SAPPORO PRECISION INC.

HIGH PRECISION
BALL BEARINGS

Extra-thin-section Bearings
Flanged Bearings
Stainless-steel Bearings
Bore Dia , 0.6mm to 95mm

EZO
PRECISION BALL BEARINGS

Introduction of revised new catalogue EZO-CAT. No. E2301

In recent years, the next-generation technologies such as ICT and robotics are developing at a remarkable speed.
The bearings used in these advanced fields are expected to contribute to light-weight, high-speed, low-vibration, long-life and energy-saving for the machines and the devices, and to have the capability to be applied to a wide variety of applications.
Therefore, we have made a major change to the general catalogue enhancing the convenience for customers which includes but not limited to the following:

- Added the information of the characteristics of the bearing materials and the necessary information for calculating the bearing life with some calculation examples
- Enriched the contents of the sections for Fitting, Internal clearance and Lubrication
- Changed the layout of the product tables for easier searching for the necessary products.

We hope that our revised new catalogue will help you make the best choice of bearings for your various needs.
We will continue to contribute to realizing a sustainable society through providing "EZO Bearings".

PRECISION BALL BEARINGS

CONTENTS

Sapporo Precision group has a policy of complying with Foreign Exchange and Foreign Trade Act and other export-related laws and regulations, and we do not export restricted products and technology in violation of such laws and regulations. Customers are requested to obtain export permissions from authorities when exporting our products which are subject to restrictions.

NOTE1. All information, data and dimension tables in this catalogue have been compiled carefully and have been thoroughly checked. However, no responsibility for damages/losses caused by possible errors or omissions can be assumed.

NOTE2. We reserve the right to change specifications and other information included in this catalogue without notice.

01 > Bearing Numbering System and Auxiliary Symbols

Material

· High Carbon Chromium Bearing Steel	
SUJ2: No Symbol	
· Stainless Steel	
KS440 (QD51, ACD34): (Outer / Inner rings)	
SUS440C, ACD34 (Balls)	
· Standard Metric Series:	H
· MR, MF, ET and Inch Series:	S

Radial Clearance

· Standard deep groove ball bearing:
C2, C0 (CN), C3, C4, C5

· Miniature / small ball bearings:
MC1 0～ 5μm
MC2 3～ 8μm
MC3 5～10μm
MC4 8～13μm
MC5 13～20μm
MC6 20～28μm

Tolerance Class

· JIS Class 0:	P0 (The symbol may not be displayed)
JIS Class 6:	P6
JIS Class 5:	P5
JIS Class 4:	P4
· ANSI/ABMA ABEC1	A1 (The symbol may not be displayed)
ANSI/ABMA ABEC3	A3
ANSI/ABMA ABEC5	A5
ANSI/ABMA ABEC7	A7
· ANSI/ABMA High-precision instrument ball bearing Class 5P:	A5P
Class 7P:	A7P

Ex.1			688	H	J	ZZ		MC3		SRL
Ex.2		F	608		TW	2RS		MC4	P6	SRL
Ex.3		MR	52		W	ZZ		MC2	P5	AF2
Ex.4	S	MF	128		W	TTS		MC3	P6	SRL
Ex.5	S	ER	1458		W	ZZS		C0	A3	SRL
Ex.6			6205	H	RJ	2RS		C3		AV2
Ex.7		F	6706		W	2RU		C0		SRL
Ex.8	S	R	144		J	ZZS		MC4	A5P	AF2
Ex.9		R	10		RJ	ZZ	CB	C2		AF2
Ex.10		F	3—8M		TP					AF2

Lubricants

Main grease brands	
Multemp SRL (Our standard grease):	SRL
Alvania Grease S2:	AV2
Barrierta L55/2 H1:	L55
Molykote 33M:	M3M
Krytox 240AC:	K24
ISOFLEX SUPER LDS18:	SL8
Beacon 325J:	B32

Main oil brands	
AeroShell Fluid 12 (Our standard oil):	AF2
Windsor Lube L-245X:	WL2

Bearing Types

· Inch-series Single-Row Deep Groove Ball Bearing:	R
· Inch-series Single-Row Deep Groove Ball Bearing with Flange:	FR
· Inch-series Single-Row Deep Groove Ball Bearing with Extended Inner Ring:	RW
· Inch-series Single-Row Deep Groove Ball Bearing with Extended Inner Ring and Flange:	FRW
· Metric-series Single-Row Deep Groove Ball Bearing:	No symbol
· Metric-series Single-Row Deep Groove Ball Bearing with Flange:	F
· Special Metric-series Single-Row Deep Groove Ball Bearing:	MR
· Special Metric-series Single-Row Deep Groove Ball Bearing with Flange:	MF
· Special Metric-series Extra Thin Single-Row Deep Groove Ball Bearing:	ET
· Special Inch-series Extra Thin Single-Row Deep Groove Ball Bearing:	ER
· Thrust Ball Bearing with Raceway:	FM
· Thrust Ball Bearing without Raceway:	F

· Ceramic Balls [Si_3N_4]:	CB

Seals & Shields

· Teflon Seals with Snap Rings on Both Sides [PTFE]:	TTS
· Steel Shields with Snap Rings on Both Sides [SUS304]:	ZZS
· Pressed-steel Shields on Both Sides [SPCC, SECC-NC, SUS304]:	ZZ
· Contact Rubber Seals on Both Sides [NBR+SPCC]:	2RS
· Non-Contact Rubber Seals on Both Sides [NBR+SPCC]:	2RU

Bearing Basic Part No.

· SINGLE ROW DEEP GROOVE BALL BEARING METRIC SERIES:
67, 68, 69, 60, 16, 62, 63

· METRIC SERIES BORE DIAMETER NUMBER:
NUMBERS 1-9, DENOTE BORE DIAMETERS IN mm
1X=1.5mm, 2X=2.5mm
00=10mm, 01=12mm, 02=15mm, 03=17mm
04～96: ×5 values denote bore dimensions in mm

Cages (The symbol may not be displayed)

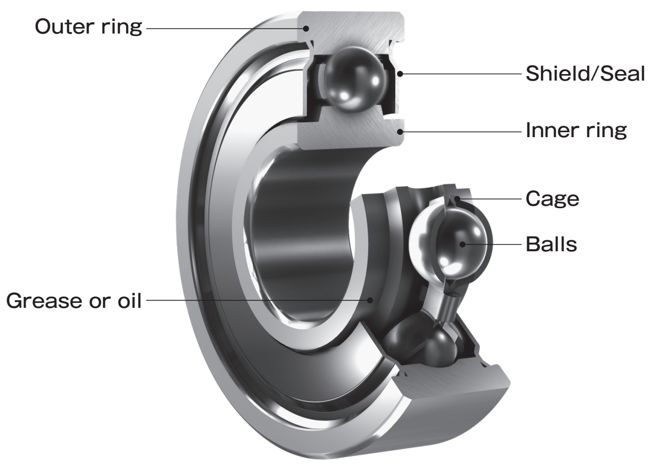
· Two-Piece Steel Ribbon Type [SPCC, SUS304]:	J
· One-Piece Steel Snap Type [SUS304, SUS420J2]:	W
· One-Piece Nylon Snap Type [66 nylon]:	TW
· Two-Piece Steel Rivet Type [SPCC, SUS304]:	RJ
· Full Complement Type (without Cage):	V
· Thrust FM Type [SUS304]:	TP
· Thrust F Type [brass]:	TD

Following special bearings are also available on certain conditions upon request.
Please contact us for details.

