



IKO

Crossed Roller Bearings

CRBT
CRBS

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CAT-57166

Super Slim & Slim Type Crossed Roller Bearing

Super Slim & Slim Type Crossed Roller Bearing are extremely compact bearings having cylindrical rollers disposed perpendicularly between inner and outer rings. A single bearing can take complicated loads such as radial, axial and moment loads.

By using cylindrical rollers whose elastic displacement due to load is smaller than steel balls, this type of crossed roller bearing can make the device compact and highly rigid comparing to ball bearings or taper roller bearings and the combination of two ball bearings.

These bearings are widely used in the rotating parts of industrial robots, optical apparatus and medical equipments, etc., which contribute compactness and lightness.

Applications of Super Slim & Slim Type Crossed Roller Bearing



Features of Super Slim & Slim Type Crossed Roller Bearing

The world's slimmest roller types
Super low sectional height of 5.5 mm

The sectional height of this type is reduced to 69% of that of CRBS which has been the slimmest. (Shaft diameter : 50 mm) Its width is 5 mm and the sectional area is made compact (43% of that of the conventional types).

Great weight saving down to 38% of the conventional types

As the result of pursue of absolute weight saving, the weight of this type is greatly reduced down to 0.38 of the conventional slim type CRBS. (Shaft diameter : 50 mm)

Realization of compact device designing and space saving

Perpendicular arrangement of cylindrical rollers enables a single bearing to take complicated loads such as radial, axial and moment loads. Since this type of bearings can be used in a cantilever structure, they can increase the degree of freedom in designing and contribute to device downsizing and space saving.

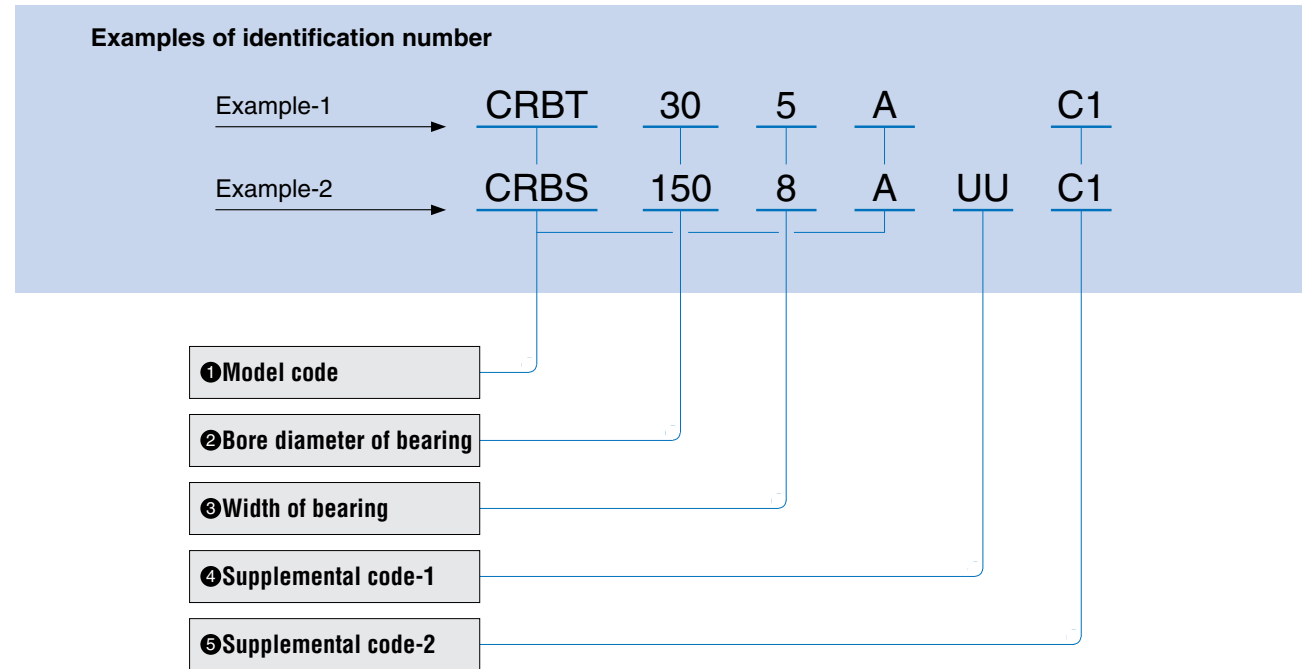
Nominal bore diameter	20 mm		30 mm		40 mm		50 mm			
Sectional view										
Series	NEW CRBT205A	CRBH208A	NEW CRBT305A	CRBH3010A	NEW CRBT405A	CRBH4010A	NEW CRBT505A	CRBS508	CRBH5013A	
Item										
Outside diameter	mm	31	36	41	55	51	65	61	66	80
Width	mm	5	8	5	10	5	10	5	8	13
Sectional height	mm	5.5	8	5.5	12.5	5.5	12.5	5.5	8	15
C	N	1400	2910	1770	7600	2000	8610	2280	4900	17300
C ₀	N	1290	2430	1970	8370	2520	10600	3200	6170	20900
Weight	g	14.8	40	20.7	120	26.5	150	32.3	84	290
	Ratio to CRBH	0.37	1.00	0.17	1.00	0.18	1.00	0.11	0.29	1.00
	Ratio to CRBS	—	—	—	—	—	—	0.38	1.00	3.45

