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CCTY

Robotic Bearings And Bearing Units

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Company Profile

Transform the Future with CCTY

In the dynamic world of humanoid robotics, manufacturers need agile, reliable bearing solutions to enable fluid motion control. CCTY is the trusted partner they turn to.

Unmatched Expertise and Innovation

Since 1996, CCTY has been collaborating with original equipment manufacturers – creating application-specific solutions that set new industry standards.

Our state-of-the-art 190,000 sqm manufacturing facility integrates critical processes onsite, ensuring unparalleled quality control and rapid design response. This technology, combined with our team of skilled engineers, leverages the latest advancements in motion control to deliver innovative, high-quality solutions.

Global Reach, Local Expertise

With factories in Zhenjiang and Xuyi, China, and Hai Phong, Vietnam, CCTY offers global engineering support, sales, and warehousing through strategic branch offices in China, the United States, Germany, India, and Japan.

Choose CCTY - Your Ultimate Partner in Motion Control

Experience the CCTY difference and take your humanoid robotics to the next level.

Issued: Sep. 2025

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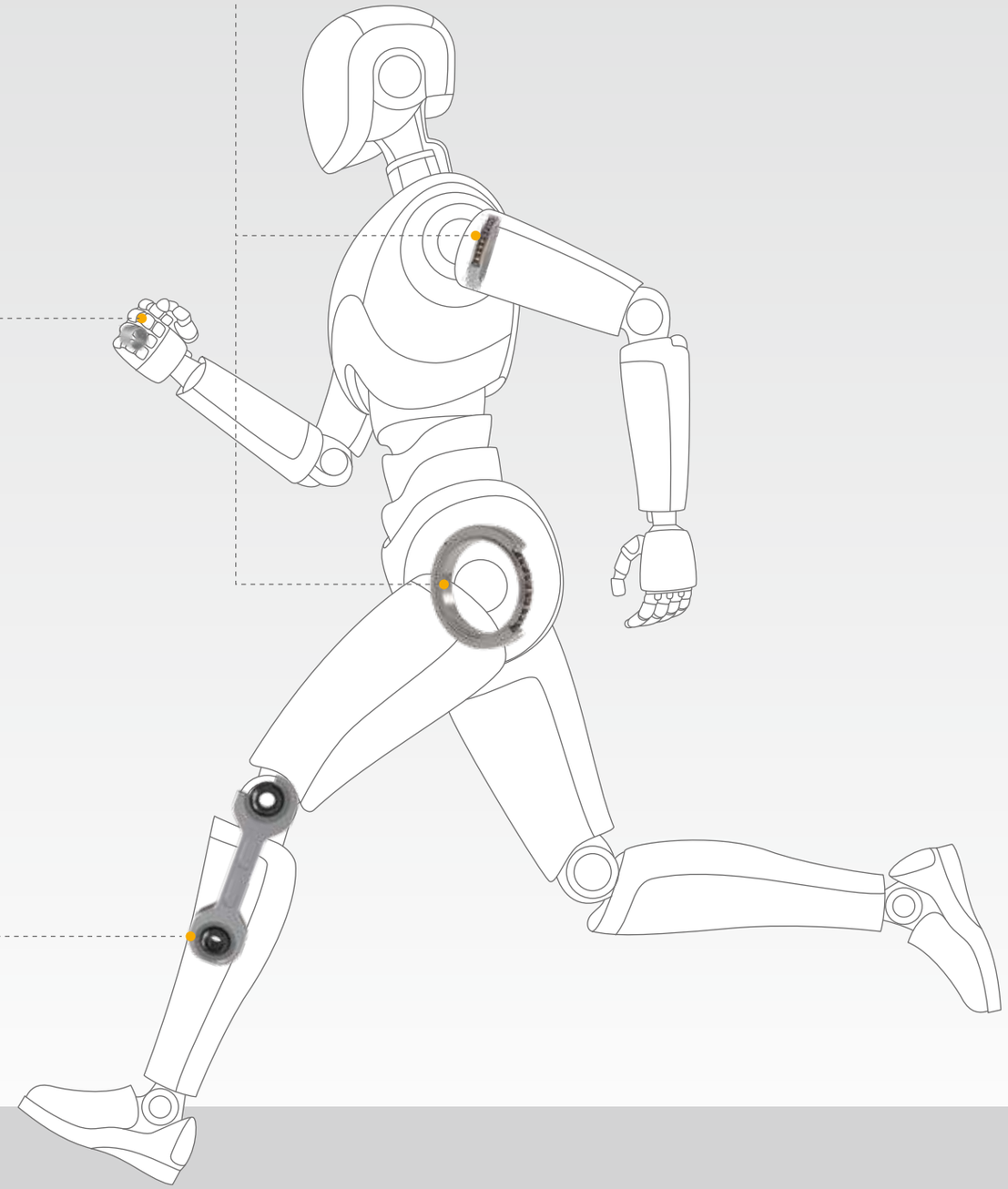


APPLICATION

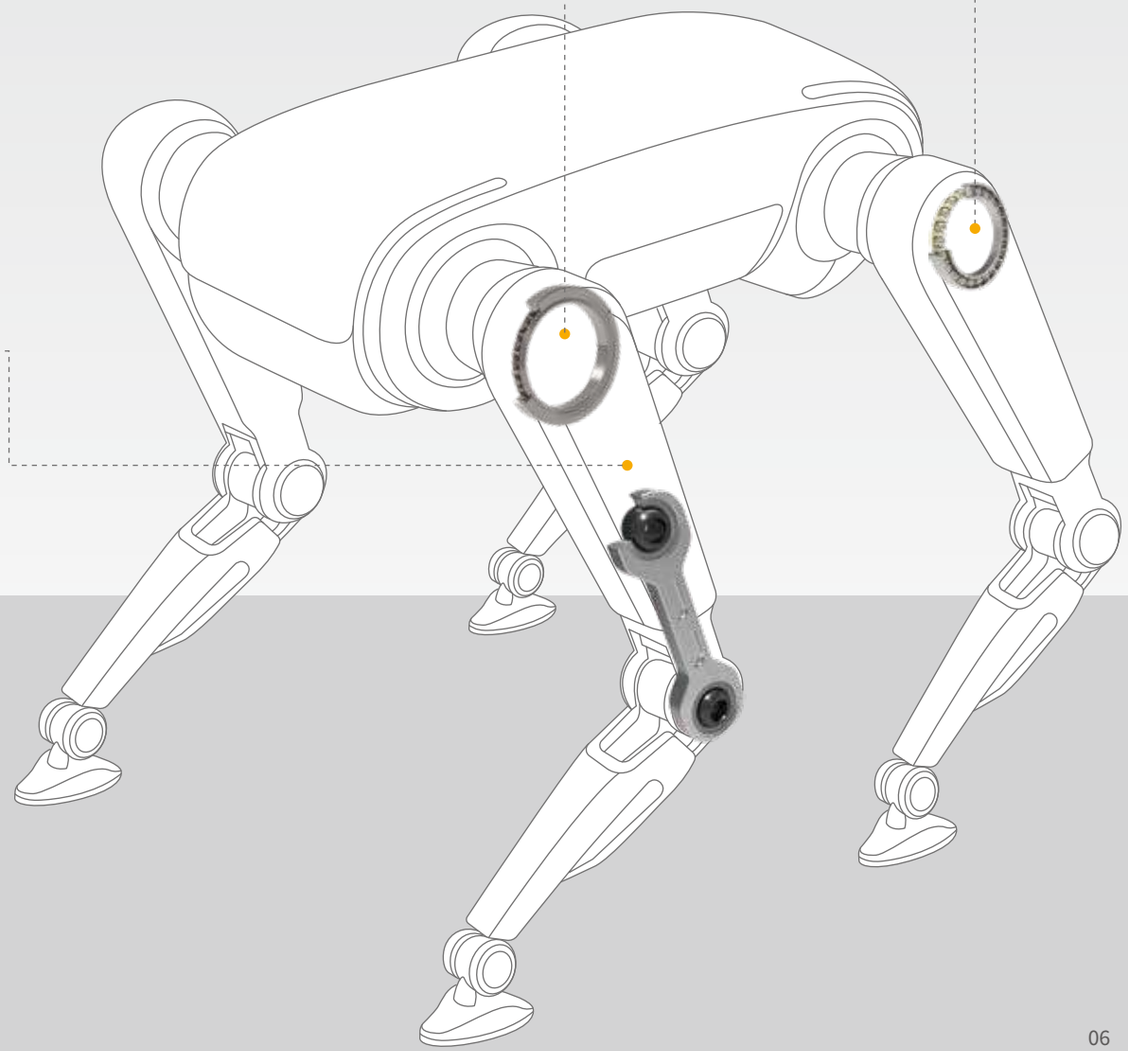
Rotary Actuator

Crossed Roller Bearings

Flexible Bearings

Linkage Assembly

Articulated Linkage Assembly



ENGINEERED FOR HUMANOID ACTUATOR EXCELLENCE

APPLICATION

Rotary Actuator

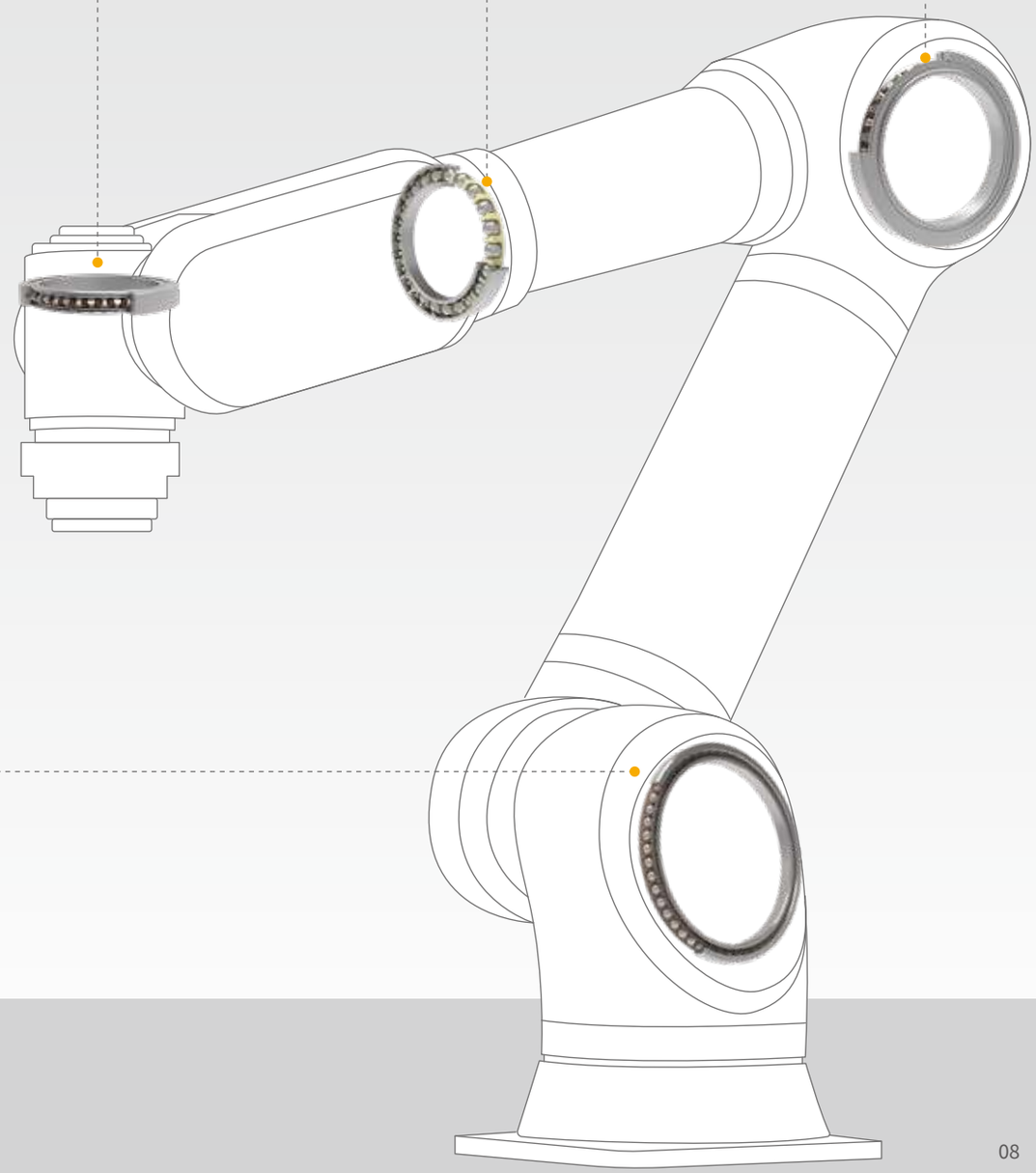
Crossed Roller Bearings

Flexible Bearings

Rotary Vector Reducer

Angular Contact Ball Bearing

Deep Groove Ball Bearing



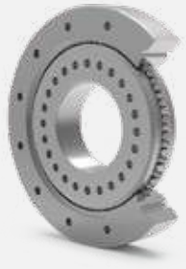
Product Index

CRAU

Crossed Roller Bearing

Thin-Wall
One-Piece Inner Ring
One-Piece Outer Ring

CRB



Crossed Roller Bearing

One-Piece Inner Ring
One-Piece Outer Ring
Inner & Outer Rings with Mounting Holes

CRBS

Crossed Roller Bearing

One-Piece Outer Ring
One-Piece Inner Ring, Stepped Bore
Inner & Outer Rings with Mounting Holes

CRBD

Crossed Roller Bearin

One-Piece Inner Ring
One-Piece Outer Ring
Inner & Outer Rings with Mounting Holes
Blind Hole in Inner Ring

CRBG

Crossed Roller Bearing

One-Piece Inner Ring
Outer Ring with Integral Step
Inner & Outer Rings with Mounting Holes

618

Deep Groove Ball Bearing

Thin-Wall
Primarily designed for radial loads,
with limited axial load capacity

619

Deep Groove Ball Bearing

Thin-Wall
Primarily designed for radial loads,
with limited axial load capacity
Higher load capacity than 618-series
bearings

RVB76

Angular Contact Ball Bearing

40° Contact Angle – Capable of Handling
Combined Axial and Radial Loads

Product Index

RVB718

Angular Contact Ball Bearing

Capable of Handling Combined Axial and Radial Loads

HDB

Flexible Bearing

Ultra-Thin-Wall
Micro-Deformation Accommodating
Complex Alternating Stress Resistant

GEC..UK

Radial Spherical Plain Bearing

Maintenance-Free
Outer Ring Formed by Cold Forging
Friction Pair: Steel/PTFE Fabric

GEC..UK V

Radial Spherical Plain Bearing

Maintenance-Free
Outer Ring Formed by Cold Forging、
End Face with V-Groove
Friction Pair: Steel/PTFE Fabric

GEC..FW

Radial Spherical Plain Bearing

Maintenance-Free
Outer Ring Formed by Cold Forging
Friction Pair: Steel/PTFE Fabric
Heavy-Duty

GEC..FW V

Radial Spherical Plain Bearing

Maintenance-Free
Outer Ring Formed by Cold Forging、
End Face with V-Groove
Friction Pair: Steel/PTFE Fabric
Heavy-Duty

GEC..BK

Radial Spherical Plain Bearing

Maintenance-Free
Outer Ring Formed by Cold Forging
Friction Pair: Steel/PTFE Composite

GECH..BK

Radial Spherical Plain Bearing

Maintenance-Free
Outer Ring Formed by Cold Forging
Friction Pair: Steel/PTFE Composite
Heavy-Duty

Product Index

GE..ES

Radial Spherical Plain Bearing

metric, requires maintenance,
ISO 12240-1, dimension series E,
sliding contact surface steel/steel

GE..ES 2RS

Radial Spherical Plain Bearing

Radial spherical plain bearing,
metric, requires maintenance,
ISO 12240-1, dimension series E,
sliding contact surface steel/steel,
lip seals on both sides

GE..FO

Radial Spherical Plain Bearing

metric, requires maintenance,
ISO 12240-1, dimension series G,
sliding contact surface steel/steel,
extended inner ring, heavy duty

GE..FO 2RS

Radial Spherical Plain Bearing

metric, requires maintenance,
ISO 12240-1, dimension series G,
sliding contact surface steel/steel,
extended inner ring, heavy duty,
lip seals on both sides

TSA

**PTFE Composite /
Metallic Plain Bushing**

metric, maintenance-free,
ISO 3547,
bushing with steel backing,
sliding layer TSA

CROSSED ROLLER BEARINGS

CROSSED ROLLER BEARINGS

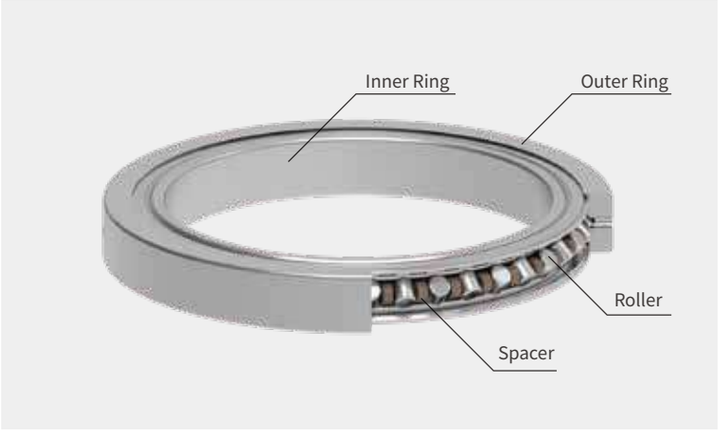
Crossed Roller Bearings

Structure and Features

Structure of Crossed Roller Bearings

Crossed roller bearings typically consist of an outer ring, inner ring, rollers, and spacers. Spacers separate the rollers, effectively preventing mutual friction between rollers and reducing rotational torque. Within the crossed roller bearing, the rollers are alternately arranged at 90 ° angles to each other, enabling the bearing to simultaneously withstand loads from different directions such as axial loads, radial loads, and moment loads. A full complement roller structure can be chosen for heavy loads.

Figure 01



Features of Crossed Roller Bearings

- High Load Capacity
- Compact Structure
- High Rigidity
- Capable of handling radial, axial, and moment loads
- Small Clearance or Negative Clearance
- Optional Sealing

Crossed Roller Bearing Types

CRAU-Thin Wall

The CRAU bearing types feature a thin-wall or ultra-thin-wall design. The inner and outer rings have no mounting holes and require flanges and support housing for installation. Suitable for applications where space is limited.

CRAU

Figure 02

CRB-High Rigidity

CRB bearings generally have mounting holes in both the inner ring and outer ring. They do not require flanges or support housing, enabling simple and quick installation. Installation has minimal impact on performance, ensuring stable rotational accuracy and rotational torque. Suitable for applications where high rigidity is required.

CRB

Figure 03

CRBS

Figure 04

CRBD

Figure 05

CRBG

Figure 06

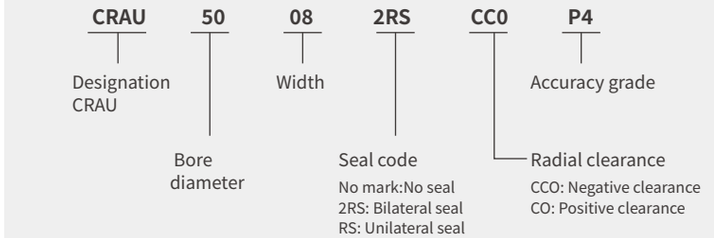
Custom CRB.

Bearings can be designed or modified according to customer requirements to achieve more innovative structures. Surface treatments can also be applied based on the customer's specific operating environment, offering greater flexibility to meet diverse customer needs.

Bearing Nomenclature

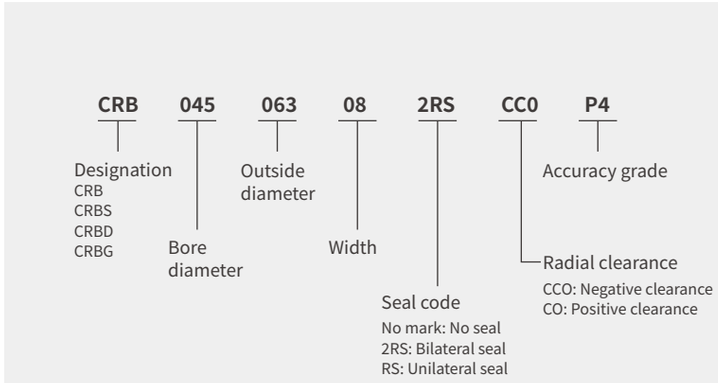
CRAU Bearing Composition

Figure 07



CRB Bearing Composition

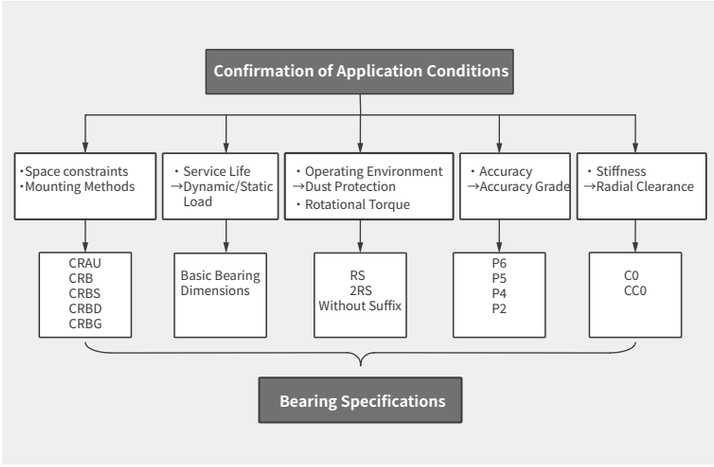
Figure 08



Selection of Crossed Roller Bearings

Figure 09

The diagram below illustrates the general sequence for selecting crossed roller bearings.