- FULL-COMPLEMENT BALL BEARING
- DOUBLE-ROW DEEP GROOVE BEARING
- ANGULAR CONTACT BEARING
- DOUBLE-ROW ANGULAR CONTACT BEARING
- FOUR-POINT CONTACT BEARING
- DUPLEX DEEP GROOVE BEARING
- DUPLEX ANGULAR CONTACT BEARING
- OUTER SURCACE SPECIAL SHAPE BEARING (SPHERICAL SURCACE, R SURFACE, V GROOVE, U GROOVE, etc.)
- HYBRID BEARING (WITH CERAMIC BALLS)

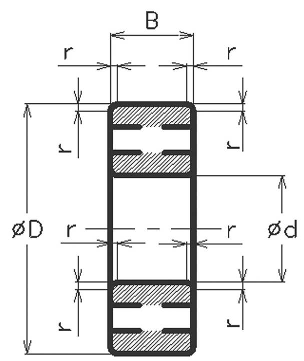
02 > Design and Characteristics of Bearings

Bearing Structure

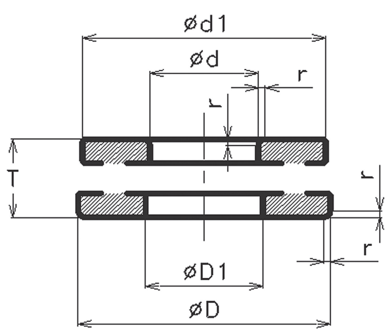


Boundary Dimensions

The boundary dimensions of bearings are the dimensions which indicate the external geometry of a bearing, including the bore diameter d, outside diameter D, width B or height T, and chamfer dimension r. These dimensions are required when mounting a bearing on a shaft or in housings.



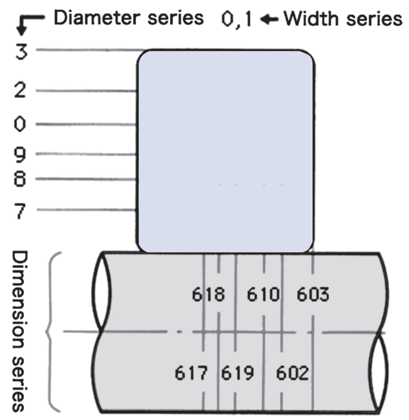
d : Nominal bore diameter
D : Nominal outside diameter
B : Nominal bearing width
r : Chamfer dimensions of inner ring and outer ring (Minimum value)



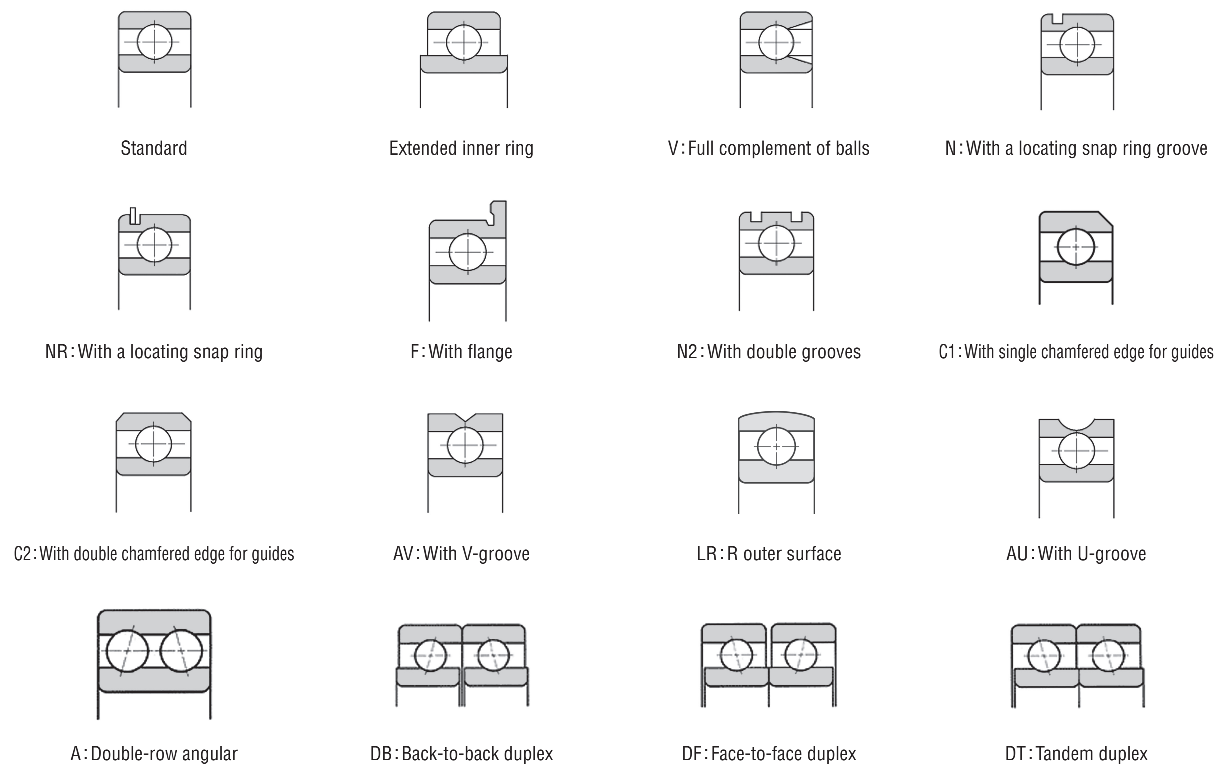
d : Nominal bore diameter of shaft washer (inner ring)
d1 : Nominal outside diameter of shaft washer (inner ring)
D : Nominal outside diameter of housing washer (outer ring)
D1 : Nominal bore diameter of housing washer (outer ring)
T : Nominal height of bearing
r : Chamfer dimensions of shaft washer (inner ring) and housing washer (outer ring) (Minimum value)

Difference by Dimension Series of Bearing Cross-Section

The outside diameter and width dimension of the diameter series increase in order from 7 → 3 to the same bore diameter dimension.