Variations

Type	Guidance of cylindrical roller	Sealing structure	Model code	Shaft diameter
Super Slim Type Crossed Roller Bearing	with Separator	Open type	CRBT...A	20~ 50 mm
	with Cage	Sealed type	CRBS...AUU	50~200 mm
Slim Type Crossed Roller Bearing	with Separator	Open type	CRBS	50~200 mm
	Full Complement	Sealed type	CRBS...VUU	50~200 mm
		Open type	CRBS...V	50~200 mm

Identification Number

The identification number of IKO Super Slim and Slim Type Crossed Roller Bearings consists of a model code, dimensions and supplemental codes as shown below.



① Model code	CRBT...A Super Slim Type Crossed Roller Bearing (With separator) CRBS Slim Type Crossed Roller Bearing (With cage) CRBS...A Slim Type Crossed Roller Bearing (With separator) CRBS...V Slim Type Crossed Roller Bearing (Full complement)
② Bore diameter of bearing	Denotes the bore diameter of bearing (unit: mm)
③ Width of bearing	Denotes the width of bearing (unit: mm)
④ Supplemental code-1 (Seal specification)	No symbol : Open type UU : Both side sealed type U : One side sealed type For applicable codes, see Table 1.
⑤ Supplemental code-2 (Internal Clearance)	T1 : T1 clearance C1 : C1 clearance No symbol: Normal clearance For applicable codes, see Table 2.

Table 1 Seal specification

Mode code	No symbol	UU	U
CRBT...A	○	—	—
CRBS	○	—	—
CRBS...A	—	○	○
CRBS...V	○	○	○

Table 2 Clearance specification

Model code	T1	C1	No symbol
CRBT...A	—	○	—
CRBS	○	○	○
CRBS...A	○	○	○
CRBS...V	○	○	○

Load Rating and Life

Basic dynamic load rating C

The basic dynamic load rating is defined as a constant radial load both in direction and magnitude under which a group of identical bearings are individually operated and 90% of the bearings in the group can rotate 1,000,000 revolutions free from material damage due to rolling contact fatigue.

Life

The basic rating life of IKO Super Slim and Slim Type Crossed Roller Bearings is obtained from the following formula.

$$L_{10} = \left(\frac{C}{P_r}\right)^{10/3} \dots\dots\dots (1)$$

where, L_{10} : Basic rating life, 10^6 rev.
 C : Basic dynamic load rating, N
 P_r : Dynamic equivalent radial load, N

If the number of revolutions per minute is known, the rating life in hours can be obtained from the following formula.

$$L_h = \frac{10^6 L_{10}}{60n} \dots\dots\dots (2)$$

where, L_h : Basic rating life in hours, h
 n : Number of revolutions per minute, rpm

Life in oscillating motion

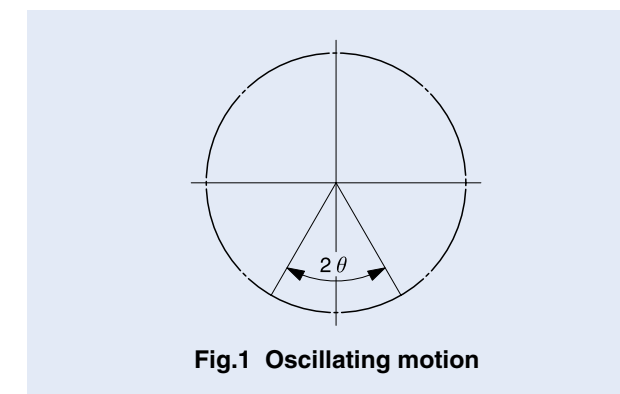
When a bearing is used in oscillating motion, the life can be obtained from the following formula.

$$L_{0c} = \frac{90}{\theta} \left(\frac{C}{P_r}\right)^{10/3} \dots\dots\dots (3)$$

where, L_{0c} : Basic rating life in oscillating motion 10^6 cycles
 2θ : Oscillating angle, degrees (Refer to Fig.1.)
 P_r : Dynamic equivalent radial load, N

If the number of oscillations per minute n_1 cpm is given, the rating life in hours can be obtained from Formula (2) by substituting n_1 for n .

