4 500
	260	42	**HAR034C**	91.8	86.4	4 600	7 100
			HAR034CA	89.6	84.3	4 400	6 700
			HAR034	83.4	78.4	3 100	4 200

Dimension table

Type R

Ceramic balls

d 30 – 70mm



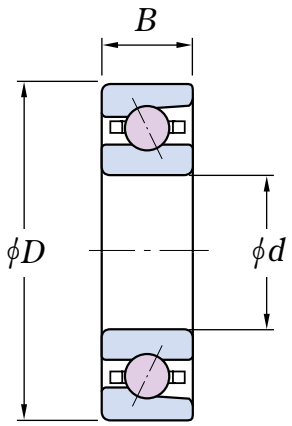
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	*D*	*B*		C	Co	Grease lub.	Oil-and-air lub.
30	55	13	**3NCHAR006C**	8.70	4.85	35 000	59 000
			3NCHAR006CA	8.55	4.75	33 000	55 000
			3NCHAR006	8.00	4.45	25 000	35 000
35	62	14	**3NCHAR007C**	9.25	5.55	31 000	52 000
			3NCHAR007CA	9.05	5.40	29 000	48 000
			3NCHAR007	8.45	5.05	22 000	31 000
40	62	12	**3NCHAR908C**	6.35	4.05	29 000	49 000
			3NCHAR908CA	6.20	3.95	27 000	46 000
			3NCHAR908	5.75	3.70	21 000	29 000
	68	15	**3NCHAR008C**	9.70	6.20	28 000	46 000
			3NCHAR008CA	9.50	6.05	26 000	44 000
			3NCHAR008	8.85	5.65	19 000	28 000
45	68	12	**3NCHAR909C**	6.80	4.70	27 000	44 000
			3NCHAR909CA	6.65	4.55	25 000	42 000
			3NCHAR909	6.15	4.25	19 000	27 000
	75	16	**3NCHAR009C**	10.9	7.10	25 000	42 000
			3NCHAR009CA	10.6	6.95	23 000	39 000
			3NCHAR009	9.90	6.45	18 000	25 000
50	72	12	**3NCHAR910C**	9.10	6.30	25 000	41 000
			3NCHAR910CA	8.90	6.15	23 000	39 000
			3NCHAR910	8.25	5.75	17 000	25 000
	80	16	**3NCHAR010C**	11.4	7.85	23 000	38 000
			3NCHAR010CA	11.1	7.65	22 000	36 000
			3NCHAR010	10.4	7.15	16 000	23 000
55	80	13	**3NCHAR911C**	10.1	7.65	22 000	37 000
			3NCHAR911CA	9.85	7.50	21 000	35 000
			3NCHAR911	9.15	6.95	16 000	22 000
	90	18	**3NCHAR011C**	14.1	9.90	21 000	34 000
			3NCHAR011CA	13.7	9.70	19 000	32 000
			3NCHAR011	12.8	9.00	14 000	21 000
60	85	13	**3NCHAR912C**	9.95	7.75	21 000	34 000
			3NCHAR912CA	9.70	7.55	19 000	32 000
			3NCHAR912	9.00	7.00	14 000	21 000
	95	18	**3NCHAR012C**	14.7	10.8	19 000	32 000
			3NCHAR012CA	14.3	10.6	18 000	30 000
			3NCHAR012	13.4	9.85	14 000	19 000
65	90	13	**3NCHAR913C**	11.8	9.45	19 000	32 000
			3NCHAR913CA	11.5	9.25	18 000	30 000
			3NCHAR913	10.7	8.55	14 000	19 000
	100	18	**3NCHAR013C**	15.3	11.8	18 000	30 000
			3NCHAR013CA	14.9	11.5	17 000	28 000
			3NCHAR013	13.9	10.7	13 000	18 000
70	100	16	**3NCHAR914C**	12.9	10.5	18 000	29 000
			3NCHAR914CA	12.6	10.2	16 000	28 000
			3NCHAR914	11.7	9.45	12 000	18 000
	110	20	**3NCHAR014C**	20.7	15.5	17 000	28 000
			3NCHAR014CA	20.2	15.1	16 000	26 000
			3NCHAR014	18.9	14.1	12 000	17 000