Bearing Types



Features of Bearings

Load	Single-row deep groove ball bearings can support an axial load on both sides and moment loads in addition to a radial load. However, full complement ball bearings are for low speed radial loads, and can only support a slight axial load.
Rotational speed	The limiting speed differs by the bearing dimensions, manufacturing accuracy, type of cages, lubrication method, sealing method and load.
Torque and Noise	Single-row deep groove ball bearings manufactured with high accuracy demonstrate low torque and noise.
Inclination of outer ring / inner ring	Inclination occurs between the outer and inner rings of a bearing when there is poor accuracy of the shaft and housing, mounting errors and deflection of the shaft. However, the internal clearance of the bearing will allow such inclination to some extent.
Rigidity	When loads are imposed on a bearing, some elastic deformation occurs in the contact areas between the rolling elements and the raceways. The amount of elastic deformation changes according to the dimensions and type of bearing and the load applied to it, and bearings with larger dimensions demonstrate higher rigidity.
Mounting and Dismounting	Single-row deep groove ball bearings are a non-separable bearing therefore, it is necessary to design the shaft and housing in consideration of periodic inspections and replacement.
Positioning of axial direction	Bearings with flange and locating snap ring are more effective for positioning the axial direction.

Classification by Bearing Dimensions

※Unit:mm

Bearing Classification of Our Company	Nominal bore diameter	Nominal outer diameter
Extra-miniature bearing	d≦2	D≦7
Miniature bearing	d≦5	D<9
Small bearing	d<10	D≧9
Large bearing	d≧10	D≧15

03 > Bearing Materials

For the material of the outer ring, inner ring and balls, high-carbon chromium bearing steel treated with vacuum degassing is used in order to improve the torque and noise level, as well as to extend the bearing life. Also, martensitic stainless steel is used to meet corrosion-resistant requirements.

Chemical Composition of Bearing Materials

Material		High Carbon Chromium Bearing Steel	Stainless Steel			Ceramic
Components		Inner ring, outer ring, balls	Inner ring, outer ring	Balls		Balls
Symbol		SUJ2	KS440 (QD51、ACD34)	SUS440C	ACD34 (Note 1)	Si_3N_4
Chemical composition (Weight %)	C	0.95～1.10	0.60～0.75	0.95～1.20	0.60～0.75	—
	Si	0.15～0.35	≦1.00	≦1.00	≦1.00	—
	Mn	≦0.50	≦1.00	≦1.00	≦1.00	—
	P	≦0.025	≦0.030	≦0.040	≦0.030	—
	S	≦0.025	≦0.020	≦0.030	≦0.020	—
	Cr	1.30～1.60	11.5～13.5	16.0～18.0	11.5～13.5	—
	Mo	≦0.08	≦0.30	≦0.75	≦0.30	—
	Ni	≦0.25	≦0.60	—	≦0.60	—
	Cu	≦0.25	≦0.20	—	≦0.20	—
	V	—	≦0.15	—	≦0.15	—
	Y	—	—	—	—	3.0～4.0
	Al	—	—	—	—	3.2～4.2
	Ti	—	—	—	—	0.5～1.0
Hardness HRC		60～64 (Inner ring, outer ring) 62～67 (Balls)	58～62	59～66		HV1300～2000
Similar steel grades (outside Japan)		SAE52100、100Cr6、ASTM52100、BS535A99、1.3505	X65Cr13、1.4037	SAE51440C、AISI440C、X102CrMo17、X105CrMo17、1.4125、1.3543	X65Cr13、1.4037	—

Note 1: Used for ball diameters of 0.500mm and 0.635mm.

Materials and Characteristics

		High carbon chromium bearing steel		Stainless steel
Material	Raceways and balls	High carbon chromium bearing steel		Stainless steel
	Cages	Low carbon steel plate (SPCC), stainless steel plate (SUS304, SUS420J2)	Polyamide (66 nylon), etc.	Stainless steel plate (SUS304, SUS420J2), polyamide (66 nylon), etc.
	Shields	Low carbon steel plate (SPCC, SECC-NC), stainless steel plate (SUS304)		Stainless steel plate (SUS304)
	Seals	Rubber (Nitrile rubber (NBR), fluoro rubber (FKM)) + core plate (SPCC-NP, SECC-NC), PTFE		
Characteristics	Operating temperature	120℃ or less (*Up to a maximum of 300℃ is possible depending on the dimensional stabilization treatment and/or other specifications)		
	Dynamic load rating	High		About 85% of bearing steel
	Static load rating	High		About 80% of bearing steel
	Friction torque	Low		Slightly higher than bearing steel
	Application	For general use & high precision	For high-speed	For corrosion resistance

Physical and Mechanical Properties of Materials

Materials		Specific Gravity	Coefficient of Linear Expansion (1/℃), [0～100℃]	Hardness (Brinell: HB)	Young's Modulus (MPa) 〔kgf/mm²〕	Tensile Strength (MPa) 〔kgf/mm²〕	Yield Point (MPa) 〔kgf/mm²〕	Elongation (%)
SUJ2		7.83	12.5×10^{-6}	650～740	208000 〔21200〕	1570～1960 〔160～200〕	—	—
KS440		7.70	10.3×10^{-6}	580	210000 〔21400〕	1900 〔194〕	—	—
SUS440C		7.68	10.1×10^{-6}	580	200000 〔20400〕	1960 〔200〕	1860 〔190〕	—
SUS420J2		7.75	10.4×10^{-6}	400	200000 〔20400〕	1650 〔168〕	1440 〔147〕	12
SUS304		7.93	17.3×10^{-6}	150	193000 〔19700〕	510～657 〔52～67〕	510～656 〔21～32〕	50～60
Mild steel (C=0.12～0.2%)		7.86	11.6×10^{-6}	100～130	208000 〔21200〕	373～471 〔38～48〕	216～294 〔22～30〕	24～36
Hard steel (C=0.3～0.5%)		7.84	11.3×10^{-6}	160～200	205000 〔20900〕	539～686 〔55～70〕	333～451 〔34～46〕	14～26
Cast iron	Gray iron FC20	7.30	10.4×10^{-6}	160～180	98100 〔10000〕	167～265 〔17～27〕	—	—
	Spheroidal graphite cast iron FCD40	7.00	11.7×10^{-6}	120～190		392 or more 〔40〕		12 or more
Copper		8.93	16.2×10^{-6}	50	123000 〔12500〕	196 〔20〕	69 〔7〕	15～20
Brass	(Annealed)	8.50	19.1×10^{-6}	About 45	103000 〔10500〕	294～343〔30～35〕	—	65～75
	(Machined)			85～130		363～539〔37～55〕		15～50
Zinc		7.14	31.0×10^{-6}	30～60	92000 〔9400〕	147 〔15〕	—	30～40
Aluminum		2.69	23.7×10^{-6}	15～26	70600 〔7200〕	78 〔8〕	34 〔3.5〕	35
Ceramic (Si_3N_4)		3.20	$(2.5～3.3)\times10^{-6}$	HV1300～2000	245000～314000 〔25000～32000〕	—	—	—

Comparison Table of SI, CGS and Engineering Units

	Length	Mass	Time	Temperature	Acceleration	Force	Stress	Pressure	Energy	Power
SI	m	kg	s	K	m/s²	N	Pa	Pa	J	W
CGS System	cm	g	s	℃	Gal	dyn	dyn/cm²	dyn/cm²	erg	erg/s
Engineering Unit System	m	kgf·s²/m	s	℃	m/s²	kgf	kgf/m²	kgf/m²	kgf·m	kgf·m/s