When the oscillating angle 2θ is small, oil film may not be formed between the rolling elements and the raceways and fretting corrosion may occur. In this case, please consult IKO.



Limitations of life formulae

These life calculation formulae are applicable when the mounting and lubrication of bearing are normal and the bearing is used without intrusion of foreign matters under a normal operating condition and not under an extreme severe condition.

If these conditions are not satisfied, the actual life may decrease rapidly.

For example, it is necessary to consider the additional factors, such as deformation of bearing by miss-mounting, large deformation of housing/shaft, large preload and use of unsuitable grease.

Furthermore, when the dynamic equivalent radial load exceeds 1/2 of the basic dynamic load rating, the life calculation formulae may not be used.

Dynamic equivalent radial load

The dynamic equivalent radial load of IKO Super Slim and Slim Type Crossed Roller Bearings can be obtained from the following formula.

$$P_r = X \left(F_r + \frac{2M}{D_{pw}} \right) + Y F_a \dots\dots\dots (4)$$

where, P_r : Dynamic equivalent radial load, kgf
 F_r : Radial load, N
 F_a : Axial load, N
 M : Moment, N·mm
 D_{pw} : Pitch circle diameter, mm $\left(D_{pw} = \frac{d+D}{2} \right)$
 X : Radial load factor (Refer to Table 3.)
 Y : Axial load factor (Refer to Table 3.)

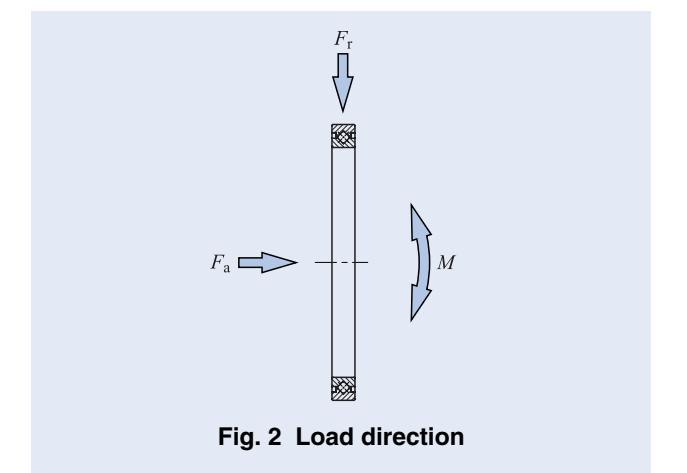


Table 3 Radial load factor and axial load factor

Conditions	X	Y
$\frac{F_a}{F_r + 2M/D_{pw}} \leq 1.5$	1	0.45
$\frac{F_a}{F_r + 2M/D_{pw}} > 1.5$	0.67	0.67

1N=0.102kgf=0.2248lbs.
 1mm=0.03937inch

Basic static load rating C_0

Basic static load rating is defined as a static load which gives a prescribed contact stress at the center of contact area between rolling elements and raceways on which the maximum load is applied.

Static safety factor

The static safety factor f_s , of IKO Super Slim and Slim Type Crossed Roller Bearings can be obtained from the following formula, and general values of this factor are shown in Table 4.

$$f_s = \frac{C_0}{P_{0r}} \quad \dots \dots \dots (5)$$

where, f_s : Static safety factor

C_0 : Basic static load rating, N

P_{0r} : Static equivalent radial load (maximum load), N

Table 4 Static safety factors

Operating conditions	f_s
When high rotating accuracy is required.	≥ 3
Normal operation	≥ 1.5
When smooth rotation is not important in normal operation Rotation without vibration When the bearing is almost not rotating	≥ 1

Accuracy

Dimensional accuracy and rotational accuracy of IKO Super Slim and Slim Type Crossed Roller Bearings are

Static equivalent radial load

The static equivalent radial load of IKO Super Slim and Slim Type Crossed Roller Bearings can be obtained from the following formula.