Dimension table

Type R

Ceramic balls

d 75 –110mm



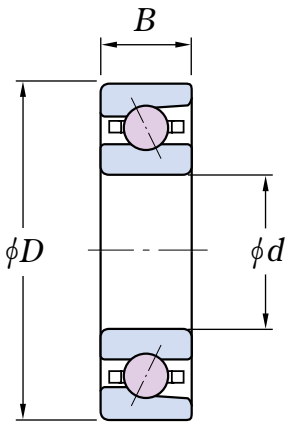
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	D	B		C	Co	Grease lub.	Oil-and-air lub.
75	105	16	3NCHAR915C	13.3	11.2	17 000	28 000
			3NCHAR915CA	12.9	10.9	16 000	26 000
			3NCHAR915	12.0	10.1	12 000	17 000
	115	20	3NCHAR015C	21.1	16.2	16 000	26 000
			3NCHAR015CA	20.6	15.8	15 000	25 000
			3NCHAR015	19.2	14.7	11 000	16 000
80	110	16	3NCHAR916C	13.6	11.9	16 000	26 000
			3NCHAR916CA	13.3	11.6	15 000	25 000
			3NCHAR916	12.3	10.8	11 000	16 000
	125	22	3NCHAR016C	24.7	19.2	14 000	23 000
			3NCHAR016CA	24.1	18.8	13 000	22 000
			3NCHAR016	22.5	17.5	9 700	14 000
85	120	18	3NCHAR917C	16.3	14.2	14 000	23 000
			3NCHAR917CA	15.9	13.8	13 000	22 000
			3NCHAR917	14.8	12.8	9 700	14 000
	130	22	3NCHAR017C	25.1	20.1	13 000	22 000
			3NCHAR017CA	24.5	19.6	12 000	21 000
			3NCHAR017	22.8	18.3	9 300	13 000
90	125	18	3NCHAR918C	16.8	15.1	13 000	22 000
			3NCHAR918CA	16.4	14.7	12 000	21 000
			3NCHAR918	15.2	13.7	9 300	13 000
	140	24	3NCHAR018C	32.8	26.1	12 000	21 000
			3NCHAR018CA	32.0	25.4	12 000	19 000
			3NCHAR018	29.8	23.7	8 700	12 000
95	130	18	3NCHAR919C	17.3	16.0	13 000	21 000
			3NCHAR919CA	16.9	15.6	12 000	20 000
			3NCHAR919	15.6	14.5	8 900	13 000
	145	24	3NCHAR019C	33.4	27.2	12 000	20 000
			3NCHAR019CA	32.6	26.6	11 000	19 000
			3NCHAR019	30.4	24.7	8 300	12 000
100	140	20	3NCHAR920C	24.2	21.7	12 000	20 000
			3NCHAR920CA	23.6	21.2	11 000	19 000
			3NCHAR920	21.9	19.7	8 300	12 000
	150	24	3NCHAR020C	34.0	28.4	11 000	19 000
			3NCHAR020CA	33.2	27.7	11 000	18 000
			3NCHAR020	30.9	25.8	8 000	11 000
105	145	20	3NCHAR921C	24.9	23.1	11000	19 000
			3NCHAR921CA	24.3	22.5	11 000	18 000
			3NCHAR921	22.5	20.9	8 000	11 000
	160	26	3NCHAR021C	38.6	32.5	11 000	18 000
			3NCHAR021CA	37.6	31.7	10 000	17 000
			3NCHAR021	35.0	29.5	7 500	11 000
110	150	20	3NCHAR922C	25.1	23.8	11 000	18 000
			3NCHAR922CA	24.5	23.2	10 000	17 000
			3NCHAR922	22.8	21.6	7 700	11 000
	170	28	3NCHAR022C	43.4	37.0	10 000	17 000
			3NCHAR022CA	42.4	36.1	9 500	16 000
			3NCHAR022	39.4	33.6	7 100	10 000