Basic Rating Life L_{10}

The basic rating life (L_{10}) can be calculated from the basic dynamic load rating (C_r) and the radial equivalent dynamic load (P_r) acting on the cross roller bearing, using the following formula.

$$L_{10} = \left(\frac{C_r}{P_r}\right)^{\frac{10}{3}}$$

The basic dynamic load rating C_r is the constant radial load under which a group of identical cross roller bearings can endure a rating life of 10^6 revolutions.

L_{10}	Basic Rating Life	(million revolutions)
C_r	Basic Dynamic Load Rating	(N)
P_r	Radial Equivalent Dynamic Load	(N)

Calculation of Modified Rating Life L_{10m}

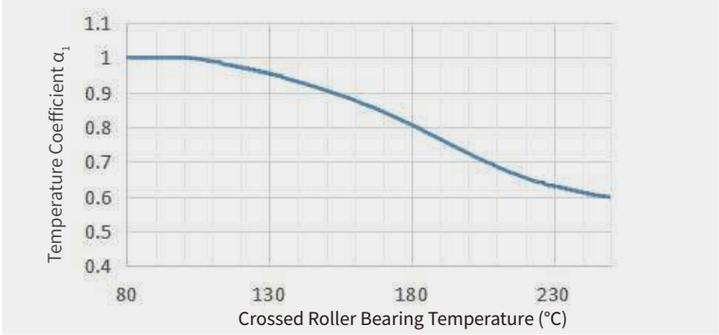
In practical use, loads acting on crossed roller bearings often fluctuate due to vibration and shock during operation, making them difficult to determine precisely. Additionally, the operating temperature significantly impacts life. Considering these conditions, the modified rating life (L_{10m}) can be calculated using the following formula.

$$L_{10m} = \alpha_1 \alpha_2 \left(\frac{C_r}{P_r}\right)^{\frac{10}{3}}$$

L_{10m}	Modified Rating Life	(million revolutions)
C_r	Basic Dynamic Load Rating	(N)
P_r	Radial Equivalent Dynamic Load	(N)
α_1	Temperature Coefficient	(Refer to Figure 10)
α_2	Load Factor	(Refer to Table 1)

Temperature Coefficient α_1 for Crossed Roller Bearings

Figure 10



Note: The product is typically used at temperatures below 80°C. For use in environments exceeding 80°C, please consult CCTY.

Load Factor α_2

Machinery performing rotational motion usually experiences vibration or impact, such as vibration from drive sources like motors and gears, or impact during frequent starts and stops. It is difficult to calculate this precisely. Therefore, when the influence of vibration or impact is significant, refer to the empirically derived load factor values a_2 in Table 01.

Table 01

Load Factor (a_2)

Operating Conditions	**α_2**
Smooth motion without impact	1
Operation with slight impact	0.67~0.83
Severe vibration / impact	0.33~0.67

Service Life Time

For rotational motion

$$L_{10h} = \frac{L_{10}}{n \cdot 60}$$

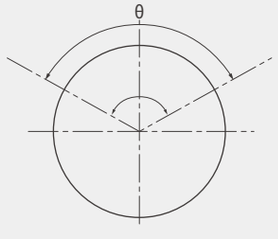
L_{10h}	Service Life Time	(h)
n	Rotational Speed	(r/min)

For oscillating motion

$$L_{10h} = \frac{}{2 \cdot \theta \cdot n_o \cdot 60}$$

L_{10h}	Service Life Time	(h)
θ	Oscillation Angle	(°)
n_o	Frequency of Oscillating Motion	(rev /min)

Figure 11



Radial Equivalent Dynamic Load P_r

The radial equivalent dynamic load for crossed roller bearings can be calculated using the following formula:

$$P_r = X \cdot (F_r + 2M / D_{pw}) + Y \cdot F_a$$

P_r	Radial Equivalent Dynamic Load	(N)
F_r	Radial Load on Bearing	(N)
F_a	Axial Load on Bearing	(N)
M	Moment	(N·mm)
X	Radial Load Factor	(Refer to Table 02)
Y	Axial Load Factor	(Refer to Table 02)
D_{pw}	Bearing Pitch Circle Diameter	(mm)

Figure 12

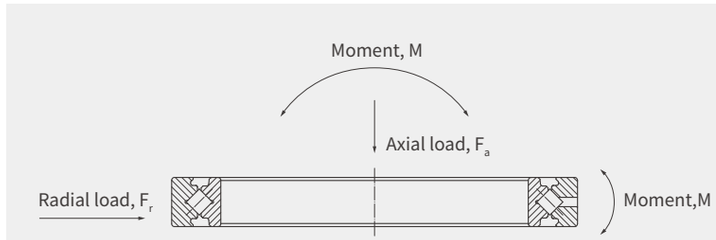


Table 02

Radial Load Factor and Axial Load Factor

Type	**X**	**Y**
$\frac{Fa}{F_r + 2M / D_{pw}} \leqslant 1.5$	1	0.45
$\frac{Fa}{F_r + 2M / D_{pw}} > 1.5$	0.67	0.67

Note: when F_r=0 N, M=0 N·mm, use X=0.67 and Y=0.67 for calculations.

Static Safety Factor

The basic static load rating, C_{or}, is defined as the static load with constant magnitude and direction that produces a calculated contact stress of 4000 MPa at the center of the contact area between the roller and raceway, under the most heavily loaded condition. lf this contact stress is exceeded, rotation may be affected. This value is denoted as C_{or} in the dimension tables. When loads areapplied, statically or dynamically, it is important to consider the static safety factoras described below.

$$S_0 = \frac{C_{or}}{P_{or}}$$

S_0	Static Safety Factor	(Refer to Table 03)
C_{or}	Basic Static Load Rating	(N)
P_{or}	Radial Equivalent Static Load	(N)

Table 03

Static Safety Factor (S_0)

Operating conditions	Minimum allowable value of S_0
Smooth operation, vibration-free, high rotational accuracy	3
Normal operation, vibration-free, standard rotational accuracy	1.5
Significant shock loads	3

Note:

1. For crossed roller bearings with surface-hardened raceways, the minimum recommended value for S_0 is 3 under all operating conditions.
2. The lower limit values for the static safety factor are as shown in the table above. If dynamic bearing life needs to be considered, it is recommended that S_0 be 7 or higher.

Radial Equivalent Static Load P_{or}

The radial equivalent static load for crossed roller bearings can be calculated using the following formula:

$$P_{or} = F_r + \frac{2M}{D_{pw}} + 0.44 \cdot F_a$$

P_{or}	Radial Equivalent Static Load	(N)
F_r	Radial Load on Bearing	(N)
F_a	Axial Load on Bearing	(N)
M	Moment	(N·mm)
D_{pw}	Bearing Pitch Circle Diameter	(mm)

Static Allowable Moment

The static allowable moment (M_0) for crossed roller bearings can be calculated using the following formula:

$$M_o = C_{or} \cdot \frac{D_{pw}}{2}$$

M_o	Static Allowable Moment	(N·m)
C_{or}	Basic Static Load Rating	(KN)
D_{pw}	Bearing Pitch Circle Diameter	(mm)

Static Allowable Axial Load

The static allowable axial load (F_{ao}) for crossed roller bearings can be calculated using the following formula:

$$F_{ao} = \frac{C_{or}}{0.44}$$

F_{ao}	Static Allowable Axial Load	(KN)
C_{or}	Basic Static Load Rating	(KN)

Product Accuracy Tables

Table 04

CRAU Inner Ring Rotation Accuracy Unit:μm

d (mm)		Inner Ring Radial Runout				Inner Ring Axial Runout			
>	≤	P0	P6	P5	P4	P0	P6	P5	P4
—	18	10	—	—	—	10	—	—	—
18	40	13	—	—	—	13	—	—	—
40	65	13	10	5	4	13	10	5	4
65	80	15	10	5	4	15	10	5	4
80	100	15	13	6	5	15	13	6	5
100	120	20	13	6	5	20	13	6	5
120	140	25	18	8	6	25	18	8	6
140	180	25	18	8	6	25	18	8	6
180	200	30	20	10	8	30	20	10	8

Note: The rotation accuracy for CRAU (ultra-thin type, width 5mm) is P0.

Table 05

CRAU Outer Ring Rotation Accuracy Unit:μm

D (mm)		Outer Ring Radial Runout				Outer Ring Axial Runout			
>	≤	P0	P6	P5	P4	P0	P6	P5	P4
—	65	13	—	—	—	13	—	—	—
65	80	13	10	8	5	13	10	8	5
80	100	15	13	10	6	15	13	10	6
100	120	15	13	10	6	15	13	10	6
120	140	20	15	11	7	20	15	11	7
140	180	25	15	11	7	25	15	11	7
180	200	25	20	15	10	25	20	15	10
200	250	30	20	15	10	30	20	15	10

Note: The rotation accuracy for CRAU (ultra-thin type, width 5mm) is P0.

Table 06

CRB Inner Ring Rotation Accuracy Unit:μm

Product Number	Inner Ring Radial Runout			Inner Ring Axial Runout		
	P5	P4	P2	P5	P4	P2
CRB02007012	4	3	2.5	4	3	2.5
CRB03509515	5	4	2.5	5	4	2.5
CRB05512015	5	4	2.5	5	4	2.5
CRB08016522	5	4	2.5	5	4	2.5
CRB09021025	6	5	2.5	6	5	2.5
CRB11524028	6	5	2.5	6	5	2.5
CRB16029535	8	6	5	8	6	5
CRB21038040	10	8	5	10	8	5
CRB35054045	15	12	7	15	12	7

Table 07

CRB Outer Ring Rotation Accuracy Unit:μm

Product Number	Outer Ring Radial Runout			Outer Ring Axial Runout		
	P5	P4	P2	P5	P4	P2
CRB02007012	8	5	4	8	5	4
CRB03509515	10	6	5	10	6	5
CRB05512015	10	6	5	10	6	5
CRB08016522	13	8	5	13	8	5
CRB09021025	15	10	7	15	10	7
CRB11524028	15	10	7	15	10	7
CRB16029535	18	11	7	18	11	7
CRB21038040	20	13	8	20	13	8
CRB35054045	25	16	10	25	16	10

Crossed Roller Bearing Radial Clearance

Table 08

Crossed Roller Bearing Radial Clearance Unit:μm

Dpw (mm)		CC0		C0	
>	⩽	min.	max.	min.	max.
—	18	—	—	0	15
18	30	—	—	0	15
30	50	—	—	0	15
50	80	-8	0	0	15
80	120	-8	0	0	15
120	140	-8	0	0	15
140	160	-8	0	0	15
160	180	-10	0	0	20
180	200	-10	0	0	20
200	225	-10	0	0	20

Note: CRAU (ultra-thin type, width 5mm) applies only to C0 clearance.

Installation of Crossed Roller Bearings

Installation steps

Install crossed roller bearings according to the following steps:

1. Pre-Installation Check:
Wipe the bearing support housing, spindle, or other mounting components to remove oil, dirt, and debris.

2. Inserting the Bearing:
For bearing installations, keep the bearing level and press only over the outer ring into the support housing or press only over the inner ring onto the shaft using even pressure. Confirm that the bearing is fully seated against the reference surace.
For interference fit designs, heating (bearing temperature not exceeding 80°C) or cooling can be used to expand or shrink components for easier assembly.
Caution: Control the applied force when tapping the bearing; excessive force may cause damage.

3. Mounting the Flange:
Place the flange onto the bearing, align the bolt holes, and insert the bolts. Tighten the bolts in sequence: first，lightly insert all bolts, then tighten them gradually in a diagonal pattern. Do not fully tighten any single bolt at once.

Further Information

Lubrication

1. Crossed roller bearings are pre-lubricated with grease upon receipt and can be used directly. Insufficient lubrication will increase friction resistance and reduce service life. Open-type bearings require regular grease replenishment, approximately every 1-6 months. The frequency depends on specific operating conditions.

2. When replenishing, use the same type of grease, ensure it is evenly distributed throughout the bearing's internal components, and avoid mixing different types of grease.

3. If the bearing is used in special environments such as high vibration, clean rooms, vacuum, high temperature, or low temperature, standard greases may not be suitable. Special lubricating greases may be required; consult CCTY.

Safety Notices for Operation

1. The normal operating temperature range for bearings is -20°C to 80°C. If used outside this range, consult CCTY.

2. Foreign contaminants entering the bearing interior can damage rollers and raceways, potentially causing bearing failure.

3. If foreign contaminants enter the bearing interior, clean the bearing and replenish with fresh grease.

4. In applications with small oscillating movements, it is difficult to form an oil film between the raceway and roller contact surfaces, which may cause fretting wear. It is recommended to periodically rotate the crossed roller bearing several full turns to help form an oil film on these contact surfaces.

Design Methods for Support Housings and Mounting Flanges

Because crossed roller bearings feature a thin-wall and compact structure, the rigidity of the support housing or mounting flange must be carefully considered.

Support Housing

The wall thickness of the support housing should be greater than 60% of the cross-section height of the crossed roller bearing.

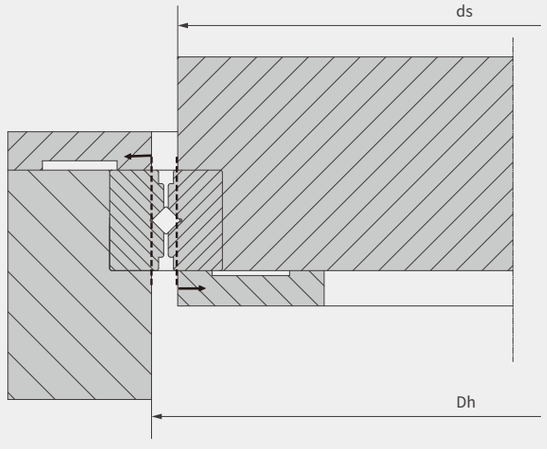
$$T = \frac{D-d}{2} \times 0.6$$

T	The wall thinckness of the support housing	(mm)
D	Outer Ring Outer Diameter	(mm)
d	Inner Ring Bore Diameter	(mm)

Shaft Shoulder Design

During design, the shaft shoulder dimension(ds) should be offset inwards relative to the rolling contact surface. Similarly, the shoulder dimension(Dh) of the support housing should be offset outwards relative to the rolling contact surface. If the shoulder dimension is too close to the rolling contact surface it may cause poor rotation.

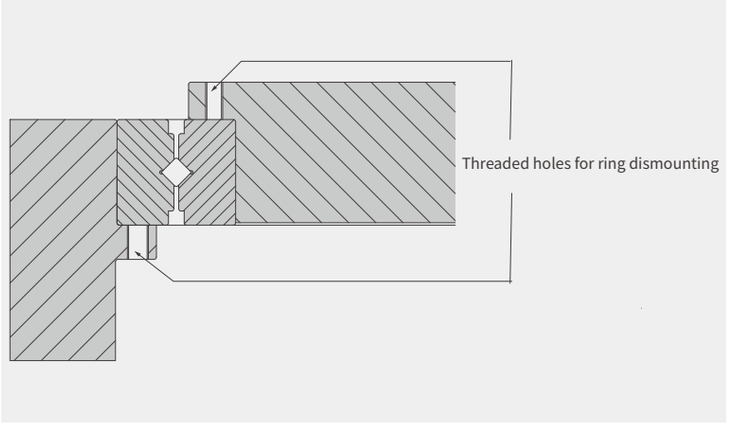
Figure 13



Threaded Holes for Ring Removal

Threaded holes for removing the inner and outer rings prevent damage to the crossed roller bearing during disassembly. Do not press against the inner ring when removing the outer ring, or against the outer ring when removing the inner ring.

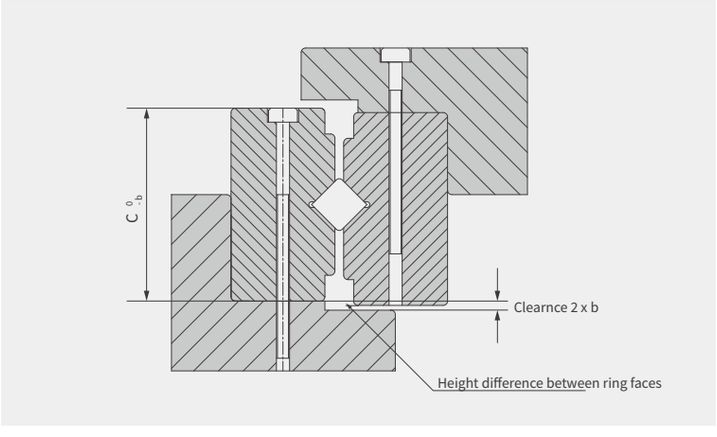
Figure 14



Height Difference Between Rings

Due to the height difference between the inner and outer rings of crossed roller bearings, the support housing must provide clearance. The clearance should generally be ⩾ 0.24mm.

Figure 15

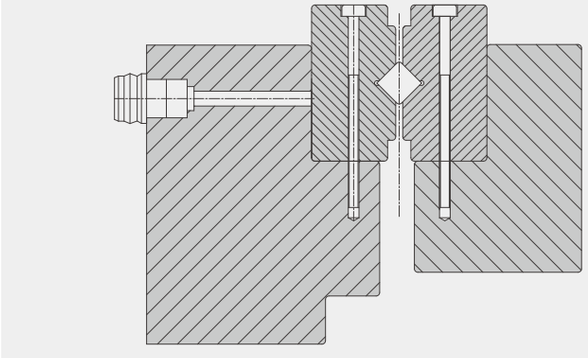


Installation Examples

Due to the thin-walled compact design of crossed roller bearings, sufficient rigidity of supporting seats and mounting flanges must be ensured.

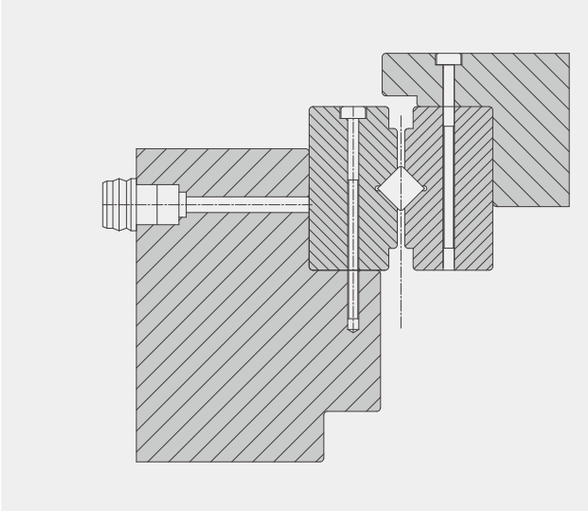
CRB Type Installation Example 1

Figure 16



CRB Type Installation Example 2

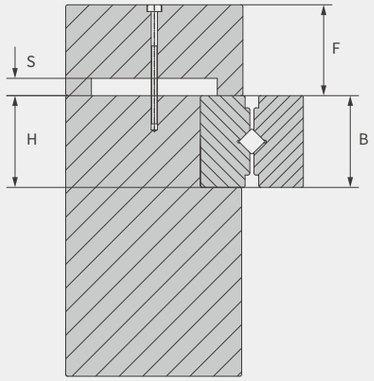
Figure 17



Mounting Flange and Mounting Bolts

Use the following dimensions as a reference for the mounting flange wall thickness(F) and the flange clearance(S).

Figure 18



$$F = B \cdot 0.5 \sim B \cdot 1.2$$
$$H = B^{0}_{-0.1}$$
$$S = 0.5$$

F	The wall thickness of the mounting flange	(mm)
B	The width of the inner ring	(mm)
H	The height of the bearing housing	(mm)
S	The flange clearance	(mm)

For oplimal perommance, it is recommended to use sleel for the mounting flange malerial, even when the shaft or support housing is made from a light alloy. For CRB installations, utilize the mounting or threaded holes in the inner ring and outer ring. Usind a torque wrench, ensure bolts are tightened to the specified torque.

The recommended tightening torque values for bolts used with support housings or mounting flanges made of standard medium-hardness sleel are listed in the table below.