$$P_{0r} = F_r + \frac{2M}{D_{pw}} + 0.44F_a \quad \dots \dots \dots (6)$$

where, P_{0r} : Static equivalent radial load, N

F_r : Radial load, N

F_a : Axial load, N

M : Moment, N·mm

D_{pw} : Pitch circle diameter, mm ($D_{pw} = \frac{d+D}{2}$)

Load factor

Actual loads applied to the bearing sometimes exceed the load value theoretically calculated due to vibration and shocks caused by machine operation. The life is calculated from the following formula while considering the load factor shown in Table 5.

$$F = f_w F_c \quad \dots \dots \dots (7)$$

where, F : Load for life calculation, N

f_w : Load factor (See Table 5)

F_c : Theoretical calculated load, N

Table 5 Load factor

Condition	f_w
Smooth operation free from vibration and/or shocks	1 ~ 1.2
Normal operation	1.2 ~ 1.5
Operation with shock loads	1.5 ~ 3

shown in Tables 6.1 and 6.2. Bearings with special accuracy are also optionally available. Please consult IKO.

Table 6.1 Accuracy of inner ring and accuracy of outer ring width Super Slim Type Crossed Roller Bearings

unit: μm

d Nominal bore diameter mm	Δd_{mp} Single plane mean bore dia. deviation		ΔD_{mp} Single plane mean outside dia. deviation		ΔB_s and ΔC_s Deviation of a single inner ring width and outer ring width		K_{ia} and S_{ia} Radial and axial run-out of assembled bearing inner ring	K_{ea} and S_{ea} Radial and axial run-out of assembled bearing outer ring
	High	Low	High	Low	High	Low		
20	0	-10	0	-11	0	-75	13	20
30	0	-10	0	-11	0	-75	13	20
40	0	-12	0	-13	0	-75	15	25
50	0	-12	0	-13	0	-75	15	25

Table 6.2 Accuracy of inner ring and accuracy of outer ring width Slim Type Crossed Roller Bearings unit: μm

d Nominal bore diameter mm	Δd_{mp} Single plane mean bore dia. deviation		ΔD_{mp} Single plane mean outside dia. deviation		ΔB_s and ΔC_s Deviation of a single inner ring width and outer ring width		K_{ia} and S_{ia} Radial and axial run-out of assembled bearing inner ring	K_{ea} and S_{ea} Radial and axial run-out of assembled bearing outer ring
	High	Low	High	Low	High	Low		
50	0	-15	0	-13	0	-127	13	13
60	0	-15	0	-13	0	-127	13	13
70	0	-15	0	-15	0	-127	15	15
80	0	-20	0	-15	0	-127	15	15
90	0	-20	0	-15	0	-127	15	15
100	0	-20	0	-15	0	-127	15	15
110	0	-20	0	-20	0	-127	20	20
120	0	-25	0	-20	0	-127	20	20
130	0	-25	0	-25	0	-127	25	25
140	0	-25	0	-25	0	-127	25	25
150	0	-25	0	-25	0	-127	25	25
160	0	-25	0	-25	0	-127	25	25
170	0	-25	0	-30	0	-127	25	25
180	0	-30	0	-30	0	-127	30	30
190	0	-30	0	-30	0	-127	30	30
200	0	-30	0	-30	0	-127	30	30

Clearance

The radial internal clearances of IKO Super Slim and Slim Type Crossed Roller Bearings are shown in Table 7.1 and 7.2.

Table 7.1 Radial internal clearances for Super Slim Type Crossed Roller Bearing unit: μm

d Nominal bore diameter of bearing mm	Radial internal clearance					
	T1		C1		Standard	
	Min.	Max.	Min.	Max.	Min.	Max.
20	0	15				
30	0	15				
40	0	15				
50	0	15				

Table 7.2 Radial internal clearances for Slim Type Crossed Roller Bearing unit: μm

d Nominal bore diameter of bearing mm	Radial internal clearance					
	T1		C1		Standard	
	Min.	Max.	Min.	Max.	Min.	Max.
50	-8	0	0	15	30	56
60	-8	0	0	15	30	56
70	-8	0	0	15	30	56
80	-8	0	0	15	41	66
90	-8	0	0	15	41	66
100	-8	0	0	15	41	66
110	-8	0	0	15	41	66
120	-8	0	0	15	51	76
130	-8	0	0	15	51	76
140	-8	0	0	15	51	76
150	-8	0	0	15	51	76
160	-10	0	0	20	51	76
170	-10	0	0	20	51	76
180	-10	0	0	20	61	86
190	-10	0	0	20	61	86
200	-10	0	0	20	61	86

Fit

In IKO Super Slim Crossed Roller Bearing, fit based on the actual measured dimensions of the bearings is recommended. And those of Slim Type Crossed Roller Bearings with normal clearance are shown in Table 8. For the interference fit, the radial internal clearance after the fit is

decreased by approximately 70% to 90% of the interference amount. To avoid excessive preload due to fit, it is recommended to use a slight interference fit adjusted to the actual measured dimensions for both T1 and C1 clearances.