Dimension table

Type R

Ceramic balls

d 120 – 170mm



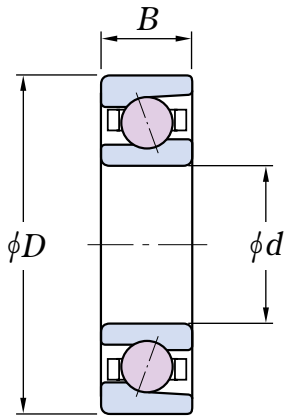
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	*D*	*B*		C	C0	Grease lub.	Oil-and-air lub.
120	165	22	**3NCHAR924C**	29.4	28.4	10 000	17 000
			3NCHAR924CA	28.6	27.7	9 300	16 000
			3NCHAR924	26.6	25.7	7 000	10 000
	180	28	**3NCHAR024C**	44.9	39.9	9 500	16 000
			3NCHAR024CA	43.8	39.0	8 900	15 000
			3NCHAR024	40.7	36.2	6 700	9 500
130	180	24	**3NCHAR926C**	35.1	35.1	9 200	15 000
			3NCHAR926CA	34.2	34.3	8 600	14 000
			3NCHAR926	31.7	31.8	6 400	9 200
	200	33	**3NCHAR026C**	56.3	48.4	8 600	14 000
			3NCHAR026CA	55.0	47.2	8 100	14 000
			3NCHAR026	51.2	43.9	6 000	8 600
140	190	24	**3NCHAR928C**	35.2	36.2	8 600	14 000
			3NCHAR928CA	34.3	35.3	8 100	14 000
			3NCHAR928	31.8	32.8	6 000	8 600
	210	33	**3NCHAR028C**	61.3	56.2	8 100	14 000
			3NCHAR028CA	59.9	54.8	7 600	13 000
			3NCHAR028	55.7	51.0	5 700	8 100
150	210	28	**3NCHAR930C**	48.9	48.9	7 900	13 000
			3NCHAR930CA	47.7	47.6	7 400	12 000
			3NCHAR930	44.3	44.2	5 500	7 900
	225	35	**3NCHAR030C**	72.2	66.1	7 200	12 000
			3NCHAR030CA	70.5	64.5	6 700	11 000
			3NCHAR030	65.6	60.0	5 000	7 200
160	220	28	**3NCHAR932C**	50.2	51.8	7 100	12 000
			3NCHAR932CA	48.9	50.5	6 600	11 000
			3NCHAR932	45.4	46.9	5 000	7 100
	240	38	**3NCHAR032C**	78.3	72.7	6 800	11 000
			3NCHAR032CA	76.4	71.0	6 300	11 000
			3NCHAR032	71.1	66.0	4 700	6 800
170	230	28	**3NCHAR934C**	51.4	54.8	6 800	11 000
			3NCHAR934CA	50.1	53.4	6 300	11 000
			3NCHAR934	46.4	49.6	4 700	6 800
	260	42	**3NCHAR034C**	91.8	86.4	6 300	10 000
			3NCHAR034CA	89.6	84.3	5 900	9 800
			3NCHAR034	83.4	78.4	4 400	6 300