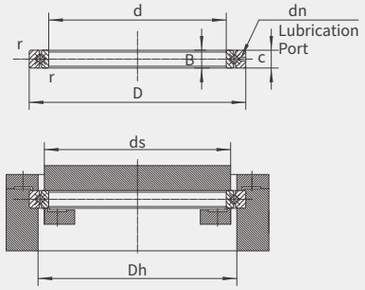
Table 09

Bolt Tightening Torque — **Unit: N•m**

Nominal designation of Bolt	Tightening Torque	Nominal designation of Bolt	Tightening Torque
M2	0.6	M8	30
M2.5	1	M10	70
M3	2	M12	120
M4	4	M16	200
M5	9	M20	390
M6	14	M22	530

CRAU

Ultra Thin-Section
5mm Width



CRAU

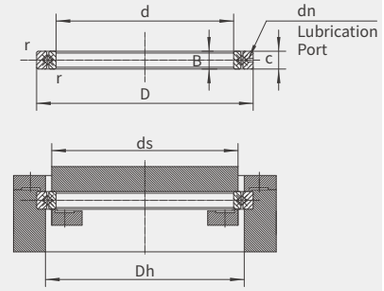
Dimension Table • Unit : mm

Product Number	Dimensions						Shoulder Dimensions		Basic load ratings		Mass
	d	D	D_{PW} 1)	C (B)	dn	r	ds (max)	Dh (min)	dyn. c_r kN	stat. c_{0r} kN	g
CRAU 1005	10	21	14.7	5	1	0.15	12.5	17	1.12	0.81	9
CRAU 1505	15	26	19.7	5	1	0.15	17.5	22	1.32	1.10	12
CRAU 2005	20	31	24.7	5	1	0.15	22.5	27	1.49	1.40	15
CRAU 3005	30	41	34.7	5	1	0.15	32.5	37	1.89	2.14	21
CRAU 4005	40	51	44.7	5	1	0.15	42.5	47	2.14	2.74	27
CRAU 5005	50	61	54.7	5	1	0.15	52.5	57	2.43	3.49	32
CRAU 6005	60	71	64.7	5	1	0.15	62.5	67	2.63	4.09	38
CRAU 7005	70	81	74.7	5	1	0.15	72..5	77	2.81	4.68	44
CRAU 8005	80	91	84.7	5	1	0.15	82.5	87	3.05	5.43	50
CRAU 9005	90	101	94.7	5	1	0.15	92.5	97	3.19	6.03	56
CRAU 10005	100	111	104.7	5	1	0.15	102.5	107	3.37	6.63	61

1) Bearing pitch circle diameter.

CRAU

Thin-Section
8mm and 13mm Width



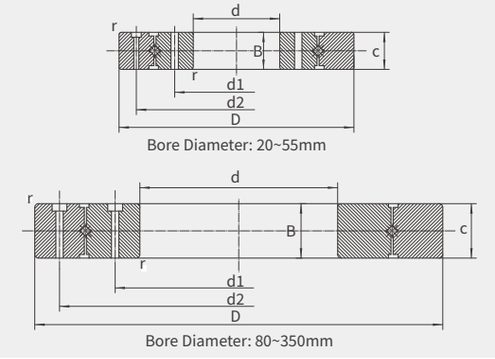
CRAU

Dimension Table • Unit : mm

Product Number	Dimensions						Shoulder Dimensions		Basic load ratings		Mass
	d	D	D_{PW} 1)	C (B)	dn	r	ds (max)	Dh (min)	dyn. c_r kN	stat. c_{0r} kN	g
CRAU 5008	50	66	57	8	1.5	0.5	53.5	60.5	5.1	7.19	0.08
CRAU 6008	60	76	67	8	1.5	0.5	63.5	70.5	5.68	8.68	0.09
CRAU 7008	70	86	77	8	1.5	0.5	73.5	80.5	5.98	9.8	0.10
CRAU 8008	80	96	87	8	1.5	0.5	83.5	90.5	6.37	11.3	0.11
CRAU 9008	90	106	97	8	1.5	0.5	93.5	100.5	6.76	12.4	0.12
CRAU 10008	100	116	107	8	1.5	0.5	103.5	110.5	7.15	13.9	0.14
CRAU 11008	110	126	117	8	1.5	0.5	113.5	120.5	7.45	15	0.15
CRAU 12008	120	136	127	8	1.5	0.5	123.5	130.5	7.84	16.5	0.17
CRAU 13008	130	146	137	8	1.5	0.5	133.5	140.5	7.94	17.6	0.18
CRAU 14008	140	156	147	8	1.5	0.5	143.5	150.5	8.33	19.1	0.19
CRAU 15008	150	166	157	8	1.5	0.5	153.5	160.5	8.82	20.6	0.20
CRAU 16013	160	186	172	13	2	0.8	165	179	23.3	44.9	0.59
CRAU 17013	170	196	182	13	2	0.8	175	189	23.5	46.5	0.64
CRAU 18013	180	206	192	13	2	0.8	185	199	24.5	49.8	0.68
CRAU 19013	190	216	202	13	2	0.8	195	209	24.9	51.5	0.69
CRAU 20013	200	226	212	13	2	0.8	205	219	25.8	54.7	0.71

1) Bearing pitch circle diameter.

CRB



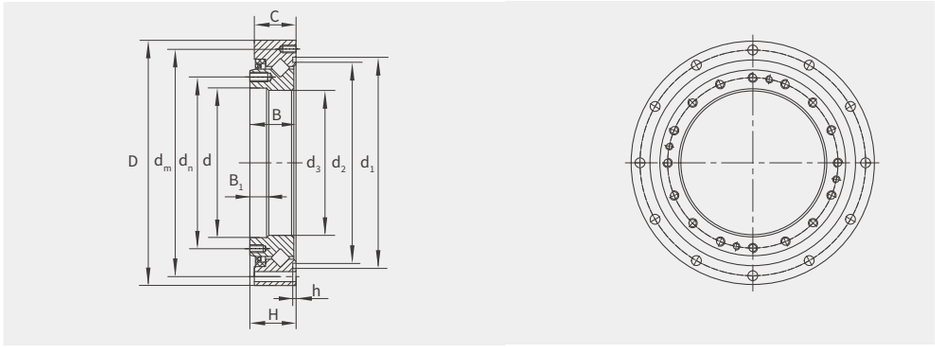
CRB

Dimension Table • Unit : mm

Product Number	Dimensions					Shoulder Dimensions		Basic load ratings		Mass	Mounting Hole Dimensions			
											Inner Ring		Outer Ring	
	d	D	D_{PW} [1]	C(B)	r	ds (max)	Dh (min)	dyn. c_r kN	stat. c_{0r} kN	kg	d1	Mounting Hole	d2	Mounting Hole
CRB 02007012	20	70	41.5	12	0.6	36	47	7.35	8.35	0.29	28	6-M3 THRU	57	6-3.4 THRU 6.5 Counterbore Depth 3.3
CRB 03509515	35	95	66	15	0.6	59	74	17.5	22.3	0.62	45	8-M4 THRU	83	8-4.5 THRU 8 Counterbore Depth 4.4
CRB 05512015	55	120	85	15	0.6	77	93	20.3	29.5	1	65	8-M5 THRU	105	8-5.5 THRU 9.5 Counterbore Depth 5.4
CRB 08016522	80	165	124	22	1.0	114	134	33.1	50.9	2.6	97	10-5.5 THRU 9.5 Counterbore Depth 5.4	148	10-5.5 THRU 9.5 Counterbore Depth 5.4
CRB 08016522 X1	80	165	124	22	1.0	114	134	33.1	50.9	2.6	97	10-M5 THRU	148	10-5.5 THRU 9.5 Counterbore Depth 5.4
CRB 09021025	90	210	147.5	25	1.5	133	162	49.1	76.8	4.9	112	12-9 THRU 14 Counterbore Depth 8.6	187	12-9 THRU 14 Counterbore Depth 8.6
CRB 09021025 X1	90	210	147.5	25	1.5	133	162	49.1	76.8	4.9	112	12-M8 THRU	187	12-9 THRU 14 Counterbore Depth 8.6
CRB 11524028	115	240	178	28	1.5	161	195	80.3	135	6.8	139	12-9 THRU 14 Counterbore Depth 8.6	217	12-9 THRU 14 Counterbore Depth 8.6
CRB 11524028 X1	115	240	178	28	1.5	161	195	80.3	135	6.8	139	12-M8 THRU	217	12-9 THRU 14 Counterbore Depth 8.6
CRB 16029535	160	295	227.5	35	2.0	208	246	104	173	11.4	184	12-11 THRU 17.5 Counterbore Depth 10.8	270	12-11 THRU 17.5 Counterbore Depth 10.8
CRB 16029535 X1	160	295	227.5	35	2.0	208	246	104	173	11.4	184	12-M10 THRU	270	12-11 THRU 17.5 Counterbore Depth 10.8
CRB 21038040	210	380	297.3	40	2.5	272	320	156	281	21.3	240	16-14 THRU 20 Counterbore Depth 13	350	16-14 THRU 20 Counterbore Depth 13
CRB 21038040 X1	210	380	297.3	40	2.5	272	320	156	281	21.3	240	16-M12 THRU	350	16-14 THRU 20 Counterbore Depth 13
CRB 35054045	350	540	445.4	45	2.5	417	473	222	473	35.4	385	24-14 THRU 20 Counterbore Depth 13	505	24-14 THRU 20 Counterbore Depth 13
CRB 35054045 X1	350	540	445.4	45	2.5	417	473	222	473	35.4	385	24-M12 THRU	505	24-14 THRU 20 Counterbore Depth 13

[1] Bearing pitch circle diameter.

CRBS



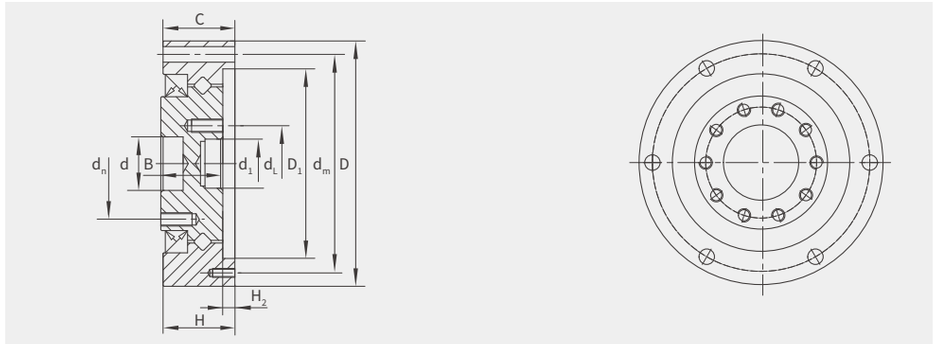
CRBS

Dimension Table • Unit : mm

Product Number	Dimensions										Mounting Hole Dimensions						Basic load ratings	
	d	d_3	D	H	C	B	B_1	d_1	d_2	h	Inner Ring			Outer Ring			dyn. C_r kN	stat. C_{0r} kN
											d_m	Mounting Hole		d_n	Mounting Hole			
CRBS 03807014	38	36	70	15.1	14.1	14.6	5	57	53	1.2	64	8-ϕ3.5 THRU	2-M3 Thread Depth 8	44	12-M3 Thread Depth 6		5.80	8.60
CRBS 04708016	47	44.1	80	17	16	16.4	6.5	68.1	64.1	1.2	74	12-ϕ3.5 THRU	4-M3 Thread Depth 8	54	20-M3 Thread Depth 6		10.4	16.3
CRBS 05409018	54	_	90	18.5	17.5	17.5	_	78	72.6	1.6	84	12-ϕ3.5 THRU	4-M3 Thread Depth-6	62	16-M3 Thread Depth 6	4-M3 Thread Depth-6	14.6	22.0
CRBS 06711019	67	65	110	20.7	18.7	19.7	7.5	94.8	90	1.45	102	12-ϕ4.5 THRU	4-M3 Thread Depth-6	77	16-M4 Thread Depth 8	4-M3 Thread Depth-6	21.8	35.8
CRBS 08814223	88	84	142	24.4	23.4	23.4	8	123	117.6	1.6	132	12-ϕ5.5 THRU	4-M4 Thread Depth 8	100	16-M5 Thread Depth 8	4-M4 Thread Depth 8	38.2	65.4
CRBS 10817029	108	106	170	30	29	28.5	9.5	148	142.6	1.55	158	12-ϕ6.6 THRU	6-M4 Thread Depth 9	122	16-M6 Thread Depth 10	4-M5 Thread Depth 10	43.3	81.6
CRBS 12019032	120	118	190	33	32	34.5	10	170	164	1.55	180	18-ϕ6.6 THRU	6-M4 Thread Depth 8	140	12-M8 Thread Depth 10	4-M5 Thread Depth 8	77.6	135
CRBS 13521434	135	129	214	36	34	34.5	_	188	182.6	1.6	64	12-ϕ9.0 THRU	6-M5-Thread Depth12	154	16-M8 Thread Depth 12	8-M5 Thread Depth 10	81.6	149

Note: Please contact CCTY for custom dimension requirements.

CRBD



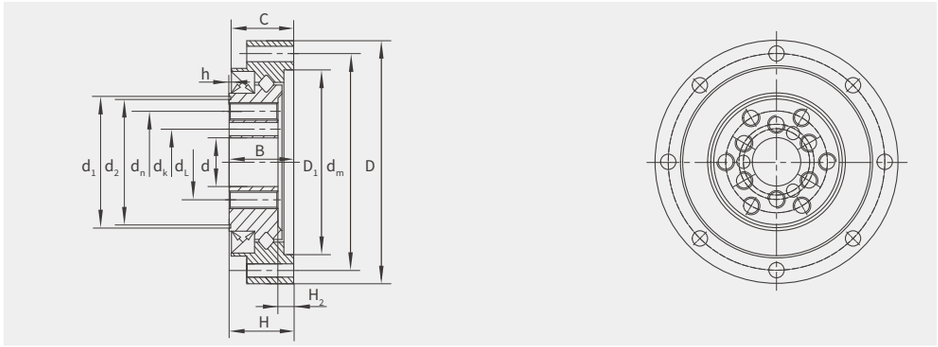
CRBD

Dimension Table • Unit : mm

Product Number	Dimensions								Mounting Hole Dimensions							Basic load ratings	
									Outer Ring			Inner Ring					
	d	d_1	D	H	C	B	H_2	D_1	d_m	Mounting Hole		d_n	Mounting Hole 1	d_1	Mounting Hole 2	dyn. C_r kN	stat. C_{0r} kN
CRBD 01205516	12	11	55	16.6	16.1	13.9	2.7	42.5	49	6-ϕ3.5 THRU	3-M2 Thread Depth 5	25	10-M3 Thread Depth 7	17	6-M3 Thread Depth 7	4.7	6.7
CRBD 01406216	14	11	62	16.6	16.1	13.9	2.7	49.7	56	10-ϕ3.5 THRU	5-M2 Thread Depth 5	27	8-M5 Thread Depth 8	19.5	8-M4 Thread Depth 8	5.3	7.5
CRBD 01807018	18	16	70	18.3	17.8	15.6	2.7	57	64	12-ϕ3.5 THRU	4-M2 Thread Depth 5	34	8-M6 Thread Depth 9	24	8-M4 Thread Depth 8	5.8	9
CRBD 02408523	24	20	85	23.4	22.9	20	3.4	73	79	18-ϕ3.5 THRU	6-M2 Thread Depth 5	42	8-M8 Thread Depth 12	30	8-M5 Thread Depth 9	9.6	15.1
CRBD 03211224	32	30	112	24.5	23.5	20.9	3.6	95.3	104	18-ϕ3.5 THRU	6-M3 Thread Depth 7	57	10-M8 Thread Depth 12	41	6-M6 Thread Depth 11	15	25
CRBD 03612628	36	32	126	29.1	28.1	24.6	4.5	109.6	117.5	18-ϕ3.5 THRU	6-M3 Thread Depth 10	72	10-M10 Thread Depth 15	48	6-M8 Thread Depth 11	21.3	36.5
CRBD 04815733	48	44	157	34	33	29.4	4.6	138	147	22-ϕ3.5 THRU	4-M3 Thread Depth 10	88	10-M12 Thread Depth 18	62	6-M10 Thread Depth 18	34.8	60.2

Note: Please contact CCTY for custom dimension requirements.

CRBG



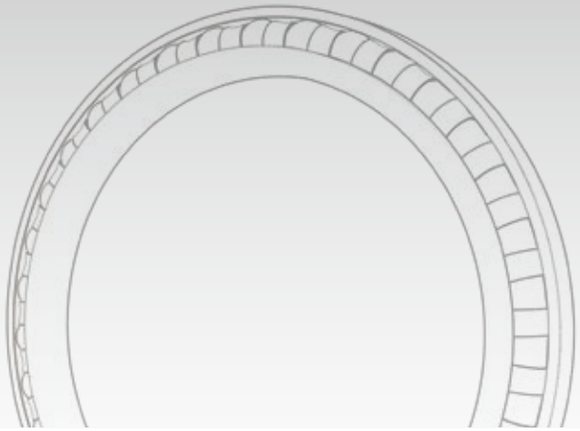
CRBG

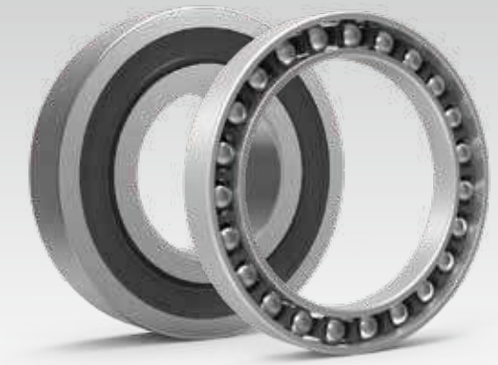
Dimension Table · Unit : mm

Product Number	Dimensions									Mounting Hole Dimensions								Basic load ratings	
										Outer Ring		Inner Ring							
	d	D	H	C	B	H_2	D_1	d_1	d_2	d_m	Mounting Hole	d_n	Mounting Hole 1	d_L	Mounting Hole 2	d_K	Dowel Hole	dyn. C_r kN	stat. C_{0r} kN
CRBG 01006216	10	62	16.5	16	13.5	4	49	36	33.8	56	10-ϕ3.5 THRU	27	6-M5 THRU	19	6-M5 THRU	15	3-ϕ3 THRU	5.3	7.5
CRBG 01105516	11	55	16.5	16	13.5	4	41.8	29.8	28.4	49	8-ϕ3.5 THRU	23	6-M4 THRU	17	6-M4 THRU	15	3-ϕ3 THRU	4.7	6.7
CRBG 011055016 X1	11	55	16.5	16	13.5	4	41.8	29.8	28.4	49	8-ϕ3.5 THRU	23	6-M4 THRU	17	6-M4 THRU	15	3-ϕ2.5 THRU	4.7	6.7
CRBG 01407016	14	70	16.5	16	13.5	4.5	56.5	42.8	40	64	12-ϕ3.5 THRU	32	8-M6 THRU	24	8-M5 THRU	19	4-ϕ3 THRU	5.8	9
CRBG 02008518	20	85	18.5	18	16.5	3.5	67	55.3	52.6	79	16-ϕ3.5 THRU	42	8-M8 THRU	30	8-M6 THRU	26	4-ϕ3 THRU	9.6	15.1
CRBG 02611222	26	112	22.5	21.5	19	4.5	90	74	68.6	104	16-ϕ4.5 THRU	55	8-M10 THRU	40	8-M8 THRU	34	4-ϕ5 THRU	15	25
CRBG 03212623	32	126	24	22.5	21.5	4.5	105	86	81.2	117	20-ϕ4.5 THRU	68	8-M10 THRU	50	8-M10 THRU	42	4-ϕ5 THRU	21.3	36.5
CRBG 03214726	32	147	27	26	23	6	121	103	97.6	137	16-ϕ5.5 THRU	82	8-M12 THRU	54	8-12 THRU	60	4-ϕ5 THRU	23	42.6
CRBG 04015730	40	157	31	30	28	5	131.6	108	102.6	147	16-ϕ5.5 THRU	84	8-M14 THRU	60	8-M14 THRU	50	4-ϕ5 THRU	34.8	60.2
CRBG 05221037	52	210	39	37	35	7	176	138	132.6	198	20-ϕ6.6 THRU	110	8-M16 THRU	80	8-M16 THRU	64	4-ϕ6 THRU	55.6	103

Note: Please contact CCTY for custom dimension requirements.

BALL BEARINGS





Ball Bearings

Bearing Types

Thin-Wall Deep Groove Ball Bearings

In robots, thin-wall deep groove ball bearings are primarily used in areas with strict space and weight constraints, such as robotic arm joints. They provide stable support in compact spaces, enable high-precision rotation, and enhance the robot's flexible movement.

Figure 19

Angular Contact Ball Bearings

Angular contact ball bearings are widely used in robots due to their unique contact angle design, which allows them to simultaneously handle radial and axial loads. In robotic joints, these bearings meet the stringent requirements for high precision and positioning accuracy.