Table 8 Recommended fits for Slim Type Crossed Roller Bearings with C1 clearance (Dimensional tolerances of shaft and housing bore)

unit: μm

Nominal bore diameter mm	Inner ring rotational load				Outer ring rotational load			
	Shaft		Housing bore		Shaft		Housing bore	
	High	Low	High	Low	High	Low	High	Low
50	+15	0	+13	0	-15	-30	-13	-25
60	+15	0	+13	0	-15	-30	-13	-25
70	+15	0	+15	0	-15	-30	-15	-30
80	+20	0	+15	0	-20	-40	-15	-30
90	+20	0	+15	0	-20	-40	-15	-30
100	+20	0	+15	0	-20	-40	-15	-30
110	+20	0	+20	0	-20	-40	-20	-40
120	+25	0	+20	0	-25	-50	-20	-40
130	+25	0	+25	0	-25	-50	-25	-50
140	+25	0	+25	0	-25	-50	-25	-50
150	+25	0	+25	0	-25	-50	-25	-50
160	+25	0	+25	0	-25	-50	-25	-50
170	+25	0	+30	0	-25	-50	-30	-60
180	+30	0	+30	0	-30	-60	-30	-60
190	+30	0	+30	0	-30	-60	-30	-60
200	+30	0	+30	0	-30	-60	-30	-60

Remark: When complex loads or shock loads are applied or when high rotational accuracy and rigidity of the bearing are required, it is recommended to use a slight interference fit adjusted to the actual measured dimensions for both inner and outer rings.

Allowable rotational speed

Allowable rotational speeds of IKO Super Slim and Slim Type Crossed Roller Bearings are affected by mounting and operating conditions. The values in general operation are shown in Table 9.

Table 9 $d_m n$ values⁽¹⁾ of bearing

Type	Lubricant	Grease	Oil
		Caged or with separator	Open type: 75 000 Sealed type: 60 000
Full complement	Open type	50 000	75 000
	Sealed type	40 000	—

Note⁽¹⁾: $d_m n$ value = $d_m \times n$

where, d_m : Mean values of bearing bore and outside diameters, mm
 n : Number of rotations per minutes, rpm

Rotational torque

Rotational torque of IKO Super Slim and Slim Type Crossed Roller Bearings are lower than that of plain bearings and the difference between the static torque and the dynamic (kinetic) torque is small. Therefore, these bearings minimize power consumption and operating temperature rise of machinery and increase the overall efficiency of machines.

The rotational torque is affected by many factors, but the following formula can be used expediently.

$$T = \mu P_{0r} \frac{D_{pw}}{2}$$

where, T : Rotational torque, N · mm
 μ : Friction coefficient (Approx. 0.010)
 P_{0r} : Static equivalent radial load, N
 D_{pw} : Pitch circle diameter, mm ($D_{pw} \approx \frac{d+D}{2}$)

When the radial clearance after mounting is a large minus value, consult IKO.

Lubrication

These bearings are generally lubricated with grease. In re-lubrication, grease is supplied through the gap between the outer ring and inner ring.

For grease prepacked bearings, ALVANIA EP grease 2 (by Shell) is prepacked. (Refer Table 10) For bearings without prepacked grease, supply grease or oil for use. Operating without grease or oil will increase the wear of the rolling contact surfaces and cause a short bearing life.

When using special grease, carefully examine the grease properties and contents such as base oil viscosity and extreme pressure additives. In this case, please contact IKO.

Table 10 Grease prepacked bearings

○: Prepacked ×: Not prepacked

Model code	Specifications		
	Open type (No symbol)	Sealed type	One side sealed type
CRBT ...A	○	—	—
CRBS	×	—	—
CRBS ...A	—	○	×
CRBS ...V	×	○	×

Oil hole

For IKO Super Slim and Slim Type Crossed Roller Bearings, oil hole and oil groove are not provided. However, for Slim Type Crossed Roller Bearings, oil holes can be made upon request. When oil holes are required on the outer ring, attach “-nOH” before the clearance symbol in the identification number. For an oil hole on the inner ring, attach “/nOH”.