Dimension table

Type C

Ceramic balls

d 10 – 45mm



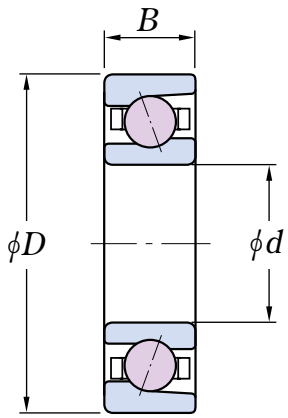
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	*D*	*B*		C	Co	Grease lub.	Oil-and-air lub.
10	22	6	3NCHAC900C	2.05	0.77	94 000	156 000
			3NCHAC900CA	2.00	0.76	88 000	147 000
	26	8	3NCHAC000C	3.50	1.25	85 000	141 000
			3NCHAC000CA	3.50	1.25	79 000	133 000
12	24	6	3NCHAC901C	2.15	0.87	83 000	139 000
			3NCHAC901CA	2.10	0.86	78 000	131 000
	28	8	3NCHAC001C	3.90	1.50	73 000	122 000
			3NCHAC001CA	3.85	1.45	68 000	115 000
15	28	7	3NCHAC902C	3.20	1.35	70 000	116 000
			3NCHAC902CA	3.15	1.30	65 000	109 000
	32	9	3NCHAC002C	4.45	1.90	64 000	106 000
			3NCHAC002CA	4.40	1.85	60 000	100 000
17	30	7	3NCHAC903C	3.40	1.50	63 000	104 000
			3NCHAC903CA	3.35	1.45	58 000	98 000
	35	10	3NCHAC003C	4.95	2.30	57 000	94 000
			3NCHAC003CA	4.85	2.25	53 000	89 000
20	37	9	3NCHAC904C	4.95	2.35	53 000	88 000
			3NCHAC904CA	4.85	2.30	49 000	82 000
	42	12	3NCHAC004C	7.50	3.35	48 000	79 000
			3NCHAC004CA	7.35	3.30	44 000	75 000
25	42	9	3NCHAC905C	5.40	2.75	44 000	73 000
			3NCHAC905CA	5.30	2.70	41 000	69 000
	47	12	3NCHAC005C	8.35	4.10	42 000	69 000
			3NCHAC005CA	8.20	4.00	39 000	65 000
30	47	9	3NCHAC906C	5.75	3.20	39 000	65 000
			3NCHAC906CA	5.65	3.10	36 000	61 000
	55	13	3NCHAC006C	10.8	5.60	35 000	59 000
			3NCHAC006CA	10.6	5.50	33 000	55 000
35	55	10	3NCHAC907C	8.65	4.90	33 000	56 000
			3NCHAC907CA	8.50	4.80	31 000	52 000
	62	14	3NCHAC007C	13.0	7.00	31 000	51 000
			3NCHAC007CA	12.8	6.85	29 000	48 000
40	62	12	3NCHAC908C	10.9	6.30	29 000	49 000
			3NCHAC908CA	10.6	6.20	27 000	46 000
	68	15	3NCHAC008C	14.1	8.10	28 000	46 000
			3NCHAC008CA	13.8	7.90	26 000	44 000
45	68	12	3NCHAC909C	11.5	7.15	27 000	44 000
			3NCHAC909CA	11.3	7.00	25 000	42 000
	75	16	3NCHAC009C	16.8	9.80	25 000	42 000
			3NCHAC009CA	16.4	9.60	23 000	39 000