Figure 20

Basic Rated Life

Basic Rated Life L_{10}

The basic rated life (L_{10}) can be calculated using the following formula:

$$L_{10} = \left(\frac{C_r}{P_r}\right)^3$$

L_{10}	Basic rated life	(million revolutions)
C_r	Basic dynamic radial load rating	(N)
P_r	Radial equivalent dynamic load	(N)

Equivalent Dynamic Load

Bearings typically experience combined radial and axial loads, which vary in magnitude. To compare these with the basic dynamic load rating, the equivalent dynamic load (P_r) is calculated as:

$$P_r = XF_r + YF_a$$

P_r	Radial equivalent dynamic load	(N)
F_r	Radial load	(N)
F_a	Axial load	(N)
X	Radial load coefficient	(refer to Table 10)
Y	Axial load coefficient	(refer to Table 10)

Table 10

Radial and Axial Load Coefficients for Radial Ball Bearings

"Relative Axial Load" [a,b]		Single-Row Bearing				e
$\frac{f_0F_a}{C_{0r}}$	$\frac{F_a}{iZD_w^2}$	$\frac{F_a}{F_r} \leqslant e$		$\frac{F_a}{F_r} > e$		
		X	Y	X	Y	
0.172	0.172	1	0	0.56	2.3	0.19
0.345	0.345	1	0	0.56	1.99	0.22
0.689	0.689	1	0	0.56	1.71	0.26
1.03	1.03	1	0	0.56	1.55	0.28
1.38	1.38	1	0	0.56	1.45	0.3
2.07	2.07	1	0	0.56	1.31	0.34
3.45	3.45	1	0	0.56	1.15	0.38
5.17	5.17	1	0	0.56	1.04	0.42
6.89	6.89	1	0	0.56	1	0.44

a. The permissible maximum value depends on bearing design (clearance and raceway depth). Either Column 1 or Column 2 values may be adopted based on known conditions.

b. For intermediate values of "relative axial load" and/or contact angle, the X, Y, and e factors may be determined by linear interpolation.

Bearing Accuracy

Rolling bearing tolerances include dimensional and rotational accuracy.
The tolerance grades are divided into five grades: Class 0, Class 6, Class 5, Class 4 and Class 2. For most applications, Class 0 is sufficient.

Table 11

Inner Ring Bore Diameter Tolerances **Unit:um**

d (mm)		Dimensional Tolerance of Mean Bore Diameter△dmp									
		P0		P6		P5		P4		P2	
>	⩽	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
10	18	0	-8	0	-7	0	-5	0	-4	0	-2.5
18	30	0	-10	0	-8	0	-6	0	-5	0	-2.5
30	50	0	-12	0	-10	0	-8	0	-6	0	-2.5
50	80	0	-15	0	-12	0	-9	0	-7	0	-4
80	120	0	-20	0	-15	0	-10	0	-8	0	-5
120	150	0	-25	0	-18	0	-13	0	-10	0	-7
150	180	0	-25	0	-18	0	-13	0	-10	0	-7
180	250	0	-30	0	-22	0	-15	0	-12	0	-8
250	315	0	-35	0	-25	0	-18	0	-15	—	—

Table 12

Inner Ring Width Tolerances **Unit:um**

d (mm)		Width Tolerance△Bs									
		P0		P6		P5		P4		P2	
>	⩽	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
10	18	0	-120	0	-120	0	-80	0	-80	0	-80
18	30	0	-120	0	-120	0	-120	0	-120	0	-120
30	50	0	-120	0	-120	0	-120	0	-120	0	-120
50	80	0	-150	0	-150	0	-150	0	-150	0	-150
80	120	0	-200	0	-200	0	-200	0	-200	0	-200
120	150	0	-250	0	-250	0	-250	0	-250	0	-250
150	180	0	-250	0	-250	0	-250	0	-250	0	-250
180	250	0	-300	0	-300	0	-300	0	-300	0	-300
250	315	0	-350	0	-350	0	-350	0	-350	—	—

Table 13

Rotational Accuracy of Inner Ring **Unit:um**

d (mm)		Kia					Sd			Sia				
>	≤	P0	P6	P5	P4	P2	P5	P4	P2	P0	P6	P5	P4	P2
10	18	10	7	4	2.5	1.5	7	3	1.5	—	—	7	3	1.5
18	30	13	8	4	3	2.5	8	4	1.5	—	—	8	4	2.5
30	50	15	10	5	4	2.5	8	4	1.5	—	—	8	4	2.5
50	80	20	10	5	4	2.5	8	5	1.5	—	—	8	5	2.5
80	120	25	13	6	5	2.5	9	5	2.5	—	—	9	5	2.5
120	150	30	18	8	6	2.5	10	6	2.5	—	—	10	7	2.5
150	180	30	18	8	6	5	10	6	4	—	—	10	7	5
180	250	40	20	10	8	5	11	7	5	—	—	13	8	5
250	315	50	25	13	10	—	13	8	—	—	—	15	9	—

Table 14

Outer Ring Outside Diameter Tolerances **Unit:um**

D (mm)		Dimensional Tolerance of Mean Outside Diameter△Dmp									
		P0		P6		P5		P4		P2	
>	≤	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
18	30	0	-9	0	-8	0	-6	0	-5	0	-4
30	50	0	-11	0	-9	0	-7	0	-6	0	-4
50	80	0	-13	0	-11	0	-9	0	-7	0	-4
80	120	0	-15	0	-13	0	-10	0	-8	0	-5
120	150	0	-18	0	-15	0	-11	0	-9	0	-5
150	180	0	-25	0	-18	0	-13	0	-10	0	-7
180	250	0	-30	0	-20	0	-15	0	-11	0	-8
250	315	0	-35	0	-25	0	-18	0	-13	0	-8
315	400	0	-40	0	-28	0	-20	0	-15	0	-10

Table 15

Outer Ring Rotational Accuracy and Width Tolerances **Unit:um**

D (mm)		Kea					SD			Sea					△Cs
		P0	P6	P5	P4	P2	P5	P4	P2	P0	P6	P5	P4	P2	P0、P6、P5、P4、P2
>	≤														
18	30	15	9	6	4	2.5	8	4	1.5	—	—	8	5	2.5	Determined by the limit deviation of △Bs corresponding to the bearing's bore diameter
30	50	20	10	7	5	2.5	8	4	1.5	—	—	8	5	2.5	
50	80	25	13	8	5	4	8	4	1.5	—	—	10	5	4	
80	120	35	18	10	6	5	9	5	2.5	—	—	11	6	5	
120	150	40	20	11	7	5	10	5	2.5	—	—	13	7	5	
150	180	45	23	13	8	5	10	5	2.5	—	—	14	8	5	
180	250	50	25	15	10	7	11	7	4	—	—	15	10	7	
250	315	60	30	18	11	7	13	8	5	—	—	18	10	7	
315	400	70	35	20	13	8	13	10	7	—	—	20	13	8	

Bearing Fits

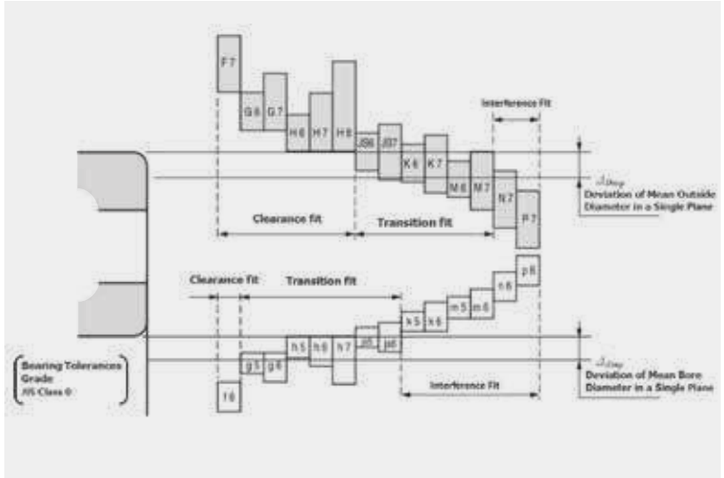
Purpose of Fits

The purpose of fit is to firmly secure the inner ring of the bearing to the shaft or the outer ring to the seat hole, so as to prevent creeping on the mating surfaces. This creeping can cause various problems such as abnormal heating, wear of mating surfaces, infiltration of worn iron powder into the bearing interior, and vibration, preventing the bearing from fully functioning. Therefore, for bearings, as they rotate under load, it is generally necessary to use an interference fit on the rotating ring to firmly fix it to the shaft or housing.

Dimensional tolerances and fits of the shaft and housing

The relationship between the dimensional tolerances of the shaft diameter, the diameter of the housing and the fit of the 0-grade tolerance bearing is shown in the figure.

Figure 21



Recommended Fits

Table 16

Shaft Tolerances for Inner Ring Fits

Bearing Grade	Inner ring rotational load or undirected load							Static load on the inner ring		
	The common tolerance grade of the shaft									
P0、P6	r6	p6	n6	m 6 m 5	k6 k5	js6 js5	h5	h6 h5	g6 g5	f6
P5	/	/	/	m 5	k4	js4	h4	h5	/	/
Fit	Interference fit					Transition fit				Clearance fit

Table 17

Housing Tolerances for Outer Ring Fits

Bearing grade	Static load on the outer ring				Load with variable direction or rotating outer ring load				
	The common tolerance grade of housing								
P0、P6	G7	H7 H6	JS7 JS6	/	JS7 JS6	K7 K6	M7 M6	N7 N6	P7
P5	/	H5	JS5	K5	/	K5	M5	/	/
Fit	Interference fit		Transition fit						Clearance fit

Bearing Clearance

Selection of Clearance

The internal clearance of a bearing refers to the amount of movement when one of the inner or outer rings is fixed while the other moves. The amount of movement during radial movement is called radial internal clearance, and the amount of movement during axial movement is called axial internal clearance. The size of the internal clearance (referred to as working clearance) during operation will affect the performance of the bearing, such as rolling fatigue life, heat generation, noise and vibration.

Figure 22

Radial Clearance

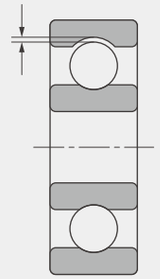
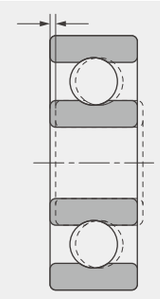


Figure 23

Axial Clearance



Theoretically, the clearance obtained by subtracting the dimensional change of bearing rings caused by interference fit during installation on shafts or in housing bores is defined as "mounted clearance". The clearance resulting from adding/subtracting dimensional variations due to internal temperature differences to/from the mounted clearance is referred to as "effective clearance".

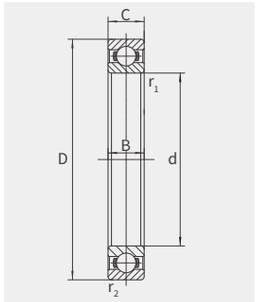
The internal clearance of mechanically installed bearings under load during rotation,-calculated by adding elastic deformation caused by bearing loads to the effective clearance, is termed "operating clearance". When the operating clearance is slightly negative, the bearing achieves maximum fatigue life. However, if the negative clearance becomes excessive, fatigue life decreases significantly. Therefore, it is generally recommended to select bearing internal clearances that maintain operating clearance slightly greater than zero.

Table 18

Radial Clearance for Ball Bearings **Unit:um**

d (mm)		Radial Internal Clearance of Ball Bearings									
		C2		CN		C3		C4		C5	
>	⩽	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	25	85	75	140	125	195	175	265
225	250	2	40	30	95	85	160	145	225	205	300
250	280	2	45	35	105	90	170	155	245	225	340
280	315	2	55	40	115	100	190	175	270	245	370

Thin-Wall Deep Groove Ball Bearings

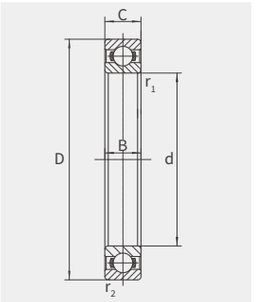


618

Dimension Table • Unit : mm

Product Number	Dimensions						Basic load ratings	
	d	D	B	C	r1 min.	r2 min.	Dyn. C_r kN	Stat. C_{0r} kN
61804	20	32	7	7	0.3	0.3	4.0	2.3
61805	25	37	7	7	0.3	0.3	4.4	2.6
61806	30	42	7	7	0.3	0.3	4.5	2.9
61807	35	47	7	7	0.3	0.3	4.4	3.4
61808	40	52	7	7	0.3	0.3	4.5	3.8
61809	45	58	7	7	0.3	0.3	6.6	6.1
61810	50	65	7	7	0.3	0.3	6.8	6.8
61811	55	72	9	9	0.3	0.3	9.0	8.8
61812	60	78	10	10	0.3	0.3	11.9	11.4
61813	65	85	10	10	0.6	0.6	12.4	12.7
61814	70	90	10	10	0.6	0.6	12.4	13.2
61815	75	95	10	10	0.6	0.6	12.7	14.3
61816	80	100	10	10	0.6	0.6	13.0	15.0
61817	85	110	13	13	1.0	1.0	19.5	20.8
61818	90	115	13	13	1.0	1.0	19.5	22.0
61819	95	120	13	13	1.0	1.0	19.9	22.8
61820	100	125	13	13	1.0	1.0	17.8	18.3
61822	110	140	16	16	1.0	1.0	28.1	26.0
61824	120	150	16	16	1.0	1.0	29.1	28.0
61826	130	165	18	18	1.1	1.1	37.7	43.0
61828	140	175	18	18	1.1	1.1	39.0	46.5
61830	150	190	20	20	1.1	1.1	48.8	61.0
61832	160	200	20	20	1.1	1.1	49.4	64.0
61834	170	215	22	22	1.1	1.1	61.8	78.0
61836	180	225	22	22	1.1	1.1	62.4	81.5
61838	190	240	24	24	1.5	1.5	76.1	98.0
61840	200	250	24	24	1.5	1.5	76.1	102

Thin-Wall Deep Groove Ball Bearings



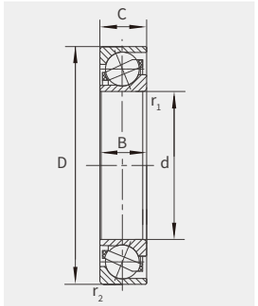
619

Dimension Table • Unit : mm

Product Number	Dimensions						Basic load ratings	
	d	D	B	C	r1 min.	r2 min.	Dyn. C_r kN	Stat. C_{0r} kN
61904	20	37	9	9	0.3	0.3	6.4	3.7
61905	25	42	9	9	0.3	0.3	7.0	4.3
61906	30	47	9	9	0.3	0.3	7.3	4.6
61907	35	55	10	10	0.6	0.6	10.8	7.8
61908	40	62	12	12	0.6	0.6	13.8	10.0
61909	45	68	12	12	0.6	0.6	14.0	10.8
61910	50	72	12	12	0.6	0.6	14.6	11.8
61911	55	80	13	13	1.0	1.0	16.5	14.0
61912	60	85	13	13	1.0	1.0	16.5	14.3
61913	65	90	13	13	1.0	1.0	17.4	16.0
61914	70	100	16	16	1.0	1.0	23.8	21.2
61915	75	105	16	16	1.0	1.0	24.2	22.4
61916	80	110	16	16	1.0	1.0	25.1	20.4
61917	85	120	18	18	1.1	1.1	31.9	30.0
61918	90	125	18	18	1.1	1.1	33.2	31.5
61919	95	130	18	18	1.1	1.1	33.8	33.5
61920	100	140	20	20	1.1	1.1	42.3	41.5
61922	110	150	20	20	1.1	1.1	43.6	45.0
61924	120	165	22	22	1.1	1.1	55.3	57.0
61926	130	180	24	24	1.5	1.5	65.0	67.0
61928	140	190	24	24	1.5	1.5	66.3	72.0
61930	150	210	28	28	2.0	2.0	88.4	93.0
61932	160	220	28	28	2.0	2.0	92.3	98.0
61934	170	230	28	28	2.0	2.0	93.6	106
61936	180	250	33	33	2.0	2.0	119	134
61938	190	260	33	33	2.0	2.0	117	134
61940	200	280	38	38	2.1	2.1	148	166

RV Bearing

Thin-Section Angular Contact Ball Bearings
Class P4



RVB 76

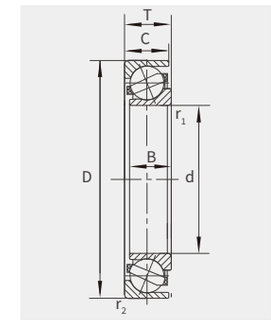
Dimension Table • Unit : mm

Product Number	Dimensions						Basic load ratings	
	d	D	B	C	r1 min.	r2 min.	Dyn. C_r kN	Stat. C_{0r} kN
RVB 76/50 P4	50	65	9	9	0.3	0.3	11.8	12.6
RVB 76/55 P4	55	70	9	9	0.3	0.3	13.2	15.4
RVB 76/60 P4	60	75	11	11	0.3	0.3	15.7	18.2
RVB 76/65 P4	65	80	11	11	0.3	0.3	17.4	20.3
RVB 76/70 P4	70	85	11	11	0.3	0.3	18.6	23.4
RVB 76/75 P4	75	95	13	13	0.6	0.6	23.1	29.3
RVB 76/100 P4	100	120	13	13	0.6	0.6	36.2	39.8
RVB 76/110 P4	110	130	13	13	0.6	0.6	40.4	48.6
RVB 76/120 P4	120	145	15	15	1.0	1.0	43.1	52.1
RVB 76/130 P4	130	155	15	15	1.0	1.0	45.3	57.2
RVB 76/140 P4	140	170	17	17	1.0	1.0	47.8	59.5
RVB 76/150 P4	150	180	17	17	1.0	1.0	49.2	63.4
RVB 76/160 P4	160	195	19	19	1.1	1.1	53	68.7
RVB 76/170 P4	170	205	19	19	1.1	1.1	59.6	74.8
RVB 76/180 P4	180	215	19	19	1.1	1.1	71.5	85.4
RVB 76/190 P4	190	225	19	19	1.1	1.1	79.2	102.8
RVB 76/200 P4	200	240	21	21	1.1	1.1	91.3	115.2
RVB 76/220 P4	220	260	21	21	1.1	1.1	106.2	132.6
RVB 76/230 P4	230	290	26	26	1.5	1.5	118.6	154.2
RVB 76/350 P4	350	400	26	26	1.5	1.5	220.5	246.7
RVB 76/400 P4	400	450	26	26	1.5	1.5	258.7	294.8
RVB 76/450 P4	450	500	26	26	1.5	1.5	291.3	352.5

Note: Please contact CCTY for custom dimension requirements.

RV Bearing

Thin-Section Angular Contact Ball Bearings
Class P4



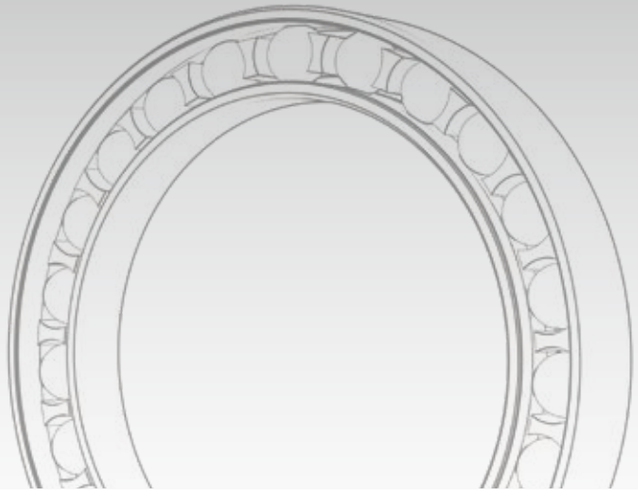
RVB 718

Dimension Table • Unit : mm

Product Number	Dimensions							Basic load ratings	
	d	D	B	C	T	r1 min.	r2 min.	Dyn. C_r kN	Stat. C_{0r} kN
RVB 718/89 P4	89	114	9	9	13	0.6	0.6	12.7	19.9
RVB 718/97 P4	97	120	13.5	10	13	1.0	1.0	20.2	24.3
RVB 718/115 P4	115	140	10.2	6.5	10	1.0	1.0	20.5	28.1
RVB 718/129 P4	129	153	14.3	11	14	1.1	1.1	26.8	36.8
RVB 718/130 P4	130	165	14.75	11	15	1.1	1.1	55.1	45.8
RVB 718/144 P4	144	174	15.1	12	15	1.1	1.1	38.5	51.6
RVB 718/159 P4	159	191	16.4	12.4	16	1.1	1.1	41.8	58.5
RVB 718/168 P4	168	205	19	15.5	20	1.1	1.1	57.8	77.8
RVB 718/182 P4	182	214	17.4	15	17	1.1	1.1	43.3	64.4
RVB 718/196 P4	196	233	21.7	15.1	21.5	1.1	1.1	50	76.2
RVB 718/208 P4	208	260	23.2	17.8	23	1.5	1.5	93.8	131
RVB 718/255 P4	255	310	27.7	20	27	2.0	2.0	107.8	164.4

Note: 0Please contact CCTY for custom dimension requirements.

FLEXIBLE BEARINGS

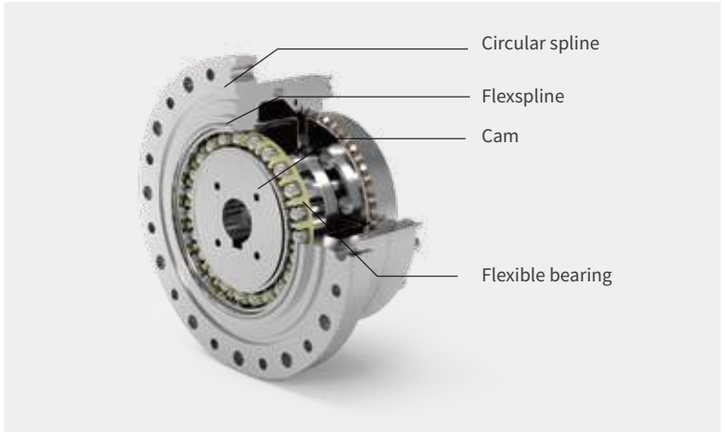


Flexible Bearings

Definition and Principle of Flexible Bearings

Flexible bearings utilize the controllable elastic deformation of flexible components to transmit motion and power. In operation, the inner ring of the flexible bearing is installed on an elliptical CAM, as shown in the following figure. During operation, it bears cyclic stress loads. The outer ring is installed on a flexspline. As the CAM rotates during operation, it generates the elastic deformation and drives the flexspline. Thus, the circular spline and flexspline continuously engage in differential meshing, achieving speed reduction. Flexible bearings not only withstand cyclic stress loads but also alternating stress loads.