Prefixes of SI Units

Multiples	10^{18}	10^{15}	10^{12}	10^{9}	10^{6}	10^{3}	10^{2}	10^{1}	10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}	10^{-18}
Prefix	Exa	Peta	Tera	Giga	Mega	Kilo	Hecto	Deca	Deci	Centi	Milli	Micro	Nano	Pico	Femto	Ato
Symbols	E	P	T	G	M	k	h	da	d	c	m	μ	n	p	f	a

04 > Types and Characteristics of Cages, Shields and Seals

Cages

W: One-piece Steel Snap Type

The snap type is made by integrally molding stainless steel in press processing. And the inner ring guided design realizes extremely high performance with low torque during low speed rotation.
Standard ball diameter: φ0.5 - φ1.588

J: Two-piece Steel Ribbon Type

For the ribbon type, a ball shaped pocket consists of two parts including a lid side and a claw side, to match the shape of the balls. Generally, this type is ball guided and designed for reducing friction torque during rotation.
Standard ball diameter: φ1.2 - φ4.762

RJ: Two-piece Steel Rivet Type

This type is suitable for larger bearings with high loads applied. Two ribbon shaped parts are riveted together to provide strength against vibration and acceleration. This type is ball guided and designed for reducing the friction torque during rotation.
Standard ball diameter: φ4.762 or larger

TW: One-piece Nylon Snap Type

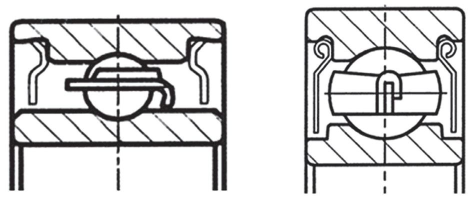
The molded nylon cage is ball guided and can endure high-speeds with less fluctuation in the running torque. In addition to the standard type made from 66 nylon, a stronger material containing glass fiber is also available. Operating temperature range (-30 to +120℃).
Standard ball diameter: φ1.2 - φ9.525

V: Full complement of balls

This type, for low-speed applications, incorporates the maximum number of balls allowed in design to endure a heavy radial load without use of a cage. It can only bear a small axial load because a slot groove is located on the outer ring and the inner ring, respectively.

Shields and Seals

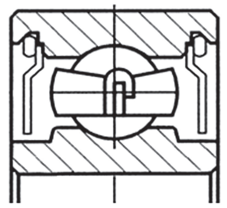
ZZ: Pressed-steel shields



Root shield　　Curl shield

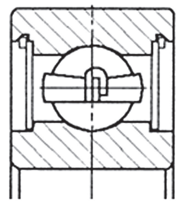
Consists of a structure that presses the steel shields into the outer ring. There is little grease leakage and less intrusion of external contaminants.

ZZS: Steel shields with snap rings



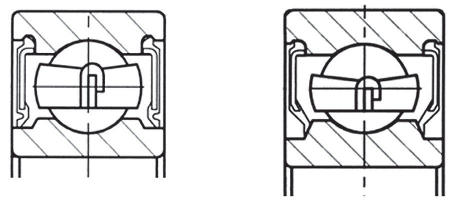
Consists of a structure where steel shields are retained in the outer ring with snap rings. There is less intrusion of external contaminants. This is mainly used for small bearings or thin-section bearings. There is less increase in torque, noises and temperature.

TTS: Teflon seals with snap rings



Consists of a structure where teflon seals reinforced with glass fiber are retained in the outer ring with snap rings. There is less intrusion of external contaminants. This is mainly used for small bearings or thin-section bearings. This structure allows the seal to breathe along with the change in the internal pressure.
Limited operating temperature range: -100 to +260℃

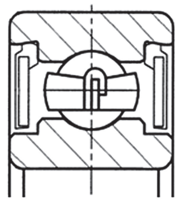
2RS: Contact rubber seals



Radial contact　　Axial contact

Consists of a structure where rubber seals are fitted in the outer ring. Since the rubber seal contacts the inner ring, there is very little intrusion of external contaminants. Mainly, NBR is used for the seal material. Limiting operating temperature range: -40 to +120℃.
A fluoro rubber (FKM) type is also available for high temperatures.
Limited operating temperature range: -30 to +230℃.

2RU: Non-contact rubber seals



Consists of a structure where rubber seals are fitted in the outer ring. The rubber seal does not contact the inner ring, and there is also less intrusion of external contaminants. There is less increase in torque, noise and temperature. Mainly, NBR is used for the seal material.
Limiting operating temperature range: -40 to +120℃.

Tolerances of inner ring and outer ring width of radial ball bearings

Unit: μm

Nominal bore diameter d (mm)		Single plane mean bore diameter deviation Δ_{dmp}					Deviation of a single bore diameter Δ_{ds}		Bore diameter variation in single plane V_{dsp}										Mean bore diameter variation V_{dmp}			
		P0		P6	P5	P4	P4		P0			P6			P5		P4		P0	P6	P5	P4
							Diameter series		Diameter series			Diameter series			Diameter series		Diameter series					
							0,1,2,3		7,8,9	0,1	2,3	7,8,9	0,1	2,3	7,8,9	0,1,2,3	7,8,9	0,1,2,3				
Over	or less	Upper	Lower	Lower	Lower	Lower	Upper	Lower	Max.			Max.			Max.		Max.		Max.	Max.	Max.	Max.
0.6(1)	2.5	0	−8	−7	−5	−4	0	−4	10	8	6	9	7	5	5	4	4	3	6	5	3	2
2.5	10	0	−8	−7	−5	−4	0	−4	10	8	6	9	7	5	5	4	4	3	6	5	3	2
10	18	0	−8	−7	−5	−4	0	−4	10	8	6	9	7	5	5	4	4	3	6	5	3	2
18	30	0	−10	−8	−6	−5	0	−5	13	10	8	10	8	6	6	5	5	4	8	6	3	2.5
30	50	0	−12	−10	−8	−6	0	−6	15	12	9	13	10	8	8	6	6	5	9	8	4	3
50	80	0	−15	−12	−9	−7	0	−7	19	19	11	15	15	9	9	7	7	5	11	9	5	3.5
80	120	0	−20	−15	−10	−8	0	−8	25	25	15	19	19	11	10	8	8	6	15	11	5	4
120	180	0	−25	−18	−13	−10	0	−10	31	31	19	23	23	14	13	10	10	8	19	14	7	5