Dimension table

Type C

Ceramic balls

d 50 – 95mm



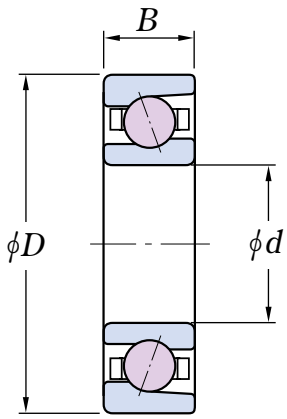
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	D	B		C	Co	Grease lub.	Oil-and-air lub.
50	72	12	3NCHAC910C	12.2	7.95	25 000	41 000
			3NCHAC910CA	11.9	7.80	23 000	39 000
	80	16	3NCHAC010C	17.9	11.2	23 000	38 000
			3NCHAC010CA	17.6	10.9	21 000	36 000
55	80	13	3NCHAC911C	13.8	9.40	22 000	37 000
			3NCHAC911CA	13.5	9.20	21 000	35 000
	90	18	3NCHAC011C	23.5	14.6	21 000	34 000
			3NCHAC011CA	23.0	14.3	19 000	32 000
60	85	13	3NCHAC912C	16.3	11.1	21 000	34 000
			3NCHAC912CA	15.9	10.8	19 000	32 000
	95	18	3NCHAC012C	24.2	15.6	19 000	32 000
			3NCHAC012CA	23.7	15.3	18 000	30 000
65	90	13	3NCHAC913C	14.7	10.8	19 000	32 000
			3NCHAC913CA	14.3	10.6	18 000	30 000
	100	18	3NCHAC013C	25.7	17.5	18 000	30 000
			3NCHAC013CA	25.2	17.1	17 000	28 000
70	100	16	3NCHAC914C	20.3	14.7	18 000	29 000
			3NCHAC914CA	19.9	14.4	16 000	28 000
	110	20	3NCHAC014C	32.4	21.9	17 000	28 000
			3NCHAC014CA	31.7	21.4	16 000	26 000
75	105	16	3NCHAC915C	20.7	15.5	17 000	28 000
			3NCHAC915CA	20.2	15.1	16 000	26 000
	115	20	3NCHAC015C	33.3	23.2	16 000	26 000
			3NCHAC015CA	32.6	22.7	15 000	25 000
80	110	16	3NCHAC916C	21.1	16.2	16 000	26 000
			3NCHAC916CA	20.6	15.8	15 000	25 000
	125	22	3NCHAC016C	40.6	28.1	14 000	23 000
			3NCHAC016CA	39.7	27.5	13 000	22 000
85	120	18	3NCHAC917C	27.4	20.6	14 000	23 000
			3NCHAC917CA	26.7	20.1	13 000	22 000
	130	22	3NCHAC017C	41.7	29.8	13 000	22 000
			3NCHAC017CA	40.8	29.2	12 000	21 000
90	125	18	3NCHAC918C	27.9	21.6	13 000	22 000
			3NCHAC918CA	27.3	21.1	12 000	21 000
	140	24	3NCHAC018C	49.6	35.2	12 000	21 000
			3NCHAC018CA	48.5	34.4	12 000	19 000
95	130	18	3NCHAC919C	28.5	22.6	13 000	21 000
			3NCHAC919CA	27.8	22.1	12 000	20 000
	145	24	3NCHAC019C	50.9	37.3	12 000	19 000
			3NCHAC019CA	49.8	36.5	11 000	18 000