Figure 24



Flexible Bearing Clearance

Radial clearance must comply with the following specifications:

Table 19

Radial clearance of flexible bearing **Unit : um**

d (mm)		Radial Clearance Gr	
>	⩽	min.	max.
10	18	11	25
18	24	13	28
24	30	13	28
30	40	15	33
40	50	18	36
50	65	23	43
65	80	25	51
80	100	30	58
100	120	36	66
120	140	41	81
140	160	46	91
160	180	53	102
180	200	63	117
200	220	75	140

Note: Please consult CCTY for special requirements.

Flexible Bearing Accuracy

Tolerances must meet the following specifications (see Tables 20–21).

Table 20

Inner Ring Tolerances — **Unit : um**

d (mm)		△dmp		Vdp	Vdmp	Kia	Sia	Sd	△Bs		VBs
>	≤	max.	min.	max.	max.	max.	max.	max.	max.	min.	max.
10	18	0	-5	7	3	2.5	3	3	0	-80	5
18	30	0	-6	8	3	3	4	4	0	-120	5
30	50	0	-8	10	4	4	4	4	0	-120	5
50	80	0	-9	12	5	4	5	5	0	-150	6
80	120	0	-10	14	5	5	5	5	0	-200	7
120	180	0	-13	18	7	6	7	6	0	-250	8
180	220	0	-15	21	8	8	8	7	0	-300	10

Note: Please consult CCTY for additional grade tolerance requirements.

Table 21

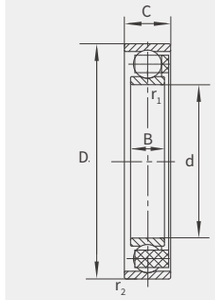
Outer Ring Tolerances — **Unit : um**

D (mm)		△Dmp		VDp	VDmp	Kea	Sea	SD	△Cs		VCs
>	≤	max.	min.	max.	max.	max.	max.	max.	max.	min.	max.
18	30	0	-6	8	3	4	5	4	Identical to △Bs of the corresponding bearing inner ring		5
30	50	0	-7	9	4	5	5	4			5
50	80	0	-9	11	5	5	5	4			6
80	120	0	-10	13	5	6	6	5			8
120	150	0	-11	15	6	7	7	5			8
150	180	0	-13	18	7	8	8	5			8
180	250	0	-15	20	8	10	10	7			10
250	300	0	-18	24	9	11	10	8			11

Note: Please consult CCTY for additional grade tolerance requirements.

Flexible Bearings

Ultra-Thin-Wall



HDB

Dimension Table • Unit : mm

Product Number	Dimensions						Basic load ratings	
	d	D	B	C	r1 min.	r2 min.	Dyn. C_r kN	Stat. C_{0r} kN
HDB 02503406	25.070	33.896	6.350	6.095	0.15	0.15	4.75	3.75
HDB 03004206	30.300	41.722	6.680	6.160	0.2	0.2	6.70	5.35
HDB 03604907	35.560	49.073	8.130	7.240	0.2	0.2	9.90	8.40
HDB 04506109	45.212	61.341	6.350	9.015	0.3	0.3	12.9	11.6
HDB 06008011	58.928	79.756	8.640	11.81	0.3	0.3	20.2	19.2

Note: Please contact CCTY for custom dimension requirements.

SPHERICAL PLAIN BEARING UNIT

SPHERICAL PLAIN BEARING UNIT

Spherical Plain Bearing Unit

Structure and Features of Spherical Plain Bearing Unit

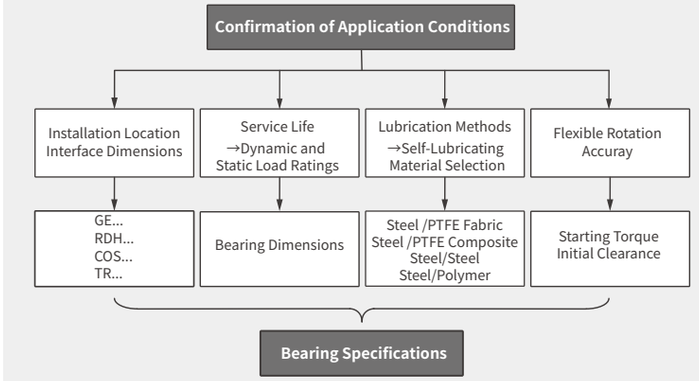
Customized solutions for robot-specific spherical plain bearings optimize key parameters such as load capacity, oscillation angle, friction torque, clearance, and lubrication methods, significantly enhancing motion accuracy, transmission efficiency, and adaptability. Customization ensures precise alignment with the specific operational requirements while achieving lightweight and compact component designs.

Joint bearing assemblies can be customized according to customer needs, combining bearing housings, links, and push rods into a complete joint link assembly (e.g., ankle joint link assembly, knee joint link assembly, etc.), simplifying procurement processes and reducing assembly time for customers.

Custom bearings can be integrated into complex robot assemblies, streamlining the assembly process and improving system reliability. This solution allows robot design engineers to focus on functionality without adjusting the overall design to accommodate standard bearings, thereby enhancing efficiency and system performance.

Selection of Spherical Plain Bearing Unit

Figure 25



Service Life

The initial lubrication life refers to the total number of oscillating cycles before the wear of a spherical plain bearing unit exceeds the specified limit.

$$L = \alpha_k \cdot \alpha_T \cdot \alpha_p \cdot \alpha_v \cdot \alpha_z \cdot (K_M C_r / P \cdot v)$$

L	the first-time lubrication life of spherical plain bearing	(r)
α_k	load feature factor	-
α_T	temperature factor	-
α_p	load factor	-
α_v	sliding speed factor	-
α_z	bearing quality and lubrication factor	-
K_M	factor related to friction couple material	-
C_r	dynamic rating load	-
P	equivalent load	(N)
v	sliding speed	(mm/s)

Note 1: For life calculations, please consult CCTY.
Note 2: CCTY's anti-friction optimization can reduce the coefficient of friction, extend bearing service life, and eliminate abnormal noise issues in self-lubricating spherical plain bearings in demanding applications.

Clearance and Torque of Spherical Plain Bearings

Clearance

Clearance (or internal clearance) is the total distance the inner ring can move radially or axially relative to the outer ring.

Radial vs. axial: In spherical plain bearings, radial clearance refers to the allowable movement between the inner and outer rings perpendicular to the inner ring axis, while axial clearance is the permitted motion along the inner ring axis. Though related, they are not in a fixed 1:1 ratio—axial clearance is typically several times larger than radial, due to the bearing's spherical geometry

Assembly clearance is the actual internal clearance present once the bearing is installed in the housing and on the shaft. It's calculated as the initial clearance minus the reduction caused by housing interference fits and inner ring expansion caused by the mating shaft.

Torque

Torque in spherical plain bearings refers to the starting or rotational frictional resistance that must be overcome to initiate or sustain movement across the spherical interface. Friction torque is affected by preload, clearance, material, lubrication, and speed.

Impact of Clearance and Torque on Robot Performance

Clearance Impact

Even small clearances cause motion transfer delays and imprecise positioning, leading to jerky movements, degrading the humanoid's fluid, human-like motion.Excess clearance can accelerate wear, introduce vibration/noise, and shorten component life.

Torque Impact

Excessive friction torque increases power consumption and may limit joint responsiveness.

Balancing Clearance and Torque for Optimal Performance

When engineering spherical plain bearings for humanoid robotics, the key to precise, smooth, and efficient joint performance lies in effectively balancing clearance and friction torque. Below are a few strategies:

·To optimize spherical plain bearings for humanoid robots, preloading is used to reduce clearance—even into slight negative territory—to eliminate backlash and boost stiffness, though this inevitably raises friction torque, which must be carefully controlled.

·Self-lubricating liners (e.g., PTFE composites) allow for simultaneously low clearance and low torque while also damping noise, provided their bonding quality and load limits are rigorously assessed.

·Achieving tight assembly tolerances in housings ensures that preload and clearance targets hold true under operating conditions, preventing ring binding and sudden torque spikes.

·Finally, collaborating with manufacturers allows customizing preload and clearance parameters , enabling smooth, precise, and energy-efficient motions.

Table 22

Radial Clearance of Spherical Plain Bearings **Unit : um**

d (mm)	Radial Clearance		
	Steel/Steel	Steel/PTFE Fabric	Steel/PTFE Composite
⩽6	5 - 20	⩽ 5	⩽ 5
＞6	5 - 20	⩽ 10	⩽ 10

Table 23

Torque of Spherical Plain Bearings **Unit : N·m**

d (mm)	Starting Torque		
	Steel/Steel	Steel/PTFE Fabric	Steel/PTFE Composite
⩽6	⩽ 0.05	⩽ 0.20	⩽ 0.20
＞6	⩽ 0.05	⩽ 0.30	⩽ 0.30

Note: The clearance and torque values provided apply to bearings in their free (uninstalled) state. Because shaft and housing dimensions can vary by customer installation, it is essential to assess the actual working clearance and torque after press-fitting.

Lubrication of Spherical Plain Bearings

Sliding Contact Surfaces

CCTY spherical plain bearings offer the following lubrication options:

- Steel/Steel (requires grease lubrication)
- Steel/PTFE Fabric
- Steel/PTFE Composite
- Steel/Polymer

Steel/Steel sliding contact surfaces are treated with surface coatings and solid lubricants at the factory. Subsequent periodic lubrication is required after the run-in period.

Rust Prevention - Neutral Salt Spray Test

Corrosion resistance is evaluated according to the neutral salt spray test standards: GB/T 10125-2012/ ISO 9227:2006

- Bearing steel materials (e.g., GCr15) with surface anti-rust oil treatment typically withstand corrosion for no more than 24 hours in salt spray test.
- Conventional stainless bearing steel usually resist corrosion for 24-48 hours, only meeting general rust prevention requirements.
- CCTY's special stainless steel offers exceptional corrosion resistance, enduring more than 480 hours under the same test conditions. It meets stringent rust prevention demands while maintaining excellent wear resistance and load capacity.

Oscillation Angle of Spherical Plain Bearings

Oscillation Angle for Optimal Performance

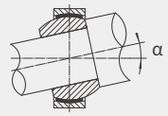
The oscillation angle of a bearing is a critical parameter in robot joint design, determining the joint's flexibility and range of motion. Different oscillation angle categoriessignificantly impact robot performance:

- For multi-degree-of-freedom joints (e.g., humanoid robot shoulders or hips), bearings with large oscillation angles enable a wider range of motion, enhancing flexibility and adaptability.
- For high-precision joints (e.g., robotic wrist or finger joints), bearings with small oscillation angles are more suitable for fine operations, ensuring high precision and stability.

Below are calculation methods for oscillation angles:

Standard Oscillation Angle

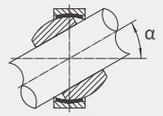
Figure 26



$$\alpha = \mathrm{Sin}^{-1}\frac{B}{d_m} - \mathrm{Sin}^{-1}\frac{H}{d_m}$$

Maximum Oscillation Angle

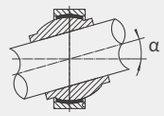
Figure 27



$$\alpha = \mathrm{Cos}^{-1}\frac{d}{d_m} - \mathrm{Sin}^{-1}\frac{H}{d_m}$$

Shouldered Bearing Oscillation Angle

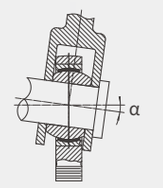
Figure 28



$$\alpha = \mathrm{Cos}^{-1}\frac{S}{d_m} - \mathrm{Sin}^{-1}\frac{H}{d_m}$$

Rod End Bearing Oscillation Angle

Figure 29



$$\alpha = \mathrm{Sin}^{-1}\frac{B}{D} - \mathrm{Sin}^{-1}\frac{H}{D}$$

α	Oscillation Angle	(°)
D	Sphere Diameter (Rod End Bearing)	(mm)
S	Shoulder Diameter (Radial Sphere)	(mm)
B	Sphere Head Width	(mm)
d	Bearing Inner Diameter	(mm)
d_m	Sphere Diameter	(mm)
H	Constraint Dimension	(mm)

Fits of Spherical Plain Bearings

The purpose of fitting is to secure the inner ring to the shaft or the outer ring to the housing to prevent relative movement between mating surfaces. For example, creeping may cause operational issues, including abnormal heat generation, wear on mating surfaces and vibration.

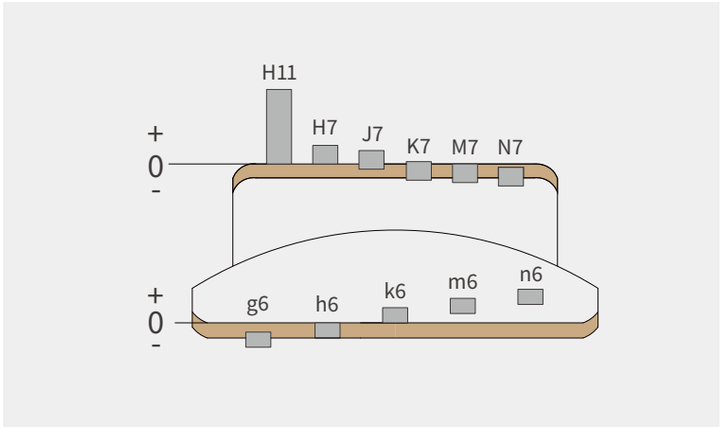
The selection of fits must thoroughly account for the bearing's application conditions. Consider the following factors when selecting fits:

Load Characteristics

- Load magnitude
- Temperature distribution during operation
- Internal bearing clearance
- Machining quality
- Materials and structure of the bearing shaft and housing
- Installation and disassembly methods

Recommended Fits

Figure 30



Recommended Shaft Fit

Table 24

Working conditions		Friction	
		Steel/Steel	Self-lubricating
Radial spherical plain bearing	All loads, interference fit	m6 (n6)	k6
	All loads, clearance or transition fit	h6 (hardened)	g6 (hardened)
Angular contact spherical plain bearing	All loads, interference fit	m6 (n6)	k6
Axial spherical plain bearing	All loads, interference fit	m6 (n6)	k6

Recommended Housing Fit

Table 25

Working conditions		Friction	
		Steel/Steel	Self-lubricating
Radial spherical plain bearing	Light loads, axial displacement required	H7	H7
	Heavy loads	M7 (N7)	K7
	Light alloy housings	N7	M7
Angular contact spherical plain bearing	All loads, interference fit	M7 (N7)	M7
	All loads, axial displacement required	J7	J7
Axial spherical plain bearing	Purely axial loads	H11	K11
	Combined loads	J7	J7

Shaft Tolerance

Table 26

Shaft diameter (mm)		△dmp (um)		Shaft tolerance (um)									
				g6		h6		k6		m6		n6	
>	≤	min.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
3	6	-8	0	-4	-12	0	-8	9	1	12	4	16	8
6	10	-8	0	-5	-14	0	-9	10	1	15	6	19	10
10	18	-8	0	-6	-17	0	-11	12	1	18	7	23	12
18	30	-10	0	-7	-20	0	-13	15	2	21	8	28	15
30	50	-12	0	-9	-25	0	-16	18	2	25	9	33	17

Housing Tolerance

Table 27

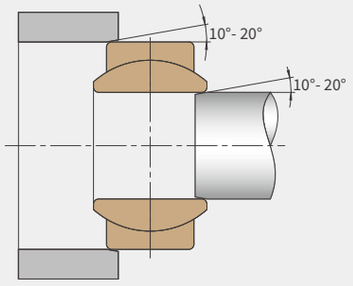
Housing diameter (mm)		△Dmp (um)		Housing tolerance (um)									
				H7		J7		K7		M7		N7	
>	≤	min.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
10	18	-8	0	18	0	10	-8	6	-12	0	-18	-5	-23
18	30	-9	0	21	0	12	-9	6	-15	0	-21	-7	-28
30	50	-11	0	25	0	14	-11	7	-18	0	-25	-8	-33

Installation of Spherical Plain Bearings

Proper bearing installation is critical to prevent bearing failure or housing damage. Before installation, inspect the shaft and housing for:

- Surface roughness below Ra1.6
- Accurate measurement of dimensions and geometric tolerances
- Leading chamfers (preferably 10-20°) as shown in Figure 31
- Removal of sharp edges and burrs
- Dry and clean surfaces free of water, moisture, and contaminants
- Concentricity between shaft and housing to prevent misalignment
- Ensure installation forse is perpendicular to the faces of inner ring and outer ring

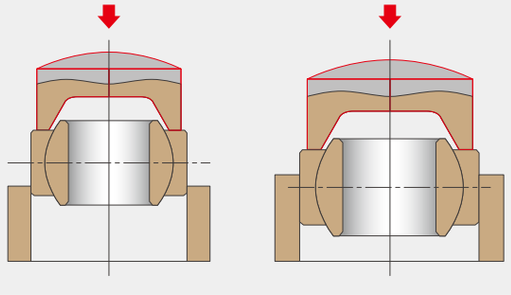
Figure 31



Correct Mechanical Installation Methods

- Use an auxiliany tool to contact the inner ring face when pressing the bearing onto the shaft.
- Use an auxiliary press plate to contact the outer ring face when pressing the bearing into the housing.
- Apply even hydraulic pressure to the auxiliary plate to axially press the bearing into the housing or shaft.

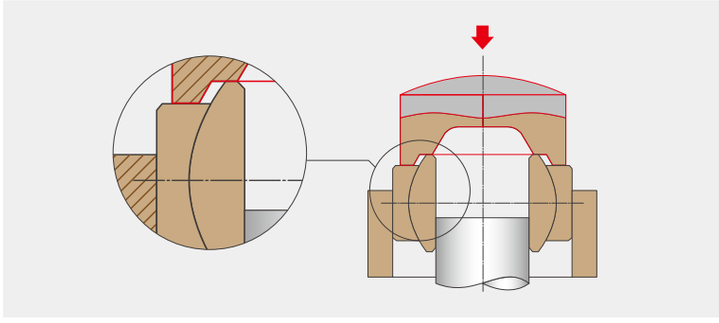
Figure 32



Simultaneous Installation of Housing and Shaft

- Align the inner ring with the shaft's leading chamfer to ensure concentricity and no misalignment.
- Use a stepped auxiliary press plate to contact both the bearing's inner and outer rings.
- Apply hydraulic pressure to the auxiliary plate to axially press the bearing into the housing.

Figure 33



Not Recommended

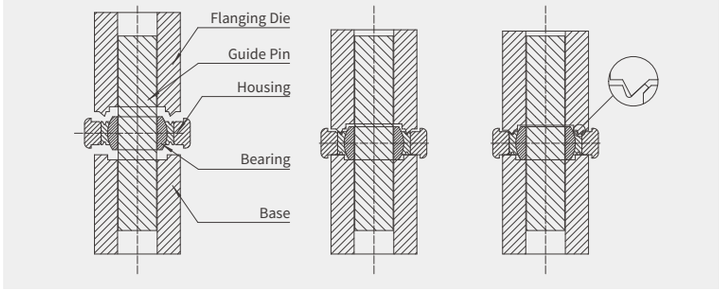
- Do not use hammers or other impact tools to directly strike the bearing.
- Do not force the bearing if misaligned.
- Do not apply pressure to the outer ring while pressing the inner ring onto a shaft.

Flanging Process Diagram

The bearing is secured to the housing via a flanging process. A specific V-groove is machined on the outer ring, and a custom mold is used with a press to locally deform the material, forming the required geometry to fix the bearing in the housing.

- Mold Material: Select suitable mold materials (e.g., high-carbon steel, stainless steel, or alloy steel) and ensure surface quality and dimensional accuracy.
- Mold Design: Create a dedicated flanging mold based on bearing design requirements to ensure flange profile, size, and positional accuracy. The mold should be hardened.
- Positioning and Clamping: Precisely fix the bearing's inner and outer rings on the flanging equipment to prevent displacement during the stamping rib process.
- Flanging: Use a hydraulic press to press the mold into the outer ring surface, causing localized plastic deformation to form the required flange.

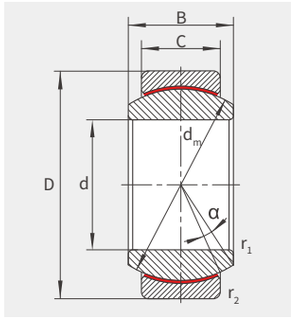
Figure 34



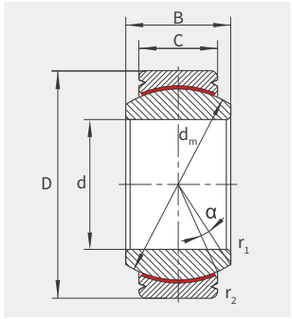
For heavy axial loads or axial shock loads, please contact CCTY.