Table 11 Oil holes

Model code	Oil hole code	
	/nOH (Inner ring)	-nOH (Outer ring)
CRBT ...A	—	—
CRBS	○	○
CRBS ...A	○	○
CRBS ...V	○	○

Remark: “n” denotes the number of oil holes not exceeding 4. For one oil hole, number is not indicated. When preparing multiple oil holes, please consult IKO.

Example 1: In case of 4 oil holes on the inner ring

CRBS 1008 / 4OH C1
 ————
 4 oil holes
 For inner ring

Example 2: In case of 1 oil holes on the outer ring

CRBS 1008 — OH C1
 ————
 1 oil hole
 For outer ring

Operating temperature range

The operating temperature range for IKO Super Slim and Slim Type Crossed Roller Bearings is -20°C to $+110^{\circ}\text{C}$. However, the maximum allowable temperature should not be exceeded $+100^{\circ}\text{C}$ when they are in continuous operation.

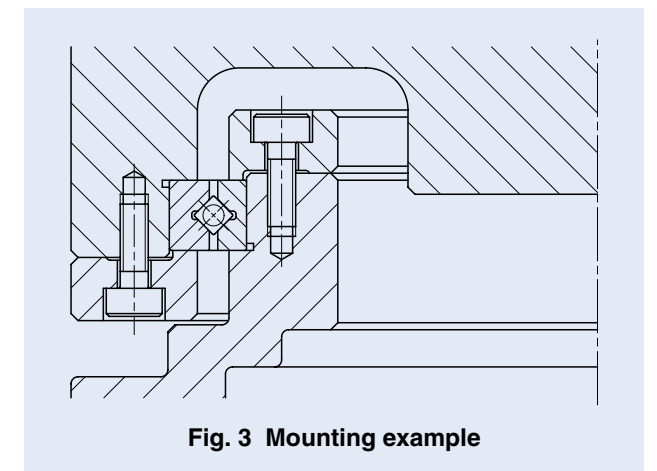
The operating temperature range for Open Type IKO Slim Type Crossed Roller Bearing is -20°C to $+120^{\circ}\text{C}$.

Mounting

When the rigidity of the mounting parts is not sufficient, stress concentration will occur at the contact area between the rollers and raceways, and the bearing performance will be deteriorated significantly.

Therefore, it is necessary to carefully examine the rigidity of housing and the strength of fixing bolts when a large moment is applied.

The shoulder height diameters (d_a and D_a) that are related to mounting should certainly satisfy the values shown in the dimension tables. When these dimensions are not appropriate, deformations of inner and outer rings will occur and the bearing performance will be deteriorated remarkably.



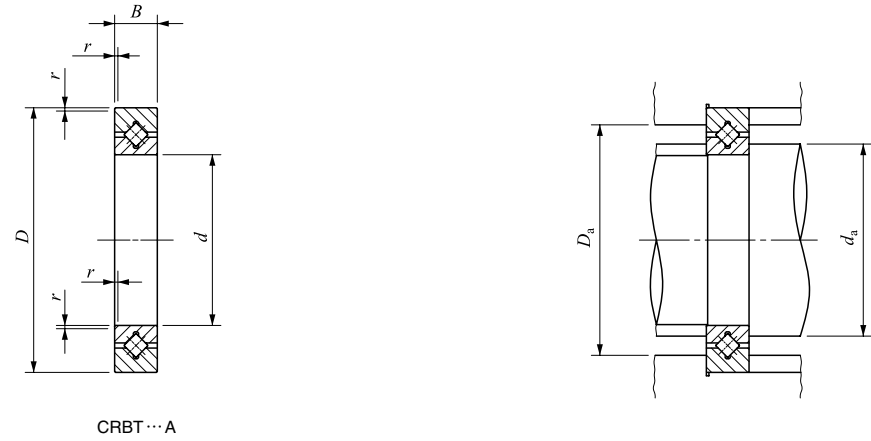
① The inner and outer rings should be securely fixed in the axial direction by using fixing plates, etc. Recommended thickness of the fixing plate is 1/2 or more of the bearing width (B). The dimensions in axial direction of the housing bore and the fixing plates should be decided to get a secure fixing while considering the actual dimension of bearing width which is zero/minus-tolerance. (See Fig.3)

② The depth of housing bore is recommended to be the same to or larger than the bearing width.

③ Bearing has a plug for hole for inserting cylindrical rollers. When mounting the bearings, located the plug at a position that is not included in the maximum loading zone. The plug location can be found by the pin that is at the side of the outer ring.