Unit: μm

Nominal bore diameter d (mm)		Deviation of a single inner ring (or outer ring) width (2) Δ_{Bs} (or Δ_{Cs})						Inner ring (or outer ring) width variation (2) and variation of outer ring flange width (2) V_{Bs} (or V_{Cs}) and V_{C1s}				Radial runout of assembled bearing inner ring K_{ia}				Perpendicularity of inner ring face with respect to the bore S_d		Assembled bearing inner ring face (back face) runout with raceway S_{ia}	
		Single bearing			Duplex bearing			Inner ring (or outer ring)		Inner ring		P0	P6	P5	P4	P5	P4	P5	P4
		P0 P6		P5 P4	P0 P6		P5 P4	P0	P6	P5	P4								
Over	or less	Upper	Lower	Lower	Upper	Lower	Lower	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.
0.6(1)	2.5	0	−40	−40	—	—	—	12	12	5	2.5	10	5	4	2.5	7	3	7	3
2.5	10	0	−120	−40	0	−250	−250	15	15	5	2.5	10	6	4	2.5	7	3	7	3
10	18	0	−120	−80	0	−250	−250	20	20	5	2.5	10	7	4	2.5	7	3	7	3
18	30	0	−120	−120	0	−250	−250	20	20	5	2.5	13	8	4	3	8	4	8	4
30	50	0	−120	−120	0	−250	−250	20	20	5	3	15	10	5	4	8	4	8	4
50	80	0	−150	−150	0	−380	−250	25	25	6	4	20	10	5	4	8	5	8	5
80	120	0	−200	−200	0	−380	−380	25	25	7	4	25	13	6	5	9	5	9	5
120	180	0	−250	−250	0	−500	−380	30	30	8	5	30	18	8	6	10	6	10	7

Notes
(1) 0.6 mm is included in this dimension classification.
(2) The deviation and variation of the outer ring width are determined based on the inner ring values of the same bearing. The variation of the outer ring width of P5 and P4 is obtained from the table "Tolerance of outer ring of radial ball bearings".

Remarks
1. The upper tolerance of the bearing bore diameter defined in this table is not applicable to the distance within 1.2 times the chamfer dimension r_{smax} from the ring face.
2. ABEC1, ABEC3, ABEC5 and ABEC7 of the inch series is equivalent to P0, P6, P5 and P4 of the metric series, respectively.
3. Please contact our company when the tolerance class is P2 or the tolerance is not indicated in the above table.

Tolerances of outer ring of radial ball bearings

Unit: μm

Nominal outside diameter D (mm)		Single plane mean bore diameter deviation Δ_{Dmp}					Deviation of a single outside diameter Δ_{Ds}		Outside diameter variation in a single radial plane (2) V_{Dsp}												Mean outside diameter variation (2) V_{Dmp}			
		P0		P6	P5	P4	P4		P0				P6				P5		P4		P0	P6	P5	P4
									Open type			Sealed type	Open type			Sealed type	Open type		Open type					
							Diameter series		Diameter series				Diameter series				Diameter series		Diameter series					
							0,1,2,3		7,8,9	0,1	2,3	2,3	7,8,9	0,1	0,1,2,3	0,1,2,3	7,8,9	0,1,2,3	7,8,9	0,1,2,3				
Over	or less	Upper	Lower	Lower	Lower	Lower	Upper	Lower	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.
2.5(1)	6	0	−8	−7	−5	−4	0	−4	10	8	6	10	9	7	5	9	5	4	4	3	6	5	3	2
6	18	0	−8	−7	−5	−4	0	−4	10	8	6	10	9	7	5	9	5	4	4	3	6	5	3	2
18	30	0	−9	−8	−6	−5	0	−5	12	9	7	12	10	8	6	10	6	5	5	4	7	6	3	2.5
30	50	0	−11	−9	−7	−6	0	−6	14	11	8	16	11	9	7	13	7	5	6	5	8	7	4	3
50	80	0	−13	−11	−9	−7	0	−7	16	13	10	20	14	11	8	16	9	7	7	5	10	8	5	3.5
80	120	0	−15	−13	−10	−8	0	−8	19	19	11	26	16	16	10	20	10	8	8	6	11	10	5	4
120	150	0	−18	−15	−11	−9	0	−9	23	23	14	30	19	19	11	25	11	8	9	7	14	11	6	5
150	180	0	−25	−18	−13	−10	0	−10	31	31	19	38	23	23	14	30	13	10	10	8	19	14	7	5

Unit: μm

Nominal outside diameter D (mm)		Radial runout of assembled bearing outer ring K_{ea}				Perpendicularity of outer ring outside surface with respect to the face S_D		Assembled bearing outer ring face (back face) runout with raceway S_{ea}		Axial runout of outer ring flange back face of assembled bearing S_{eal}		Outer ring width variation (3) and variation of outer ring flange width (3) V_{Cs} V_{C1s}	
		P0	P6	P5	P4	P5	P4	P5	P4	P5	P4	P5	P4
Over	or less	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.
2.5(1)	6	15	8	5	3	8	4	8	5	11	7	5	2.5
6	18	15	8	5	3	8	4	8	5	11	7	5	2.5
18	30	15	9	6	4	8	4	8	5	11	7	5	2.5
30	50	20	10	7	5	8	4	8	5	11	7	5	2.5
50	80	25	13	8	5	8	4	10	5	14	7	6	3
80	120	35	18	10	6	9	5	11	6	16	8	8	4
120	150	40	20	11	7	10	5	13	7	18	10	8	5
150	180	45	23	13	8	10	5	14	8	20	11	8	5

Notes
(1) 2.5 mm is included in this dimension classification.
(2) This is applicable when the snap ring is not mounted.
(3) The width variation of the outer ring of P0 and P6 is based on the tolerance of the inner ring.

Remarks
1. The lower tolerance of the bearing outside diameter defined in this table is not applicable to the distance within 1.2 times the chamfer dimension r_{smax} from the the ring face.
2. ABEC1, ABEC3, ABEC5 and ABEC7 of the inch series is equivalent to P0, P6, P5 and P4 of the metric series, respectively.
3. Please contact our company when the tolerance class is P2 or the tolerance is not indicated in the above table.

Unit: μm

Nominal flange outside diameter D1 (mm)		Deviation of a single outside diameter of outer ring flange Δ_{D1s}			
		P0 P6		P5 P4	
Over	or less	Upper	Lower	Upper	Lower
2.5 (1)	6	125	−50	0	−25
6	18	125	−50	0	−25
18	30	125	−50	0	−52
30	50	125	−50	0	−62
50	80	460	−74	0	−74
80	120	540	−87	0	−87
120	150	630	−100	0	−100
150	180	630	−100	0	−100

Unit: μm

Nominal bore diameter d (mm)		Deviation of a single outer ring flange width Δ_{C1s}	
		P0 P5 P6 P4	
Over	or less	Upper	Lower
0.6 (1)	2.5	0	−50
2.5	10	0	−50
10	18	0	−50
18	30	0	−50
30	50	0	−120
50	80	0	−150
80	120	0	−200
120	150	0	−250

Notes

(1) 2.5 mm is included in this dimension classification.

Remarks

1. The lower tolerance of the bearing outside diameter defined in this table is not applicable to the distance within 1.2 times the chamfer dimension r_{smax} from the the ring face.
2. ABEC1, ABEC3, ABEC5 and ABEC7 of the inch series is equivalent to P0, P6, P5 and P4 of the metric series, respectively.
3. Please contact our company when the tolerance class is P2 or the tolerance is not indicated in the above table.