GEC .. UK/GEC .. UK V

Sliding contact surface:
Steel /PTFE Fabric



GEC .. UK



GEC .. UK V

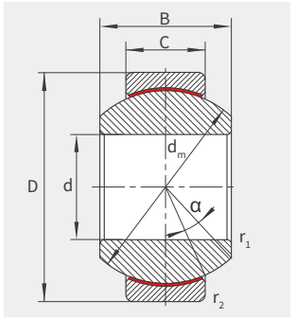
Dimension Table • Unit : mm

Product Number		Dimensions							Basic load ratings		Angle	Mass
		d	D	B	C	d_m	r_1 min.	r_2 min.	dyn. c_r kN	stat. c_{0r} kN	α[°]	≈kg
GEC 4 UK XID	GEC 4 UK XID V	4	12	5	3	8	0.2	0.2	5.2	7.3	16	0.002
GEC 6 UK	GEC 6 UK V	6	14	6	4	10	0.3	0.3	9.6	13.4	13	0.004
GEC 8 UK	GEC 8 UK V	8	16	8	5	13	0.3	0.3	16.3	22.9	15	0.006
GEC 10 UK	GEC 10 UK V	10	19	9	6	16	0.3	0.3	24.0	33.6	12	0.011
GEC 12 UK	GEC 12 UK V	12	22	10	7	18	0.3	0.3	27.0	37.8	10	0.016
GEC 15 UK	GEC 15 UK V	15	26	12	8	22	0.3	0.3	39.6	55.4	12	0.031

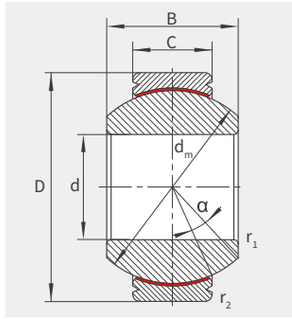
Note: Please contact CCTY for custom dimension requirements.

GEC .. FW/GEC .. FW V

Sliding contact surface:
Steel / PTFE Fabric



GEC .. FW



GEC .. FW V

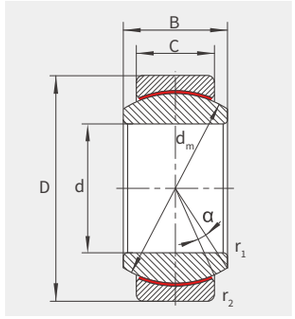
Dimension Table • Unit : mm

Product Number		Dimensions							Basic load ratings		Angle	Mass
		d	D	B	C	d_m	r_1 min.	r_2 min.	dyn. c_r kN	stat. c_{0r} kN	α[°]	≈kg
GEC 4 FW	GEC 4 FW V	4	14	7	4	10	0.3	0.3	9.6	13.4	20	0.005
GEC 5 FW	GEC 5 FW V	5	16	9	5	13	0.3	0.3	16.3	22.9	21	0.008
GEC 6 FW	GEC 6 FW V	6	16	9	5	12.7	0.3	0.3	16.3	22.9	21	0.008
GEC 6 FW X1	GEC 6 FW X1 V	6	16	9	4	15.37	0.3	0.3	12.2	17.0	26	0.007
GEC 6 FW X2	GEC 6 FW X2 V	6	19	12.5	6.2	16	0.3	0.3	25.8	36.1	30	0.015
GEC 8 FW	GEC 8 FW V	8	19	11	6	15.37	0.3	0.3	24.0	33.6	21	0.015
GEC 8 FW X1	GEC 8 FW X1 V	8	18	11	8	18	0.3	0.3	30.4	42.6	14	0.013
GEC 8 FW X2	GEC 8 FW X2 V	8	22	14.5	7	15	0.3	0.3	32.4	45.3	30	0.022
GEC 8 FW X3	GEC 8 FW X3	8	23	15.5	6	15	0.3	0.3	22.5	31.5	35	0.020

Note: Please contact CCTY for custom dimension requirements.

GEC .. BK

Sliding contact surface:
Steel / PTFE Composite



GEC .. BK

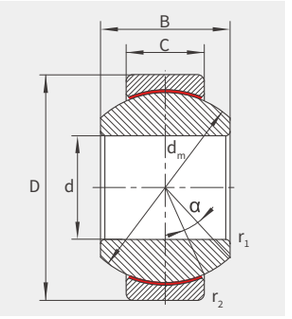
Dimension Table • Unit : mm

Product Number	Dimensions							Basic load ratings		Angle	Mass
	d	D	B	C	d_m	r_1 min.	r_2 min.	dyn. c_r kN	stat. c_{0r} kN	α[°]	≈kg
GEC 3 BK	3	7	3	2	5	0.1	0.1	1.0	2.0	13	0.002
GEC 4 BK	4	12	5	3	8	0.2	0.2	2.2	5.5	13	0.003
GEC 5 BK	5	14	6	4	10	0.3	0.3	3.6	9.2	13	0.005
GEC 6 BK	6	14	6	4	10	0.3	0.3	3.6	9.2	13	0.004
GEC 8 BK	8	16	8	5	13	0.3	0.3	5.9	14.6	15	0.007
GEC 10 BK	10	19	9	6	16	0.3	0.3	8.7	21.6	12	0.011
GEC 12 BK	12	22	10	7	18	0.3	0.3	11.4	28.5	11	0.016
GEC 15 BK	15	26	12	9	22	0.3	0.3	17.6	44	8	0.027

Note: Please contact CCTY for custom dimension requirements.

GECH .. BK

Sliding contact surface:
Steel / PTFE Composite



GECH .. BK

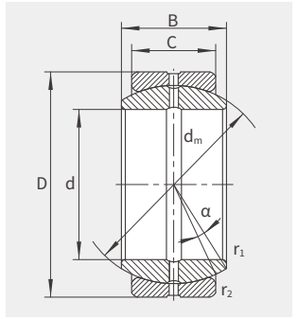
Dimension Table • Unit : mm

Product Number	Dimensions							Basic load ratings		Angle	Mass
	d	D	B	C	d_m	r_1 min.	r_2 min.	dyn. c_r kN	stat. c_{0r} kN	α[°]	≈kg
GECH 3 BK	3	9	4	3	6	0.2	0.2	1.60	4.1	13	0.003
GECH 4 BK	4	14	7	4	10	0.3	0.3	3.60	9.1	20	0.005
GECH 5 BK	5	16	9	5	13	0.3	0.3	5.85	14.6	21	0.008
GECH 6 BK	6	16	9	5	13	0.3	0.3	5.85	14.6	21	0.007
GECH 8 BK	8	19	11	6	16	0.3	0.3	8.65	21.6	21	0.015
GECH 10 BK	10	22	12	7	18	0.3	0.3	11.4	28.5	18	0.021
GECH 12 BK	12	26	15	9	22	0.3	0.3	17.6	44.0	18	0.037
GECH 15 BK	15	30	16	10	25	0.3	0.3	22.4	56.0	16	0.05

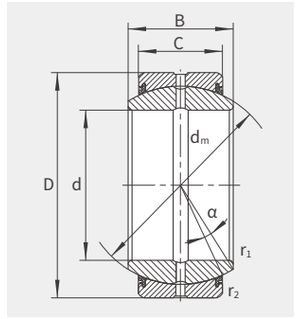
Note: Please contact CCTY for custom dimension requirements.

GE .. ES/GE .. ES 2RS

Sliding contact surface:
Steel/Steel



GE .. ES



GE .. ES 2RS

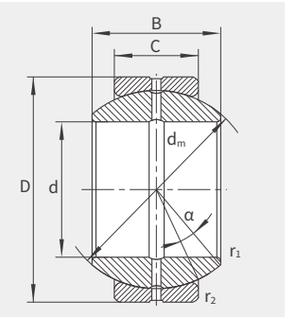
Dimension Table • Unit : mm

Product Number		Dimensions							Basic load ratings		Angle	Mass
		d	D	B	C	d_m	r_1 min.	r_2 min.	dyn. c_r kN	stat. c_{0r} kN	α[°]	≈kg
GE 6 E [1)]		6	14	6	4	10	0.3	0.3	3.4	17	13	0.005
GE 8 E [1)]		8	16	8	5	13	0.3	0.3	5.5	27.5	15	0.007
GE 10 E [1)]		10	19	9	6	16	0.3	0.3	8.2	40.5	12	0.012
GE 12 E [1)]		12	22	10	7	18	0.3	0.3	10.8	54	11	0.017
GE 15 ES	GE 15 ES 2RS	15	26	12	9	22	0.3	0.3	17	85	8	0.027

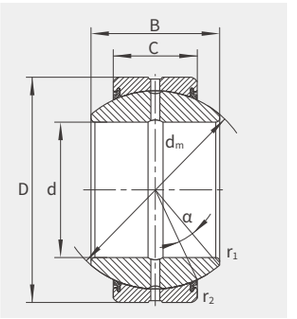
Note: [1)] Without relubrication device
Please contact CCTY for custom dimension requirements.

GE .. FO/GE .. FO 2RS

Sliding contact surface:
Steel/Steel



GE .. FO



GE .. FO 2RS

Dimension Table • Unit : mm

Product Number		Dimensions							Basic load ratings		Angle	Mass
		d	D	B	C	d_m	r_1 min.	r_2 min.	dyn. c_r kN	stat. c_{0r} kN	α[°]	≈kg
GE 6 FO [1)]		6	16	9	5	13	0.3	0.3	5.5	27.5	21	0.009
GE 8 FO [1)]		8	19	11	6	16	0.3	0.3	8.15	40.5	21	0.015
GE 10 FO [1)]		10	22	12	7	18	0.3	0.3	10.8	54	18	0.021
GE 12 FO [1)]		12	26	15	9	22	0.3	0.3	17	85	18	0.037
GE 15 FO	GE 15 FO 2RS	15	30	16	10	25	0.3	0.3	21.2	106	16	0.047

Note: [1)] Without relubrication device
Please contact CCTY for custom dimension requirements.

Other Special Designs

RDH ..

Eyelets

Technical parameters	Units	Values
Range (inner diameter)	mm	3-20
Clearance	mm	0 - 0.02
Breakaway torque	N•m	0 - 0.20

Advantages:

- Lightweight: High-strength and light weight materials ensure durable housing.
- No maintenance required: Self-lubricating liner can be used for life long lubrication.
- High Load Capacity: Withstands heavy loads and impact forces, suitable for heavy-duty applications
- Flexible Design: Customizable dimensions and specifications to adapt to diverse applications.

COS .. N

Rod Ends

Technical parameters	Units	Values
Range (inner diameter)	mm	3-20
Clearance	mm	0 - 0.02
Breakaway torque	N•m	0 - 0.20

Advantages:

- Low Clearance
- Self-lubricating: Some bearings feature self-lubrication to minimize maintenance.
- High Oscillation Angle
- Low Torque

TR ..

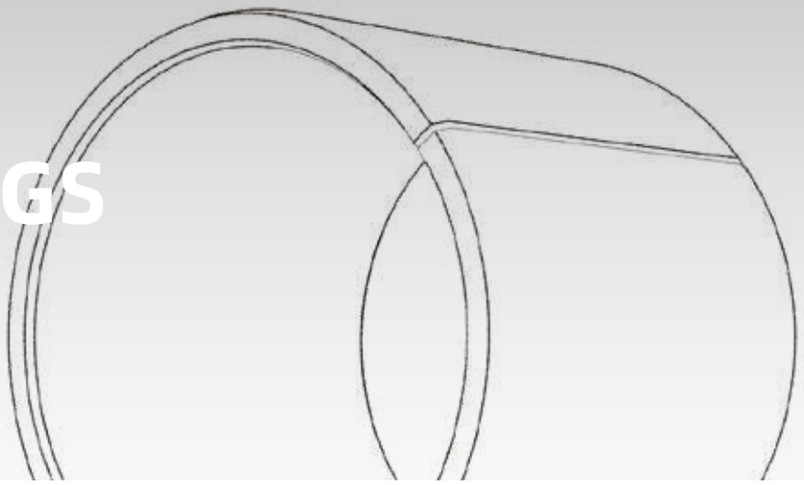
Push Rod

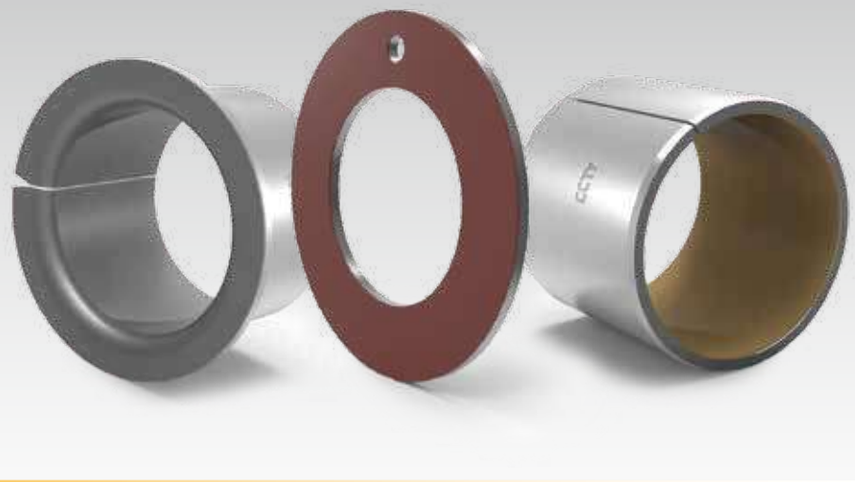
Technical parameters	Units	Values
Range (inner diameter)	mm	3-20
Clearance	mm	0 - 0.02
Breakaway torque	N•m	0 - 0.20

Advantages:

- Low Clearance: Reduce motion error and improve positioning accuracy.
- High Load Capacity: Utilizes high-strength alloy or stainless steel to withstand heavy loads.
- Self-lubricating: Some bearings feature self-lubrication to minimize maintenance needs.
- Flexible Design: Customizable dimensions and specifications to meet diverse applications.

BUSHINGS





BUSHINGS

Bushings

Material

TSA bushing material

Structure

Figure 35

1. PTFE composite: 0.01-0.05 mm
2. Porous bronze: 0.2-0.3 mm
3. Steel backing: 0.5-2.3 mm
4. Coating: phosphating /tin-plating/copper plating

Features

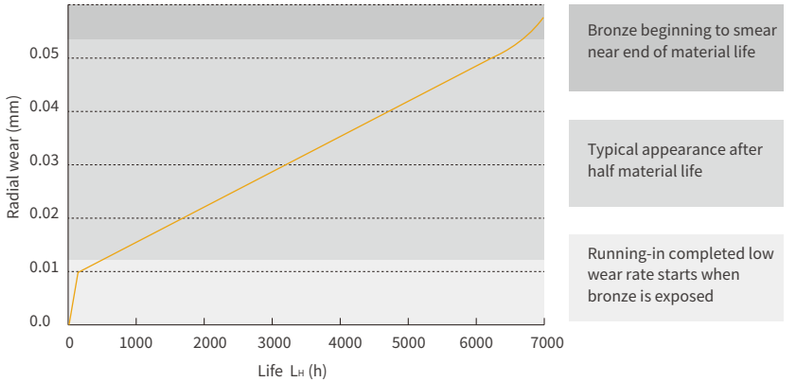
- Low carbon steel backing with sintered porous bronze impregnated with a PTFE composite polymer
- Self-lubricating material resulting in low friction and excellent wear resistance providing a long operation life
- Excels in dry applications by managing bearing load, speed and temperatures under environmental conditions
- Lead-free material compliant with RoHS and REACH
- Available as cylindrical, flanged, and thrust

Table 28

Physical and mechanical performance				
Characteristics		**Symbol**	**Parameter**	**Unit**
Physical performance	Thermal conductivity	λ	40	W/mK
	Linear expansion factor:			
	Parallel to surface	α_1	11	$1/10^6$K
	Normal to surface	α_2	30	$1/10^6$K
	Max working temperature	T_{max}	280	°C
	Min working temperature	T_{min}	-200	°C
Mechanical properties	Compressive strength	σ_c	350	N/mm²
	Maximum load			
	Static load	$P_{sta.max}$	250	N/mm²
	Dynamic load	$P_{dyn.max}$	140	N/mm²
	Ultimate pv	pv	3.6	N/mm²x m/s
	Ultimate v	v	2.5	m/s

Dry Wear Mechanism

Figure 36



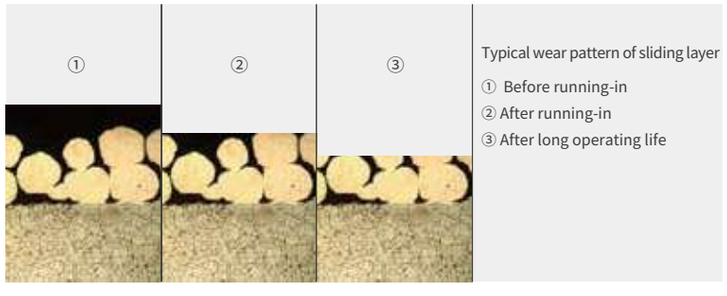
Running-in Process

During the running-in phase, some of the PTFE layer is transferred to the mating shaft forming a low coefficient of friction by compensating for uneven areas, Figure 37.

After the running-in phase is complete, some of the porous bronze layer is visible on the sliding layers, Figure 38.

Figure 37

Figure 38

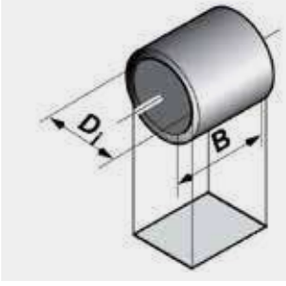


Performance

Specific Load P

The specific load P is the working load divided by the projected area (A) of the bushing.

Figure 39



A	Projected area of bushing	(mm^2)
D_i	Inner diameter of bushing, flanged bushing or thrust washer	(mm)
B	Width of bushing	(mm)

Bushing

$$p = \frac{F}{D_i \cdot B}$$

Flanged bushing (axial load)

$$p = \frac{F}{0.04 \cdot (D_{f1}^2 - D_i^2)}$$

Thrust washer

$$p = \frac{4F}{\pi \cdot (D_o^2 - D_i^2)}$$

p	Specific load	(N/mm^2)
F	Bushing load	(N)
D_o	Outer diameter of bushing or thrust washer	(mm)
D_{f1}	Nominal flange outer diameter	(mm)

Specific Load Limit p_{lim}

The maximum load that can be borne by the bushing is the ultimate load. When the limit load is high under constant steady load, the specific load limit will be decreased due to fatigue pressure on bushing under dynamic load or vibrating load.

Table 29

Type of load	P_{lim}[N/mm²]									
Rotating under constant load	140									
Oscillation under constant load										
P_{lim}	140	140	115	95	85	80	60	44	30	20
Number of movement cycles Q	1000	2000	4000	6000	8000	10^4	10^5	10^6	10^7	10^8
Dynamic load, rotating or oscillating movement										
P_{lim}	60	60	50	46	42	40	30	22	15	10
Number of movement cycles Q	1000	2000	4000	6000	8000	10^4	10^5	10^6	10^7	10^8

Sliding Speed V

Continuous rotating

$$v = \frac{D_i \cdot \pi \cdot n}{60 \cdot 10^3}$$ Bushing

$$v = \frac{\frac{D_o + D_i}{2} \cdot \pi \cdot n}{60 \cdot 10^3}$$ Thrust washer

Oscillating movement

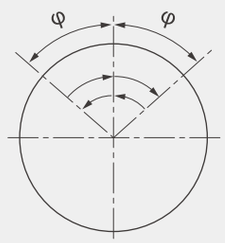
$$v = \frac{D_i \cdot \pi}{60 \cdot 10^3} \cdot \frac{4\varphi \cdot N_{osz}}{360}$$ Bushing

$$v = \frac{\frac{D_o + D_i}{2} \cdot \pi \cdot n}{60 \cdot 10^3} \cdot \frac{4\varphi \cdot N_{osz}}{360}$$ Thrust washer

v	Sliding speed	(m/s)
D_i	Inner diameter of bushing, flanged bushing or thrust washer	(mm)
n	Revolution	(min^{-1})
ϕ	Angular displacement	(°)
N_{osz}	Oscillating frequency	(min^{-1})

Oscillating Angle φ

Figure 40



pv value

The service life of bushing depends on pV value, i.e. the actual load p[N/mm²] times the sliding speed v[m/s].

$$pv = p \cdot v$$

p	Specific load	(N/mm²)
v	Sliding speed	(m/s)

Application Factors

Temperature f_T

The service life of the bushing depends on the operating temperature. Under dry running conditions, frictional heat is generated at the surface of the bushing dependent on the pv condition. While pv is given, the operating temperature of the bushing depends on the environment temperature and thermal dissipation properties of the housing. Intermittent operation affects the thermal dissipation and the operating temperature. The influence of operating temperature on bushing is indicated by f_T

Table 30

Working mode	Property of bushing housing	Ambient temperature of bushing T_{amb} [°C] and temperature application factor f_T					
		25	60	100	150	200	280
Dry friction, continuous running	Average heat dissipation	1	0.8	0.6	0.4	0.2	0.1
Dry friction, continuous running	Light housing fit or isolated housing with poor heat dissipation	0.5	0.4	0.3	0.2	0.1	-
Dry friction, continuous running	Non-metal bearing housing with extremely poor heat dissipation	0.3	0.3	0.2	0.1	-	-
Dry friction, intermittent operation (cycle less than 2 min before long-term standby)	Average heat dissipation	2	1.6	1.2	0.8	0.4	0.2
Continuous operation in water		2	1.5	0.6	-	-	-
Alternative operation of water immersion and dry friction		0.2	0.1	-	-	-	-
Continuous operation in unlubricated fluid other than water		1.5	1.2	0.9	0.6	0.3	0.1
Continuous operation in lubricated fluid		3	2.5	2	1.5	-	-

Mating Surface f_M and Modification Factor For Service Life f_L

The influence of material of fitting surface on the service life is represented by factor for mating surface f_M , modification factor for service life f_L.