1N=0.102kgf=0.2248lbs.
 1mm=0.03937inch

IKO Super Slim Type Crossed Roller Bearings

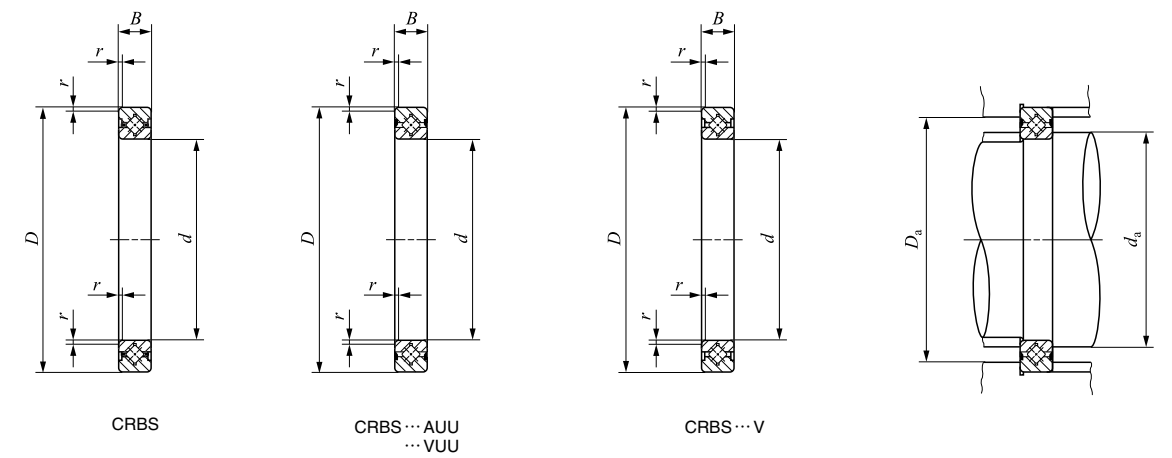


CRBT...A

Shaft diameter mm	Identification number	Weight (Ref.) g	Boundary dim. mm				Mounting dimensions mm		Basic dynamic load rating C N	Basic static load rating C ₀ N
			d	D	B	r ⁽¹⁾ r _{min}	d _a	D _a		
20	CRBT 205 A	14.8	20	31	5	0.15	22.5	27	1 400	1 290
30	CRBT 305 A	20.7	30	41	5	0.15	32.5	37	1 770	1 970
40	CRBT 405 A	26.5	40	51	5	0.15	42.5	47	2 000	2 520
50	CRBT 505 A	32.3	50	61	5	0.15	52.5	57	2 280	3 200

Note(1): Minimum allowable single value of chamfer *r*.
Remarks 1. Oil hole is not provided.
2. Grease is pre-packed.

IKO Slim Type Crossed Roller Bearings



CRBS

CRBS...AUU
...VUU

CRBS...V

Shaft diameter mm	Identification number ⁽¹⁾	Weight (Ref.) g	Boundary dim. mm				Mounting dimensions mm		CRBS ⁽³⁾ With cage		CRBS...AUU ⁽⁴⁾ With separator		CRBS...V ⁽³⁾ CRBS...VUU ⁽⁴⁾ Full complement	
			d	D	B	r ⁽²⁾ r _{min}	d _a	D _a	Basic dynamic load rating C N	Basic static load rating C ₀ N	Basic dynamic load rating C N	Basic static load rating C ₀ N	Basic dynamic load rating C N	Basic static load rating C ₀ N
50	CRBS 508	84	50	66	8	0.4	54	61	4 900	6 170	4 680	5 810	6 930	9 800
60	CRBS 608	94	60	76	8	0.4	64	71	5 350	7 310	5 350	7 310	7 600	11 700
70	CRBS 708	108	70	86	8	0.4	74	81	5 740	8 440	5 740	8 440	8 190	13 600
80	CRBS 808	122	80	96	8	0.4	84	91	6 130	9 590	6 130	9 590	8 790	15 500
90	CRBS 908	135	90	106	8	0.4	94	101	6 490	10 700	6 490	10 700	9 310	17 400
100	CRBS 1008	152	100	116	8	0.4	104	111	6 850	11 900	6 530	11 100	9 850	19 300
110	CRBS 1108	163	110	126	8	0.4	114	121	7 160	13 000	6 850	12 300	10 300	21 200
120	CRBS 1208	184	120	136	8	0.4	124	131	7 530	14 100	7 070	13 000	10 900	23 000
130	CRBS 1308	199	130	146	8	0.4	134	141	7 860	15 300	7 270	13 800	11 200	24 600
140	CRBS 1408	205	140	156	8	0.4	144	151	8 060	16 400	7 510	14 900	11 700	26 800
150	CRBS 1508	220	150	166	8	0.4	154	161	8 350	17 500	7 810	16 000	12 100	28 700
160	CRBS 16013	620	160	186	13	0.6	166	179	20 300	39 900	19 400	37 700	26 900	58 200
170	CRBS 17013	675	170	196	13	0.6	176	189	20 900	42 200	20 000	39 900	27 800	61 600
180	CRBS 18013	710	180	206	13	0.6	186	199	21 500	44 600	21 900	45 700	28 600	65 200
190	CRBS 19013	740	190	216	13	0.6	196	209	22 100	46 900	22 900	49 200	29 300	68 600
200	CRBS 20013	780	200	226	13	0.6	206	219	22 500	49 300	23 300	51 600	30 000	72 200