Dimension table

Type C

Ceramic balls

d 100 – 170mm



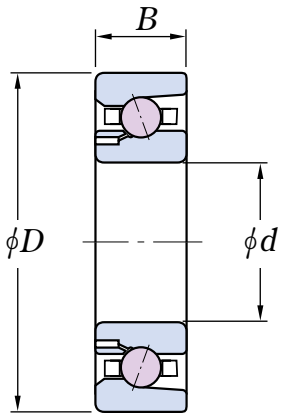
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}	
d	D	B		C	Co	Grease lub.	Oil-and-air lub.
100	140	20	3NCHAC920C	39.0	29.7	12 000	20 000
			3NCHAC920CA	38.1	29.0	11 000	19 000
	150	24	3NCHAC020C	52.4	39.3	11 000	19 000
			3NCHAC020CA	51.2	38.4	11 000	18 000
105	145	20	3NCHAC921C	39.9	31.2	11 000	19 000
			3NCHAC921CA	38.9	30.5	11 000	18 000
	160	26	3NCHAC021C	61.0	45.6	11 000	18 000
			3NCHAC021CA	59.6	44.6	9 900	17 000
110	150	20	3NCHAC922C	40.7	32.7	11 000	18 000
			3NCHAC922CA	39.8	31.9	10 000	17 000
	170	28	3NCHAC022C	69.9	51.6	9 500	17 000
			3NCHAC022CA	68.4	50.4	10 000	16 000
120	165	22	3NCHAC924C	50.5	41.2	10 000	17 000
			3NCHAC924CA	49.3	40.3	9 300	16 000
	180	28	3NCHAC024C	74.0	57.5	9 500	16 000
			3NCHAC024CA	72.3	56.2	8 900	15 000
130	180	24	3NCHAC926C	61.2	50.8	9 200	15 000
			3NCHAC926CA	59.8	49.6	8 600	14 000
	200	33	3NCHAC026C	89.7	69.7	8 600	14 000
			3NCHAC026CA	87.7	68.2	8 100	14 000
140	190	24	3NCHAC928C	62.3	53.2	8 600	14 000
			3NCHAC928CA	60.8	52.0	8 100	14 000
	210	33	3NCHAC028C	91.9	73.8	8 100	14 000
			3NCHAC028CA	89.8	72.1	7 600	13 000
150	210	28	3NCHAC930C	83.2	69.8	7 500	12 000
			3NCHAC930CA	81.3	68.2	7 000	12 000
	225	35	3NCHAC030C	105	85.7	7 100	12 000
			3NCHAC030CA	103	83.7	6 700	11 000
160	220	28	3NCHAC932C	84.8	73.3	7 100	12 000
			3NCHAC932CA	82.8	71.6	6 600	11 000
	240	38	3NCHAC032C	119	98.1	6 700	11 000
			3NCHAC032CA	116	95.9	6 300	11 000
170	230	28	3NCHAC934C	86.4	76.7	6 700	11 000
			3NCHAC934CA	84.3	74.9	6 300	11 000
	260	42	3NCHAC034C	142	119	6 300	10 000
			3NCHAC034CA	139	117	5 900	9 800

Dimension table

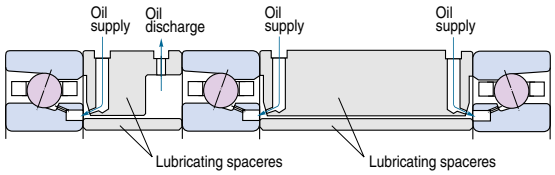
Type D

Ceramic balls

d 35 – 130mm



These bearings are useful only with oil and air lubrication.
Please use with lubricating spacers as shown below.
For spacer dimensions and nozzle locations, consult JTEKT.



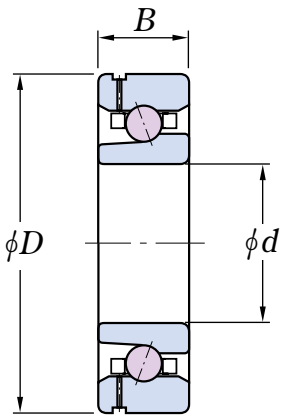
Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}
d	*D*	*B*		C	C0	Oil-and-air lub.
35	62	14	3NCHAD007CA	9.05	5.40	52 000
40	68	15	3NCHAD008CA	9.50	6.05	46 000
45	75	16	3NCHAD009CA	10.6	6.95	42 000
50	80	16	3NCHAD010CA	11.1	7.65	38 000
55	90	18	3NCHAD011CA	13.7	9.70	34 000
60	95	18	3NCHAD012CA	14.3	10.6	32 000
65	100	18	3NCHAD013CA	14.9	11.5	30 000
70	110	20	3NCHAD014CA	20.2	15.1	28 000
75	115	20	3NCHAD015CA	20.6	15.8	26 000
80	125	22	3NCHAD016CA	24.1	18.8	23 000
85	130	22	3NCHAD017CA	24.5	19.6	22 000
90	140	24	3NCHAD018CA	32.0	25.5	21 000
95	145	24	3NCHAD019CA	32.6	26.6	20 000
100	150	24	3NCHAD020CA	33.2	27.7	19 000
105	160	26	3NCHAD021CA	37.6	31.8	18 000
110	170	28	3NCHAD022CA	42.4	36.1	17 000
120	180	28	3NCHAD024CA	43.8	39.0	16 000
130	200	33	3NCHAD026CA	55.0	47.2	14 000