Note

The surface mated with the bushing is fine machined to roughness Ra 0.4 or better. After surface fine ground, the mating surface is cleaned to remove grinding particles. The cast iron surface should be <Ra 0.3.

Table 31

Material	f_M	f_L	Material	f_M	f_L	Material	f_M	f_L
Steel and cast iron			Coating on steel no less than 0.013mm			Non-ferrous metal materials		
Carbon steel	1	200	Cadmium plating	0.2	600		0.4	200
Carbon manganese steel	1	200	Hard chrome	2	600		0.1-0.4	200
Alloy steel	1	200	Lead	1.5	600		3.0	600
Hardened tempered steel	1	200	Nickel plating	0.2	600			
Nitriding steel	1	200	Phosphating	0.2	300			
Salt-bath nitro cemented steel	1	200	Tin-nickel alloy	1.2	600			
Nitriding steel	1	200	Titanium nitride	1	600			
Cast iron	1	200	Hard alloy	3	600			
			Galvanizing	0.2	600			

Dimensional f_B

The running clearance of a bushing increases with bushing diameter resulting in a proportionally smaller contact area between the shaft and bushing (Figure 41). The reduced contact area will affect the actual load and the service life of bushing, hence, the dimensional factor for bushing f_B is used.

Contact Area Between The Shaft and Bushing

Figure 41

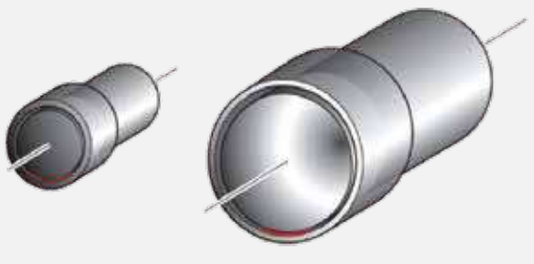
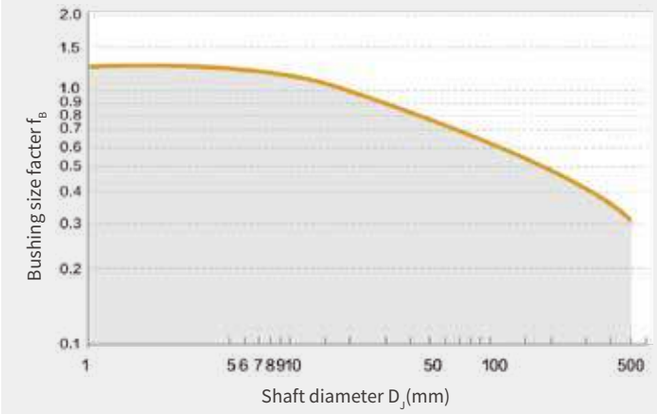
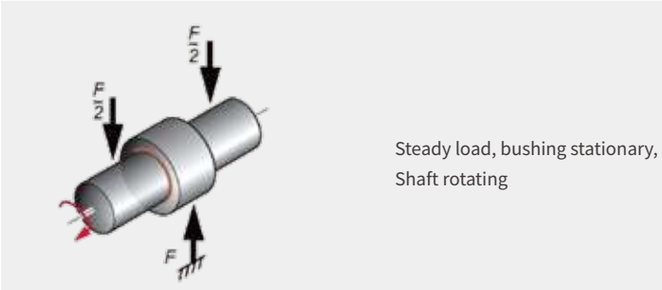


Figure 42



Type of Load

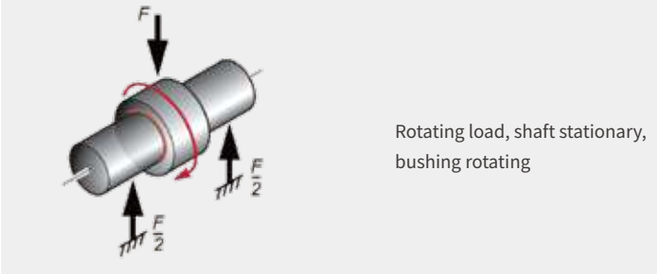
Figure 43



Steady load, bushing stationary, Shaft rotating

Type of Load

Figure 44



Rotating load, shaft stationary, bushing rotating

Calculation of Bushing Service Life

The bearing is overloaded when the calculated high load factor is negative, the diameter and width of bushing is increased.

High load f_E

$$f_E = \frac{p_{lim} - p}{p_{lim}}$$

f_E	Factor for high load	-
p_{lim}	Specific load limit	(N/mm^2)
p	Specific load	(N/mm^2)

Modified pV Factor

Bushing

$$pv = \frac{5.25 \cdot 10^{-5} \cdot F \cdot n}{f_E \cdot B \cdot f_T \cdot f_M \cdot f_B}$$

Flanged bushing (axial load)

$$pv = \frac{6.5 \cdot 10^{-4} \cdot F \cdot n}{f_E \cdot (D_{f1}-D_i) \cdot f_T \cdot f_M \cdot f_B}$$

Thrust washer

$$pv = \frac{3.34 \cdot 10^{-5} \cdot F \cdot n}{f_E \cdot (D_o-D_i) \cdot f_T \cdot f_M \cdot f_B}$$

Estimated Service Life of Bushing L_H

Bushing (Steady load)

$$L_H = \frac{615}{pv} - f_L$$

Thrust washer

$$L_H = \frac{410}{pv} - f_L$$

Bushing (Rotating load)

$$L_H = \frac{1230}{pv} - f_L$$

Flanged bushing (Axial load)

$$L_H = \frac{410}{pv} - f_L$$

L_H	Service life	(h)
p	Specific load	(N/mm^2)
V	Sliding speed	(m/s)
F_L	Factor for service life	-

Estimating Example For Service Life of Bushing L_H

Table 32

Given data			
Detail load information	Steady load	Inner diameter D_i	40 mm
	Continuous rotating	Width B	30 mm
Shaft	Steel	Bushing load F	5000 N
	25°C without lubricating	Rotary speed N	25 min^{-1}

Table 33

Calculation constants and application factors		
Specific load limit P_{lim}	140 N/mm^2	Table 29, P105
Application factor f_T	1	Table 30, P106
Application factor of material f_M	1	Table 31, P107
Modification factor for service life f_L	200 h	Table 31, P107
Dimensional factor of bushing f_B	0.85	Figure 42, P108

Table 34

Calculation	Reference	Value
Specific load p[N/mm^2]	Page 104	$p = \frac{F}{D_i \cdot B} = \frac{5000}{40 \cdot 30} = 4.17$
Sliding speed v [m/s]	Page 105	$v = \frac{D_i \cdot \pi \cdot n}{60 \cdot 10^3} = \frac{40 \cdot \pi \cdot 25}{60000} = 0.052$
High load factor f_E[-]	Page 109	$f_E = \frac{p_{lim} - p}{p_{lim}} = \frac{140 - 4.17}{140} = 0.970$
pV modification factor [N/mm^2 x m/s]	Page 109	$pv = \frac{5.25 \cdot 10^{-5} \cdot F \cdot n}{f_E \cdot B \cdot f_T \cdot f_M \cdot f_B} = \frac{6.5625}{24.265} = 0.27$
Service life L_H [h]	Page 109	$L_H = \frac{615}{pv} - f_L = \frac{615}{0.27} - 200 = 2077$

Note: The service life of bushing products depends on many factors. The calculated theoretical service life varies under different test conditions.

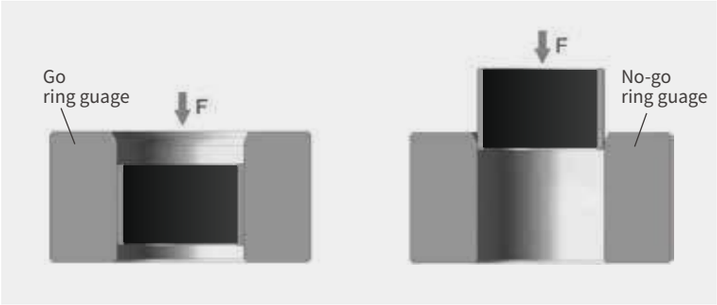
Please contact CCTY if theoretical service life calculations are required. We will complete a theoretical calculation for the service life based on the working conditions.

Methods of Checking

Checking Method For Outer Diameter (OD)

Check OD by go ring gauge and no go ring gauge:bushings can be pressed into go ring gauge under hand pressing of no more than 250 N, the length into no-go ring gauge should not exceed 1/3 height under same force.

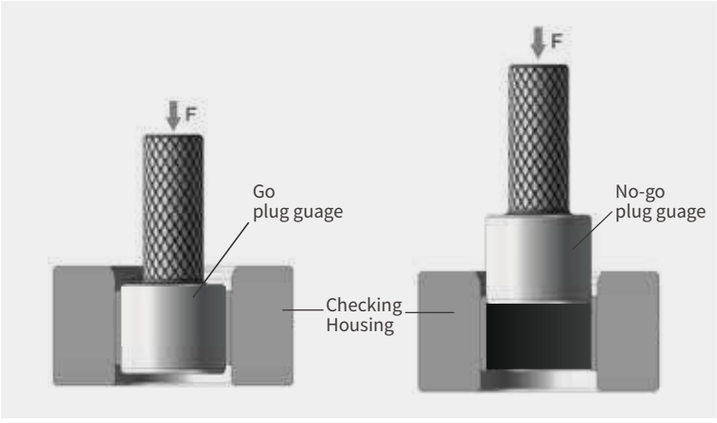
Figure 45



Checking Method For Inner Diameter (ID)

When pressing a bushing into its checking housing, check the bushing bore with the go plug gage and no-go plug gage. The go plug gage can be inserted into the internal diameter of the bushing with minimal hand force of 250N or less. It should stop at no more than 1/3 height of the bushing under the same force.

Figure 46

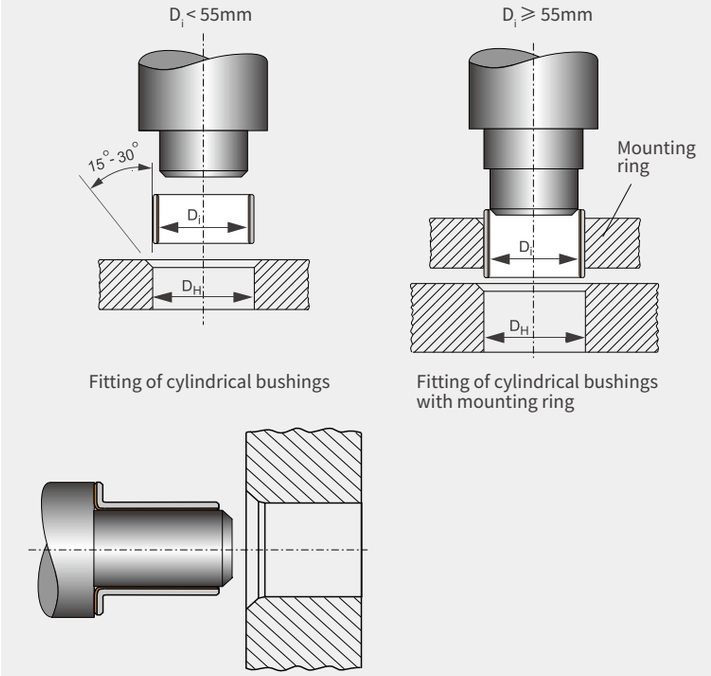


Mounting

Installation

The bushings can be easily pressed into the housing bore. The bushing can be easily pressed if the bushing backing or housing bore is lightly oiled.

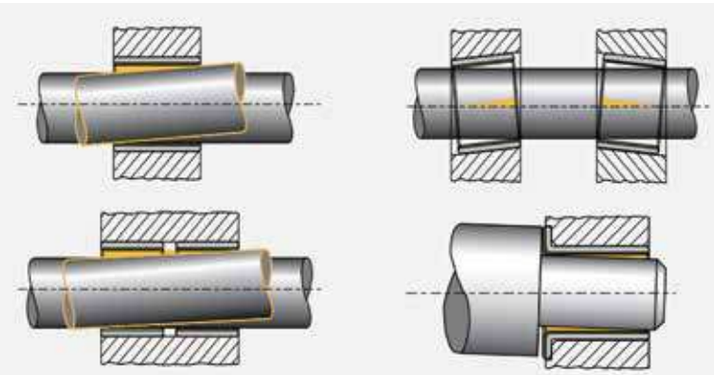
Figure 47



Design Of Bushing Arrangements

In terms of bushing installation, accurate alignment is very important. Alignment is reflected in the length of the entire sleeve. If the sleeve is incorrectly aligned, edge load will occur and cause premature failure.

Figure 48



Wrong Alignment

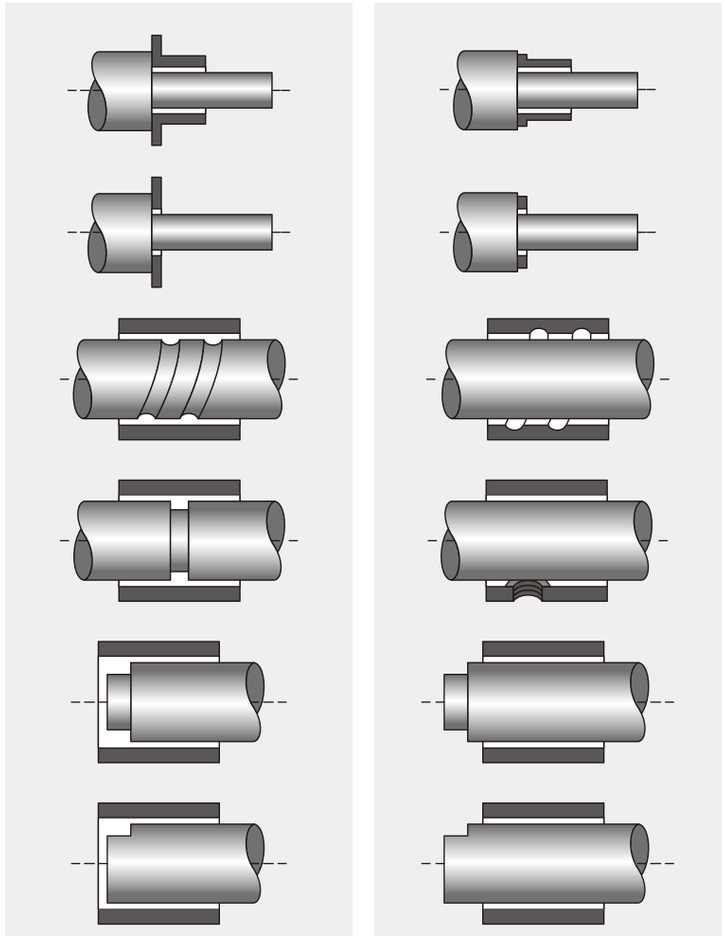
Pressing In Force For Bushings

The pressing force is related to the material, external diameter and interference of housing bore, and the height of bushing. If your application has special pressing force requirements, contact CCTY technical service.

Design of Mating Shaft For Bushings

The bushings rely on self-lubricating materials to reduce wear and protect the mating shaft. The preferred shaft surface finish is Ra 0.4 or better. The shaft, shoulder or thrust washer must extend beyond the bushing surface. The shaft surface must be free of holes and grooves. Here are some typical designs for mating shafts:

Figure 49



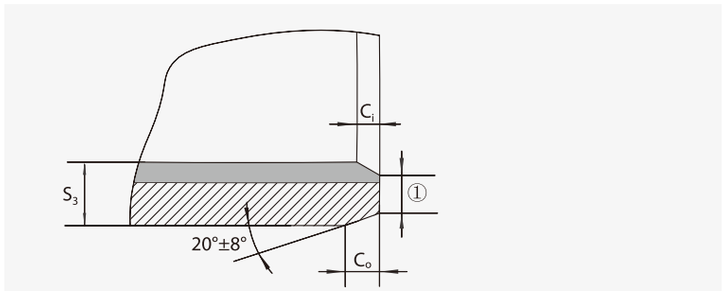
Improper

Proper

Chamfers and Chamfer Tolerance

The tolerances and dimensions of the outer chamfer C_o and the inner edge break C_i for bushings of metric sizes conform to ISO 3547-1. Chamfer deformation due to round bending is permissible.

Figure 50



① ⩾0.3mm 0(0.012 inch)

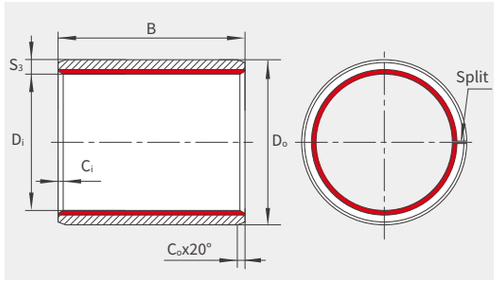
C_i	inner edge break	(mm)
C_o	length of outer chamfer	(mm)
S_3	wall thickness	(mm)

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
0.75	0.5 ± 0.3	0.1	0.4
1	0.6 ± 0.4	0.1	0.5



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 0203	2	3.5	3.25	2.75	0.75	2.000	1.994	3.508	3.500	2.048	2.000	0.054	0.000
TSA 0205	2	3.5	5.25	4.75	0.75	2.000	1.994	3.508	3.500	2.048	2.000	0.054	0.000
TSA 0303	3	4.5	3.25	2.75	0.75	3.000	2.994	4.508	4.500	3.048	3.000	0.054	0.000
TSA 0305	3	4.5	5.25	4.75	0.75	3.000	2.994	4.508	4.500	3.048	3.000	0.054	0.000
TSA 0306	3	4.5	6.25	5.75	0.75	3.000	2.994	4.508	4.500	3.048	3.000	0.054	0.000
TSA 0403	4	5.5	3.25	2.75	0.75	4.000	3.992	5.508	5.500	4.048	4.000	0.056	0.000
TSA 0404	4	5.5	4.25	3.75	0.75	4.000	3.992	5.508	5.500	4.048	4.000	0.056	0.000
TSA 0406	4	5.5	6.25	5.75	0.75	4.000	3.992	5.508	5.500	4.048	4.000	0.056	0.000
TSA 0410	4	5.5	10.25	9.75	0.75	4.000	3.992	5.508	5.500	4.048	4.000	0.056	0.000
TSA 0505	5	7	5.25	4.75	1	4.990	4.978	7.015	7.000	5.055	4.990	0.077	0.000
TSA 0508	5	7	8.25	7.75	1	4.990	4.978	7.015	7.000	5.055	4.990	0.077	0.000
TSA 0510	5	7	10.25	9.75	1	4.990	4.978	7.015	7.000	5.055	4.990	0.077	0.000
TSA 0604	6	8	4.25	3.75	1	5.990	5.978	8.015	8.000	6.055	5.990	0.077	0.000
TSA 0606	6	8	6.25	5.75	1	5.990	5.978	8.015	8.000	6.055	5.990	0.077	0.000
TSA 0608	6	8	8.25	7.75	1	5.990	5.978	8.015	8.000	6.055	5.990	0.077	0.000
TSA 0610	6	8	10.25	9.75	1	5.990	5.978	8.015	8.000	6.055	5.990	0.077	0.000
TSA 0710	7	9	10.25	9.75	1	6.987	6.972	9.015	9.000	7.055	6.990	0.083	0.003
TSA 0806	8	10	6.25	5.75	1	7.987	7.972	10.015	10.000	8.055	7.990	0.083	0.003
TSA 0808	8	10	8.25	7.75	1	7.987	7.972	10.015	10.000	8.055	7.990	0.083	0.003
TSA 0810	8	10	10.25	9.75	1	7.987	7.972	10.015	10.000	8.055	7.990	0.083	0.003
TSA 0812	8	10	12.25	11.75	1	7.987	7.972	10.015	10.000	8.055	7.990	0.083	0.003

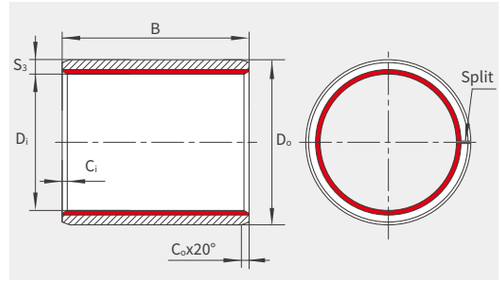
Note: Please contact CCTY for custom dimension requirements.