Tolerances of inner ring and outer ring width of radial ball bearings (high-precision instrument ball bearings)

Unit: μm

Nominal bore diameter d (mm)		Single plane mean bore diameter deviation Δ_{dmp}		Deviation of a single bore diameter Δ_{ds}		Bore diameter variation in single plane V_{dsp}	Mean bore diameter variation V_{dmp}	Deviation of a single inner ring width Δ_{Bs}		Inner ring width variation Δ_{Bs}		Radial runout of assembled bearing inner ring K_{ia}		Assembled bearing inner ring face (back face) runout with raceway S_{ia}		Perpendicularity of inner ring face with respect to the bore S_d	
		ABEC5P ABEC7P		ABEC5P ABEC7P		ABEC5P ABEC7P	ABEC5P ABEC7P	ABEC5P ABEC7P		ABEC 5P	ABEC 7P	ABEC 5P	ABEC 7P	ABEC 5P	ABEC 7P	ABEC 5P	ABEC 7P
Over	or less	Upper	Lower	Upper	Lower	Max.	Max.	Upper	Lower	Max.		Max.		Max.		Max.	
—	10	0	−5.1	0	−5.1	2.5	2.5	0	−25.4	5.1	2.5	3.8	2.5	7.6	2.5	7.6	2.5
10	18	0	−5.1	0	−5.1	2.5	2.5	0	−25.4	5.1	2.5	3.8	2.5	7.6	2.5	7.6	2.5
18	30	0	−5.1	0	−5.1	2.5	2.5	0	−25.4	5.1	2.5	3.8	3.8	7.6	3.8	7.6	3.8

Tolerances of outer ring of radial ball bearings (high-precision instrument ball bearings)

Unit: μm

Nominal outer diameter D (mm)		Single plane mean bore diameter deviation Δ_{Dmp}		Deviation of a single outside diameter Δ_{Ds}				Outside diameter variation in a single radial plane (2) V_{Dsp}		Mean outside diameter variation (2) V_{Dmp}		Deviation of a single outer ring width Δ_{Cs}		Outer ring width variation (1) V_{Cs}		Perpendicularity of outer ring outside surface with respect to the face S_D		Radial runout of assembled bearing outer ring K_{ea}		Assembled bearing outer ring face (back face) runout with raceway S_{ea}	
		ABEC5P ABEC7P		Open type		Sealed type		ABEC5P ABEC7P		ABEC5P ABEC7P		ABEC5P ABEC7P		ABEC 5P	ABEC 7P	ABEC 5P	ABEC 7P	ABEC 5P	ABEC 7P	ABEC 5P	ABEC 7P
				ABEC5P ABEC7P		ABEC5P ABEC7P		Open type	Sealed type	Open type	Sealed type										
Over	or less	Upper	Lower	Upper	Lower	Upper	Lower	Max.	Max.	Max.	Max.	Upper	Lower	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.
—	18	0	−5.1	0	−5.1	+1.0	−6.1	2.5	5.1	2.5	5.1	0	−25.4	5.1	2.5	7.6	3.8	5.1	3.8	7.6	5.1
18	30	0	−5.1	0	−5.1	+1.0	−6.1	2.5	5.1	2.5	5.1	0	−25.4	5.1	2.5	7.6	3.8	5.1	3.8	7.6	5.1
30	50	0	−5.1	0	−5.1	+1.0	−6.1	2.5	5.1	2.5	5.1	0	−25.4	5.1	2.5	7.6	3.8	5.1	5.1	7.6	5.1

Unit: μm

Nominal outside outer D (mm)		Deviation of a single outside diameter of outer ring flange Δ_{D1s}		Deviation of a single outer ring flange width Δ_{C1s}		Variation of outer ring flange width V_{C1s}		Axial runout of outer ring flange back face of assembled bearing S_{ea1}
		ABEC5P ABEC7P		ABEC5P ABEC7P		ABEC5P ABEC7P		ABEC5P ABEC7P
Over	or less	Upper	Lower	Upper	Lower	Max.	Max.	Max.
—	18	0	−25.4	0	−50.8	5.1	2.5	7.6
18	30	0	−25.4	0	−50.8	5.1	2.5	7.6
30	50	0	−25.4	0	−50.8	5.1	2.5	7.6

Notes

(1) This is also applicable to the flange width variation of a flanged bearing.

Remarks

1. ABEC5P and ABEC7P is the tolerance and class of high-precision instrument ball bearings.
2. Please contact our company when the tolerance class is ABEC9P or the tolerance is not indicated in the above table.

Tolerances of thrust ball bearings

●Tolerances of shaft washer (inner ring)

Unit: μm

Class	Nominal bore diameter d (mm)		Single plane mean bore diameter deviation Δ_{dmp}		Bore diameter variation in single plane V_{dsp}	Raceway to back face thickness variation of shaft washer (inner ring) S_i
	Over	or less	Upper	Lower	Max.	Max.
P0	—	18	0	−8	6	10
	18	30	0	−10	8	10
	30	50	0	−12	9	10
P6	—	18	0	−8	6	5
	18	30	0	−10	8	5
	30	50	0	−12	9	6
P5	—	18	0	−8	6	3
	18	30	0	−10	8	3
	30	50	0	−12	9	3
P4	—	18	0	−7	5	2
	18	30	0	−8	6	2
	30	50	0	−10	8	2

●Tolerances of housing washer (outer ring)

Unit: μm

Class	Nominal outer diameter D (mm)		Single plane mean bore diameter deviation Δ_{Dmp}		Outside diameter variation in a single radial plane (2) V_{Dsp}	Raceway to back face thickness variation of housing washer (outer ring) S_e
	Over	or less	Upper	Lower	Max.	Max.
P0	—	18	0	−11	8	Same as the value of S_i for d of the same bearing
	18	30	0	−13	10	
	30	50	0	−16	12	
P6	—	18	0	−11	8	
	18	30	0	−13	10	
	30	50	0	−16	12	
P5	—	18	0	−11	8	
	18	30	0	−13	10	
	30	50	0	−16	12	
P4	—	18	0	−7	5	
	18	30	0	−8	6	
	30	50	0	−9	7	

●Tolerance of bearing height

Unit: μm

Class	Nominal bore diameter d (mm)		Deviation of the actual bearing height Δ_{Ts}	
	Over	or less	Upper	Lower
P0、P6、P5、P4	—	50	+20	−250