Dimension table

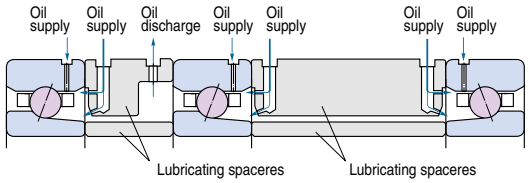
Type F

Ceramic balls

d 30 – 130mm



These bearings are useful only with oil and air lubrication.
Please use with lubricating spacers as shown below.
For spacer dimensions and nozzle locations, consult **JTEKT**.



Boundary dimensions mm			Bearing numbers	Basic load ratings kN		Limiting speeds min^{-1}
d	D	B		C	Co	Oil-and-air lub.
30	55	13	**3NCHAF006CA**	7.55	3.95	85 000
35	62	14	**3NCHAF007CA**	8.15	4.60	74 000
40	62	12	**3NCHAF908CA**	6.05	3.80	71 000
	68	15	**3NCHAF008CA**	8.65	5.20	67 000
45	68	12	**3NCHAF909CA**	6.50	4.35	64 000
	75	16	**3NCHAF009CA**	10.0	6.35	60 000
50	72	12	**3NCHAF910CA**	8.40	5.65	58 000
	80	16	**3NCHAF010CA**	10.5	7.00	56 000
55	80	13	**3NCHAF911CA**	9.00	6.45	53 000
	90	18	**3NCHAF011CA**	12.6	8.45	50 000
60	85	13	**3NCHAF912CA**	9.10	6.75	49 000
	95	18	**3NCHAF012CA**	13.3	9.30	47 000
65	90	13	**3NCHAF913CA**	10.3	7.75	46 000
	100	18	**3NCHAF013CA**	13.9	10.2	44 000
70	100	16	**3NCHAF914CA**	11.8	9.20	42 000
	110	20	**3NCHAF014CA**	18.7	13.2	40 000
75	105	16	**3NCHAF915CA**	12.2	9.90	40 000
	115	20	**3NCHAF015CA**	19.1	13.9	38 000
80	110	16	**3NCHAF916CA**	12.6	10.6	38 000
	125	22	**3NCHAF016CA**	22.4	16.5	35 000
85	120	18	**3NCHAF917CA**	15.1	12.5	35 000
	130	22	**3NCHAF017CA**	22.8	17.4	32 000
90	125	18	**3NCHAF918CA**	15.6	13.4	32 000
	140	24	**3NCHAF018CA**	28.8	21.4	30 000
95	130	18	**3NCHAF919CA**	15.6	13.4	30 000
	145	24	**3NCHAF019CA**	29.5	22.5	29 000
100	140	20	**3NCHAF920CA**	15.7	13.9	29 000
	150	24	**3NCHAF020CA**	30.1	23.6	27 000
105	145	20	**3NCHAF921CA**	22.3	19.3	27 000
	160	26	**3NCHAF021CA**	34.2	27.1	26 000
110	150	20	**3NCHAF922CA**	23.0	20.6	26 000
	170	28	**3NCHAF022CA**	37.4	29.5	25 000
120	165	22	**3NCHAF924CA**	23.3	21.3	24 000
	180	28	**3NCHAF024CA**	43.0	37.6	23 000
130	180	24	**3NCHAF926CA**	27.3	25.4	22 000
	200	33	**3NCHAF026CA**	53.8	45.3	21 000

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