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
0.75	0.5 ± 0.3	0.1	0.4
1	0.6 ± 0.4	0.1	0.5



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 1008	10	12	8.25	7.75	1	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
TSA 1010	10	12	10.25	9.75	1	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
TSA 1012	10	12	12.25	11.75	1	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
TSA 1015	10	12	15.5	14.5	1	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
TSA 1020	10	12	20.5	19.5	1	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
TSA 1208	12	14	8.25	7.75	1	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
TSA 1210	12	14	10.25	9.75	1	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
TSA 1212	12	14	12.25	11.75	1	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
TSA 1215	12	14	15.5	14.5	1	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
TSA 1220	12	14	20.5	19.5	1	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
TSA 1225	12	14	25.5	24.5	1	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
TSA 1310	13	15	10.25	9.75	1	12.984	12.966	15.018	15.000	13.058	12.990	0.092	0.006
TSA 1320	13	15	20.5	19.5	1	12.984	12.966	15.018	15.000	13.058	12.990	0.092	0.006
TSA 1405	14	16	5.25	4.75	1	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
TSA 1410	14	16	10.25	9.75	1	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
TSA 1412	14	16	12.25	11.75	1	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
TSA 1415	14	16	15.5	14.5	1	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
TSA 1420	14	16	20.5	19.5	1	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
TSA 1425	14	16	25.5	24.5	1	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
TSA 1510	15	17	10.25	9.75	1	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006
TSA 1512	15	17	12.25	11.75	1	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006
TSA 1515	15	17	15.5	14.5	1	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006
TSA 1520	15	17	20.5	19.5	1	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006
TSA 1525	15	17	25.5	24.5	1	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006

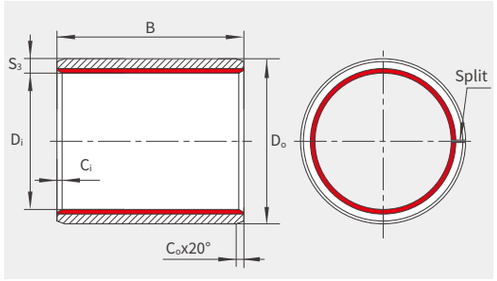
Note: Please contact CCTY for custom dimension requirements.

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
1	0.6 ± 0.4	0.1	0.5
1.5	0.6 ± 0.4	0.1	0.7



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 1610	16	18	10.25	9.75	1	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
TSA 1612	16	18	12.25	11.75	1	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
TSA 1615	16	18	15.5	14.5	1	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
TSA 1620	16	18	20.5	19.5	1	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
TSA 1625	16	18	25.5	24.5	1	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
TSA 1720	17	19	20.25	19.75	1	16.984	16.966	19.021	19.000	17.061	16.990	0.095	0.006
TSA 1810	18	20	10.25	9.75	1	17.984	17.966	20.021	20.000	18.061	17.990	0.095	0.006
TSA 1815	18	20	15.5	14.5	1	17.984	17.966	20.021	20.000	18.061	17.990	0.095	0.006
TSA 1820	18	20	20.5	19.5	1	17.984	17.966	20.021	20.000	18.061	17.990	0.095	0.006
TSA 1825	18	20	25.5	24.5	1	17.984	17.966	20.021	20.000	18.061	17.990	0.095	0.006
TSA 2010	20	23	10.25	9.75	1.5	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
TSA 2015	20	23	15.25	14.75	1.5	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
TSA 2020	20	23	20.5	19.5	1.5	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
TSA 2025	20	23	25.5	24.5	1.5	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
TSA 2030	20	23	30.5	29.5	1.5	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
TSA 2215	22	25	15.25	14.75	1.5	21.980	21.959	25.021	25.000	22.071	21.990	0.112	0.010
TSA 2220	22	25	20.5	19.5	1.5	21.980	21.959	25.021	25.000	22.071	21.990	0.112	0.010
TSA 2225	22	25	25.5	24.5	1.5	21.980	21.959	25.021	25.000	22.071	21.990	0.112	0.010
TSA 2230	22	25	30.5	29.5	1.5	21.980	21.959	25.021	25.000	22.071	21.990	0.112	0.010
TSA 2415	24	27	15.25	14.75	1.5	23.980	23.959	27.021	27.000	24.071	23.990	0.112	0.010
TSA 2420	24	27	20.5	19.5	1.5	23.980	23.959	27.021	27.000	24.071	23.990	0.112	0.010
TSA 2425	24	27	25.5	24.5	1.5	23.980	23.959	27.021	27.000	24.071	23.990	0.112	0.010
TSA 2430	24	27	30.5	29.5	1.5	23.980	23.959	27.021	27.000	24.071	23.990	0.112	0.010

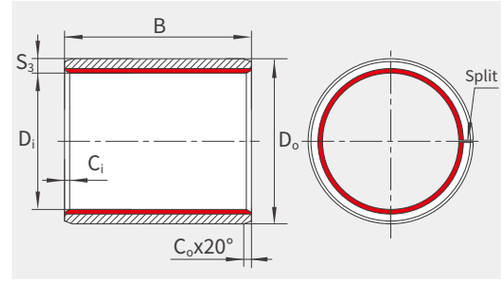
Note: Please contact CCTY for custom dimension requirements.

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
1.5	0.6 ± 0.4	0.1	0.7
2	1.2 ± 0.4	0.1	0.7



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 2515	25	28	15.25	14.75	1.5	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
TSA 2520	25	28	20.5	19.5	1.5	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
TSA 2525	25	28	25.5	24.5	1.5	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
TSA 2530	25	28	30.5	29.5	1.5	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
TSA 2550	25	28	50.5	49.5	1.5	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
TSA 2815	28	32	15.25	14.75	2	27.980	27.959	32.025	32.000	28.085	27.990	0.126	0.010
TSA 2820	28	32	20.25	19.75	2	27.980	27.959	32.025	32.000	28.085	27.990	0.126	0.010
TSA 2825	28	32	25.25	24.75	2	27.980	27.959	32.025	32.000	28.085	27.990	0.126	0.010
TSA 2830	28	32	30.5	29.5	2	27.980	27.959	32.025	32.000	28.085	27.990	0.126	0.010
TSA 3010	30	34	10.25	9.75	2	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
TSA 3015	30	34	15.25	14.75	2	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
TSA 3020	30	34	20.25	19.75	2	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
TSA 3025	30	34	25.25	24.75	2	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
TSA 3030	30	34	30.5	29.5	2	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
TSA 3040	30	34	40.5	39.5	2	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
TSA 3220	32	36	20.25	19.75	2	31.975	31.950	36.025	36.000	32.085	31.990	0.135	0.015
TSA 3230	32	36	30.5	29.5	2	31.975	31.950	36.025	36.000	32.085	31.990	0.135	0.015
TSA 3240	32	36	40.5	39.5	2	31.975	31.950	36.025	36.000	32.085	31.990	0.135	0.015
TSA 3520	35	39	20.25	19.75	2	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015
TSA 3530	35	39	30.5	29.5	2	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015
TSA 3535	35	39	35.5	34.5	2	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015
TSA 3540	35	39	40.5	39.5	2	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015
TSA 3550	35	39	50.5	49.5	2	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015

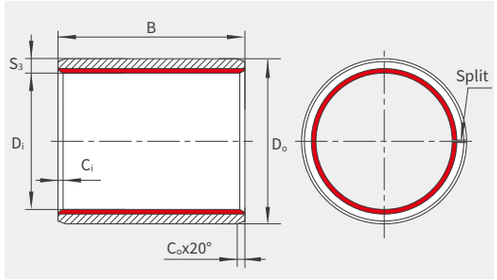
Note: Please contact CCTY for custom dimension requirements.

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
2	1.2 ± 0.4	0.1	0.7
2.5	1.8 ± 0.6	0.2	1



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 3720	37	41	20.25	19.75	2	36.975	36.950	41.025	41.000	37.085	36.990	0.135	0.015
TSA 3815	38	42	15.25	14.75	2	37.975	37.950	42.025	42.000	38.085	37.990	0.135	0.015
TSA 3820	38	42	20.25	19.75	2	37.975	37.950	42.025	42.000	38.085	37.990	0.135	0.015
TSA 3830	38	42	30.5	29.5	2	37.975	37.950	42.025	42.000	38.085	37.990	0.135	0.015
TSA 3840	38	42	40.5	39.5	2	37.975	37.950	42.025	42.000	38.085	37.990	0.135	0.015
TSA 4020	40	44	20.25	19.75	2	39.975	39.950	44.025	44.000	40.085	39.990	0.135	0.015
TSA 4030	40	44	30.5	29.5	2	39.975	39.950	44.025	44.000	40.085	39.990	0.135	0.015
TSA 4040	40	44	40.5	39.5	2	39.975	39.950	44.025	44.000	40.085	39.990	0.135	0.015
TSA 4050	40	44	50.5	49.5	2	39.975	39.950	44.025	44.000	40.085	39.990	0.135	0.015
TSA 4520	45	50	20.25	19.75	2.5	44.975	44.950	50.025	50.000	45.105	44.990	0.155	0.015
TSA 4530	45	50	30.25	29.75	2.5	44.975	44.950	50.025	50.000	45.105	44.990	0.155	0.015
TSA 4540	45	50	40.5	39.5	2.5	44.975	44.950	50.025	50.000	45.105	44.990	0.155	0.015
TSA 4545	45	50	45.5	44.5	2.5	44.975	44.950	50.025	50.000	45.105	44.990	0.155	0.015
TSA 4550	45	50	50.5	49.5	2.5	44.975	44.950	50.025	50.000	45.105	44.990	0.155	0.015
TSA 5020	50	55	20.25	19.75	2.5	49.975	49.950	55.030	55.000	50.110	49.990	0.160	0.015
TSA 5030	50	55	30.25	29.75	2.5	49.975	49.950	55.030	55.000	50.110	49.990	0.160	0.015
TSA 5040	50	55	40.5	39.5	2.5	49.975	49.950	55.030	55.000	50.110	49.990	0.160	0.015
TSA 5050	50	55	50.5	49.5	2.5	49.975	49.950	55.030	55.000	50.110	49.990	0.160	0.015
TSA 5060	50	55	60.5	59.5	2.5	49.975	49.950	55.030	55.000	50.110	49.990	0.160	0.015
TSA 5520	55	60	20.25	19.75	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
TSA 5525	55	60	25.25	24.75	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
TSA 5530	55	60	30.25	29.75	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
TSA 5540	55	60	40.5	39.5	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
TSA 5550	55	60	50.5	49.5	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
TSA 5555	55	60	55.5	54.5	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
TSA 5560	55	60	60.5	59.5	2.5	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020

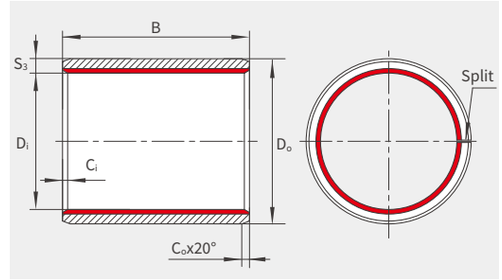
Note: Please contact CCTY for custom dimension requirements.

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
2.5	1.8 ± 0.6	0.2	1



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 6020	60	65	20.25	19.75	2.5	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
TSA 6030	60	65	30.25	29.75	2.5	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
TSA 6040	60	65	40.5	39.5	2.5	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
TSA 6050	60	65	50.5	49.5	2.5	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
TSA 6060	60	65	60.5	59.5	2.5	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
TSA 6070	60	65	70.75	69.25	2.5	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
TSA 6530	65	70	30.25	29.75	2.5	64.970	64.940	70.030	70.000	65.110	64.990	0.170	0.020
TSA 6550	65	70	50.5	49.5	2.5	64.970	64.940	70.030	70.000	65.110	64.990	0.170	0.020
TSA 6570	65	70	70.75	69.25	2.5	64.970	64.940	70.030	70.000	65.110	64.990	0.170	0.020
TSA 7030	70	75	30.25	29.75	2.5	69.970	69.940	75.030	75.000	70.110	69.990	0.170	0.020
TSA 7040	70	75	40.5	39.5	2.5	69.970	69.940	75.030	75.000	70.110	69.990	0.170	0.020
TSA 7050	70	75	50.5	49.5	2.5	69.970	69.940	75.030	75.000	70.110	69.990	0.170	0.020
TSA 7070	70	75	70.75	69.25	2.5	69.970	69.940	75.030	75.000	70.110	69.990	0.170	0.020
TSA 7540	75	80	40.5	39.5	2.5	74.970	74.940	80.030	80.000	75.110	74.990	0.170	0.020
TSA 7560	75	80	60.5	59.5	2.5	74.970	74.940	80.030	80.000	75.110	74.990	0.170	0.020
TSA 7580	75	80	80.75	79.25	2.5	74.970	74.940	80.030	80.000	75.110	74.990	0.170	0.020
TSA 8040	80	85	40.5	39.5	2.5	80.000	79.954	85.035	85.000	80.155	80.020	0.201	0.020
TSA 8060	80	85	60.5	59.5	2.5	80.000	79.954	85.035	85.000	80.155	80.020	0.201	0.020
TSA 8080	80	85	80.75	79.25	2.5	80.000	79.954	85.035	85.000	80.155	80.020	0.201	0.020
TSA 80100	80	85	100.75	99.25	2.5	80.000	79.954	85.035	85.000	80.155	80.020	0.201	0.020
TSA 8530	85	90	30.25	29.75	2.5	85.000	84.946	90.035	90.000	85.155	85.020	0.209	0.020
TSA 8540	85	90	40.5	39.5	2.5	85.000	84.946	90.035	90.000	85.155	85.020	0.209	0.020
TSA 8560	85	90	60.5	59.5	2.5	85.000	84.946	90.035	90.000	85.155	85.020	0.209	0.020
TSA 8580	85	90	80.75	79.25	2.5	85.000	84.946	90.035	90.000	85.155	85.020	0.209	0.020
TSA 85100	85	90	100.75	99.25	2.5	85.000	84.946	90.035	90.000	85.155	85.020	0.209	0.020

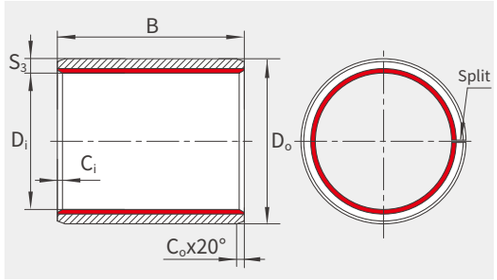
Note: Please contact CCTY for custom dimension requirements.

Cylindrical Bushings

Maintenance-free
Metric sizes

Chamfer specification

S_3	C_o	C_i	
		min.	max.
2.5	1.8 ± 0.6	0.2	1



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 9040	90	95	40.5	39.5	2.5	90.000	89.946	95.035	95.000	90.155	90.020	0.209	0.020
TSA 9060	90	95	60.5	59.5	2.5	90.000	89.946	95.035	95.000	90.155	90.020	0.209	0.020
TSA 90100	90	95	100.75	99.25	2.5	90.000	89.946	95.035	95.000	90.155	90.020	0.209	0.020
TSA 9560	95	100	60.5	59.5	2.5	95.000	94.946	100.035	100.000	95.155	95.020	0.209	0.020
TSA 95100	95	100	100.75	99.25	2.5	95.000	94.946	100.035	100.000	95.155	95.020	0.209	0.020
TSA 10050	100	105	50.5	49.5	2.5	100.000	99.946	105.035	105.000	100.155	100.020	0.209	0.020
TSA 10060	100	105	60.5	59.5	2.5	100.000	99.946	105.035	105.000	100.155	100.020	0.209	0.020
TSA 100100	100	105	100.75	99.25	2.5	100.000	99.946	105.035	105.000	100.155	100.020	0.209	0.020
TSA 100115	100	105	115.75	114.25	2.5	100.000	99.946	105.035	105.000	100.155	100.020	0.209	0.020
TSA 10560	105	110	60.5	59.5	2.5	105.000	104.946	110.035	110.000	105.155	105.020	0.209	0.020
TSA 105100	105	110	100.75	99.25	2.5	105.000	104.946	110.035	110.000	105.155	105.020	0.209	0.020
TSA 105115	105	110	115.75	114.25	2.5	105.000	104.946	110.035	110.000	105.155	105.020	0.209	0.020
TSA 11060	110	115	60.5	59.5	2.5	110.000	109.946	115.035	115.000	110.155	110.020	0.209	0.020
TSA 110100	110	115	100.75	99.25	2.5	110.000	109.946	115.035	115.000	110.155	110.020	0.209	0.020
TSA 110115	110	115	115.75	114.25	2.5	110.000	109.946	115.035	115.000	110.155	110.020	0.209	0.020
TSA 11550	115	120	50.5	49.5	2.5	115.000	114.946	120.035	120.000	115.155	115.020	0.209	0.020
TSA 11560	115	120	60.5	59.5	2.5	115.000	114.946	120.035	120.000	115.155	115.020	0.209	0.020
TSA 11570	115	120	70.5	69.5	2.5	115.000	114.946	120.035	120.000	115.155	115.020	0.209	0.020
TSA 115100	115	120	100.75	99.25	2.5	115.000	114.946	120.035	120.000	115.155	115.020	0.209	0.020
TSA 12050	120	125	50.5	49.5	2.5	120.000	119.946	125.040	125.000	120.210	120.070	0.264	0.070
TSA 12060	120	125	60.5	59.5	2.5	120.000	119.946	125.040	125.000	120.210	120.070	0.264	0.070
TSA 120100	120	125	100.75	99.25	2.5	120.000	119.946	125.040	125.000	120.210	120.070	0.264	0.070
TSA 12560	125	130	60.5	59.5	2.5	125.000	124.937	130.040	130.000	125.210	125.070	0.273	0.070
TSA 125100	125	130	100.75	99.25	2.5	125.000	124.937	130.040	130.000	125.210	125.070	0.273	0.070

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Cylindrical Bushings

Maintenance-free
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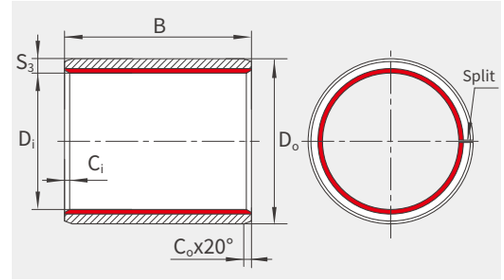
S_3	C_o	C_i	
		min.	max.
2.5	1.8 ± 0.6	0.2	1



TSA

Dimensional Table • Unit : mm

Product Number	D_i	D_o	B		S_3	Shaft Diameter		Housing Diameter		I.D. after assembly		Clearance	
			max.	min.		max.	min.	max.	min.	max.	min.	max.	min.
TSA 13060	130	135	60.5	59.5	2.5	130.000	129.937	135.040	135.000	130.210	130.070	0.273	0.070
TSA 130100	130	135	100.75	99.25	2.5	130.000	129.937	135.040	135.000	130.210	130.070	0.273	0.070
TSA 13560	135	140	60.5	59.5	2.5	135.000	134.937	140.040	140.000	135.210	135.070	0.273	0.070
TSA 13580	135	140	80.75	79.25	2.5	135.000	134.937	140.040	140.000	135.210	135.070	0.273	0.070
TSA 135100	135	140	100.75	99.25	2.5	135.000	134.937	140.040	140.000	135.210	135.070	0.273	0.070
TSA 14060	140	145	60.5	59.5	2.5	140.000	139.937	145.040	145.000	140.210	140.070	0.273	0.070
TSA 140100	140	145	100.75	99.25	2.5	140.000	139.937	145.040	145.000	140.210	140.070	0.273	0.070
TSA 15060	150	155	60.5	59.5	2.5	150.000	149.937	155.040	155.000	150.210	150.070	0.273	0.070
TSA 15080	150	155	80.75	79.25	2.5	150.000	149.937	155.040	155.000	150.210	150.070	0.273	0.070
TSA 150100	150	155	100.75	99.25	2.5	150.000	149.937	155.040	155.000	150.210	150.070	0.273	0.070
TSA 16060	160	165	60.5	59.5	2.5	160.000	159.937	165.040	165.000	160.210	160.070	0.273	0.070
TSA 16080	160	165	80.75	79.25	2.5	160.000	159.937	165.040	165.000	160.210	160.070	0.273	0.070
TSA 160100	160	165	100.75	99.25	2.5	160.000	159.937	165.040	165.000	160.210	160.070	0.273	0.070
TSA 170100	170	175	100.75	99.25	2.5	170.000	169.937	175.040	175.000	170.210	170.070	0.273	0.070
TSA 180100	180	185	100.75	99.25	2.5	180.000	179.937	185.046	185.000	180.216	180.070	0.279	0.070
TSA 200100	200	205	100.75	99.25	2.5	200.000	199.928	205.046	205.000	200.216	200.070	0.288	0.070
TSA 210100	210	215	100.75	99.25	2.5	210.000	209.928	215.046	215.000	210.216	210.070	0.288	0.070
TSA 220100	220	225	100.75	99.25	2.5	220.000	219.928	225.046	225.000	220.216	220.070	0.288	0.070
TSA 250100	250	255	100.75	99.25	2.5	250.000	249.928	255.052	255.000	250.222	250.070	0.294	0.070
TSA 300100	300	305	100.75	99.25	2.5	300.000	299.919	305.052	305.000	300.222	300.070	0.303	0.070

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