Selection Criteria of Tolerance

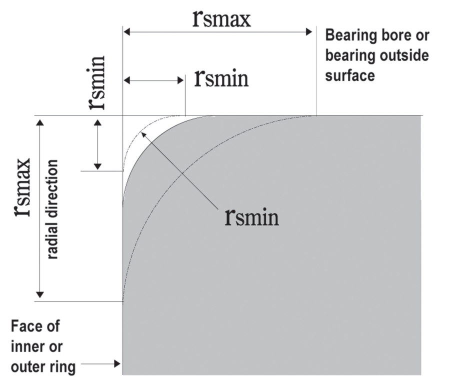
Required Function	Application Examples	Tolerance Class
General precision	Small-size motors, gear mechanisms, cam mechanisms, generators, stepper motor, pinch rollers, printers, copy mechanisms and measuring instruments	P0、P6、ABEC1、ABEC3
Low torque and slight torque fluctuation	High frequency spindles, servomotors, potentiometers, gyroscope gimbals	P4、ABEC7P
High-speed operation	Turbochargers, centrifugal separators, dental drill spindles, high frequency spindles, tension reels	P5、P4、ABEC5P、ABEC7P
High rotational accuracy	Hard disk motors, encoders, polygon mirror motors, synchronous motors, machine tool spindles	P5、P4、ABEC5P、ABEC7P
Corrosion resistance	Dental drill spindles, surgery assist robots, in vitro fertilization device, peristalsis pumps	P5、P4、ABEC5P、ABEC7P
	Food processors, food and beverage filling machines, electric adjustable beds, robot suits for nursing care	P0、P6、ABEC1、ABEC3

Chamfer Dimensions Limits for Radial Bearings

Permissible chamfer dimensions of inner/outer rings r_{smin}	Nominal bore diameter d (mm)		Permissible chamfer dimensions of inner/outer rings r_{smax}		(Reference) Radius of rounded corners of shafts or housings r_{amax}
	Over	or less	Radial direction	Axial direction	
0.05	—	—	0.1	0.2	0.05
0.08	—	—	0.16	0.3	0.08
0.1	—	—	0.2	0.4	0.1
0.15	—	—	0.3	0.6	0.15
0.2	—	—	0.5	0.8	0.2
0.25	—	—	0.55	0.9	0.25
0.3	—	40	0.6	1	0.3
	40	—	0.8	1	
0.4	—	—	0.7	1.1	0.4
0.5	—	—	0.9	1.2	0.5
0.6	—	40	1	2	0.6
	40	—	1.3	2	
0.8	—	—	1.2	2.2	0.8
1	—	50	1.5	3	1
	50	—	1.9	3	
1.1	—	120	2	3.5	1
	120	—	2.5	4	
1.5	—	120	2.3	4	1.5
	120	—	3	5	

Chamfer Dimensions Limits for Thrust Bearings

Permissible chamfer dimensions of inner/outer rings r_{smin}	Permissible chamfer dimensions of inner/outer rings r_{smax}	(Reference) Radius of rounded corners of shafts or housings r_{amax}
	Radial direction and axial direction	
0.05	0.1	0.05
0.08	0.16	0.08
0.1	0.2	0.1
0.15	0.3	0.15
0.2	0.5	0.2
0.3	0.8	0.3
0.6	1.5	0.6
1	2.2	1
1.1	2.7	1.1



rs: Chamfer dimension of inner/outer rings

Remarks

1. There are no regulations for the accurate shape of the chamfered surface. However, the profile in the axial plane must not extend outside the virtual arc of the radius rsmin which contacts the face of the inner ring and bearing bore, or the face of the outer ring and bearing outside diameter.

06 > Life and Load Rating

Bearing Life

- The raceway and raceway surface of the inner/outer rings of the bearing continuously receive a repeated load, when rotated with a load applied. This causes material fatigue that results in a damage called flaking. The total rotational frequency to this point is called rolling fatigue life.
- The life of a bearing is based on a statistical value because there is a considerably large variation even though the same dimensions, material and heat treatment processing method are used to operate the bearing under the same conditions. Therefore, generally, the total rotating speed in which 90% of the bearings can be operated without the occurrence of flaking is called the basic rating life.

Basic Dynamic Load Rating

The basic dynamic load rating is the constant load applied in a direction under which the basic rating life of the bearing reaches 1 million revolutions. This is the centric radial load in radial bearings, and the centric axial load in thrust bearings. Also, for duplex bearings that consist of two single-row radial bearings with adjusted standouts, the basic dynamic load rating is converted by about 1.62 times that of a single-row bearing.

Life Equation

The relationships between the basic dynamic load rating, dynamic equivalent load, and the basic rating life of ball bearings are as follows.

Total rotating speed	$L_{10}=(C/P)^3\times10^6$ (Revolutions)
Operating hours	$L_{10h}=(C/P)^3\times16667/n$ (hours)
Distance	$L_{10d}=\pi\times D\times L_{10}\times10^{-6}$ (km)
Minimum basic dynamic load rating for operating conditions	$C_{min}=P\times(L_{10h}\times n/16667)^{1/3}$ (N)

- L_{10}=basic rating life (rev)
- L_{10h}=basic rating life (h)
- L_{10d}=basic rating life (km)
- P=dynamic equivalent load (N)
  ※ Expressed as P_r in radial bearings and P_a in thrust bearings
- C=basic dynamic load rating (N)
  ※ Expressed as C_r in radial bearings and C_a in thrust bearings
- C_{min}=minimum basic dynamic load rating (N)
- n=rotating speed (min^{-1})
- D=rotating body outside diameter dimension (mm)

L_{10h} can be obtained by the following equation using life factor (f_h) and speed factor (f_n).
$L_{10h}=500\times f_h^3$、 $f_h=f_n\times C/P$、 $f_n=(33.3/n)^{(1/3)}$

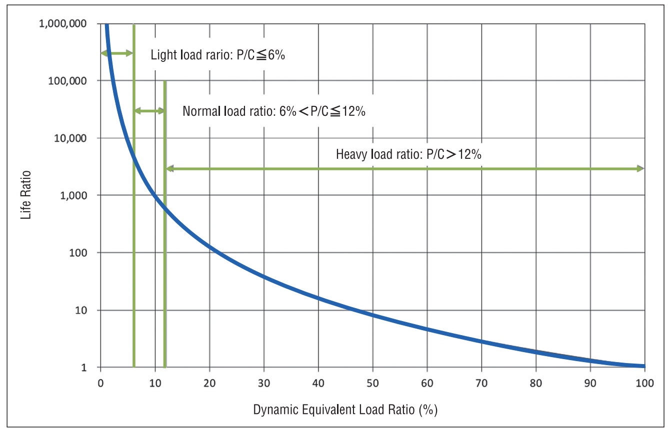
●How to select basic rating life L_{10h}

Operating Conditions of a Machine	Basic rating life (h) L_{10h}
In the case of low frequency of use	500
In the case of no great effect when a machine used for a short time or intermittently fails	4,000~8,000
In the case of great effect when a machine used intermittently fails	8,000~12,000
When a machine is used for 8 hours per day without being in full operation at all times	12,000~20,000
When a machine is operated full time 8 hours per day	20,000~30,000
When a machine is continuously operated 24 hours per day	40,000~60,000
When a machine is continuously operated 24 hours per day, and absolutely no stoppage due to failure is allowed	100,000~200,000

Selection method of bearings in consideration of life for the operating conditions