Note(1): Only representative models are shown in the table. However also applicable to same size of all Slim Type Crossed Roller Bearings.

(2): Minimum allowable single value of chamfer *r*.

(3): Grease is not pre-packed. Apply proper lubrication.

(4): Grease is prepacked.

Remarks: Oil hole is not provided.

Environment-friendly **IKEO** C-Lube Bearings Minimizing Lubricant Requirement



What is your trouble?

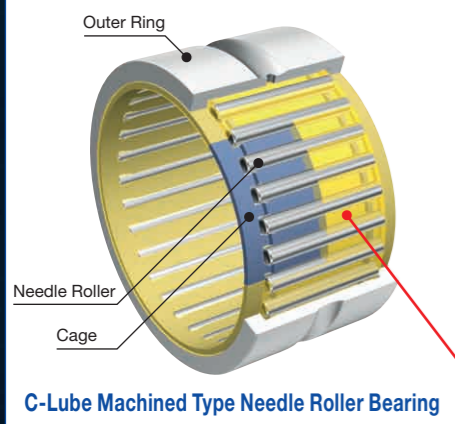
- 1 *Hard access to lubricating?*
- 2 *Machines and work places are dirty with lubricant?*
- 3 *Lubricating tools and instruments occupy the working places?*
- 4 *Having problems keeping up with lubrication maintenance schedule?*

Find solutions with **IKEO**

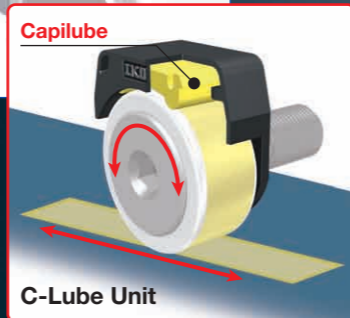
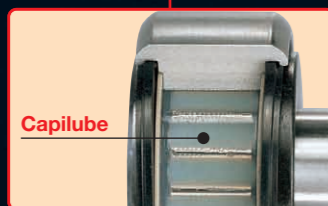
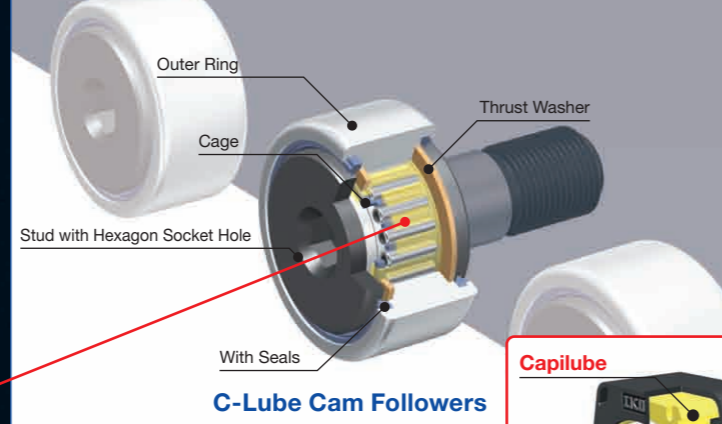
"C-Lube bearings" are **IKEO**'s unique maintenance free bearing products with thermosetting solid lubricant (Capilube) pre-packed in the bearing space. As the bearing rotates, the lubricating oil oozes out onto needle rollers and raceways in proper quantity keeping the lubrication performance for a long period of time.



For shaft support



For cam mechanisms and follower bearings



IKEO Maintenance Free C-Lube Bearing CAT-57165

Maintenance work can be reduced greatly

Requires no periodical lubrication and increases the productivity.

Minimizes the amount of lubricant and contributes to the earth environment

Contributes to the earth environment and reduces the running cost.

Suppresses machine designing and device costs

Working spaces can be utilized.

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