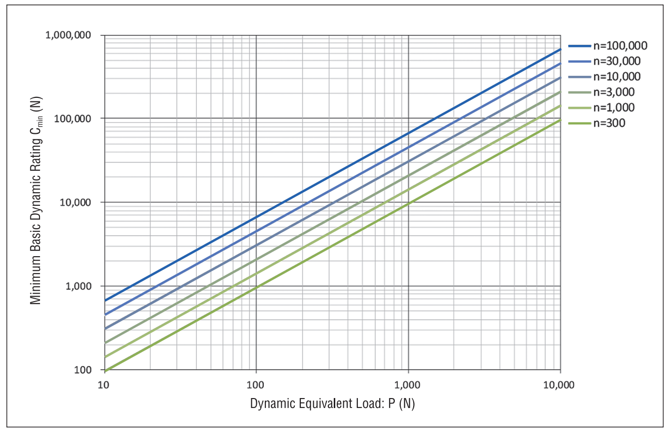
When a large dynamic equivalent load P close to the basic dynamic load rating C is applied to a bearing, the bearing life is reduced in a very short time. However, when a bearing rotates at a high speed with high acceleration, or beyond the limiting speed x 0.5, it is necessary to set to P/C ≥ 1% in general, in order to prevent the occurrence of damage due to the sliding of the balls and the raceway surface.
A suitable bearing type must be selected based on $C_{min} = P\times(L_{10h}\times n/16667)^{1/3}$ by clarifying the operating conditions of the machine (dynamic equivalent load P, rotating speed n) and the required lifetime L_{10h} in advance.

As shown in the following table and graph, generally, it is necessary to consider selection of a bearing using [dynamic equivalent load] / [dynamic load rating] = P/C = [normal load ratio: 6 to 12%] as a guide.

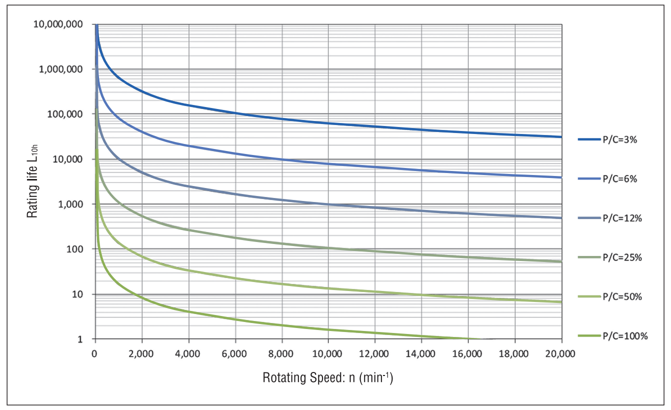


Dynamic Equivalent Load Ratio: P/C and Life Ratio

When P/C and n are known, rating life: L_{10h} can be obtained easily using the following graph.



Dynamic Equivalent Load: P, Rotating Speed: n and Minimum Basic Dynamic Load Rating: C_{min}



Dynamic Equivalent Load Ratio: P/C, Rotating Speed: n and Rating life: L_{10h}

If P and n are known based on L_{10h}= 50,000 hours as a reference, the minimum basic dynamic load rating: C_{min} can be obtained easily using the upper right graph. It is recommended to select a bearing type with a basic dynamic load rating: C higher than this C_{min}. However, rotating speed: n must not exceed the limiting speed of the selected bearing type.

Modification of Life Equation

Generally, the life can be calculated by the above equation, however, it is insufficient when a high reliability of 90% or more is required depending on the application. Since the fatigue life of bearings has been prolonged due to improved bearing steel in recent years, and the relationship between the lubricant and the bearing life has also been clarified, the following modified life equation is used in ISO281.

$$L_{na}=a_1\times a_2\times a_3\times L_{10}$$

L_{na}: Modified rating life [life when the level of reliability is based (100—n) %]
L_{10}: Basic rating life (rev)
a_1: Life modification factor for reliability
a_2: Life modification factor for bearing characteristics
a_3: Life modification factor for operating conditions

(1) Life modification factor for reliability a_1

When calculating the life with a reliability of 90% or more, modify the value according to the following factor a_1.

●Values of life modification factor for reliability a_1

Reliability (%)	90	95	96	97	98	99	99.2	99.4	99.6	99.8	99.9	99.92	99.94	99.95
Reliability Factor a_1	1	0.64	0.55	0.47	0.37	0.25	0.22	0.19	0.16	0.12	0.093	0.087	0.08	0.077

(2) Life modification factor for bearing characteristics a_2

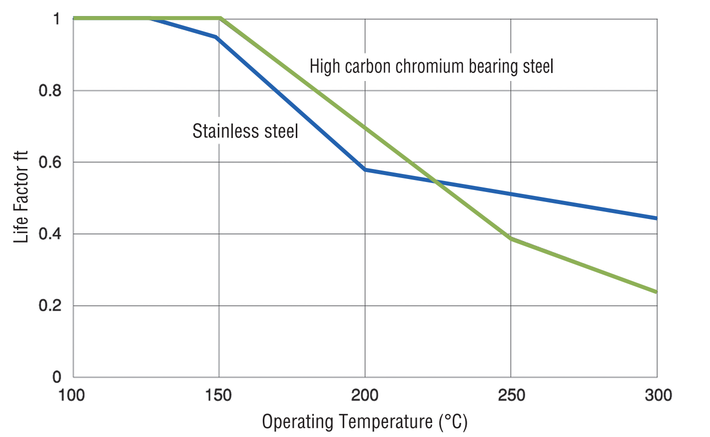
When the fatigue life is prolonged due to improvements in the manufacturing method and heat treatment condition, etc. of the bearing material, modify the value according to the life modification factor for bearing characteristics a_2. In the case of the standard bearing material of our company, modify the value to a_2=1.

(3) Life modification factor for operating conditions a_3

In the operating conditions of a bearing, the modification factors which originate in the conditions of the lubrication, temperature and load, etc. is called "the life modification factor for operating conditions a_3. In the case of favorable lubrication conditions, where there is no metal contact due to a lubricating film applied between the raceway surface and balls, and dynamic viscosity of lubricant is above 13 mm^2/s (13cSt), then a_3=1 is used for the effect of the lubrication on the life.
When the operating conditions are not favorable (dmn ≦ 10,000, deterioration of lubricant, large inclination of inner/outer rings), a_3<1 is used. If the operating temperature exceeds 120℃, the life becomes shorter because the dimensional change becomes larger, and also the hardness deteriorates. The operating temperature and the life modification factor in such a case are based on the following table.

Remarks: dmn is the rolling element pitch circle diameter (mm) x rotating speed (min^{-1}).

●Value of temperature factor f_t



●Dimensional Stabilization Treatment

Dimensional stabilization treatment symbol	S0	S1	S2	S3
Maximum operating temperature (℃)	150	200	250	300

※ The dimensional change of a bearing with normal heat treatment applied becomes larger at temperatures exceeding 120℃. Although a reduction in the basic dynamic load rating due to the deterioration of the hardness is unavoidable, the dimensional change can be suppressed even at high temperatures by performing a dimensional stabilization treatment.

System Life of Multiple Bearings

The basic rating life of each bearing has a probability of 90%. The system life of multiple bearings becomes even shorter than the shortest basic rating life of each bearing. Considering all the bearings being used as one bearing system, the system life can be obtained by the following equation.

$$L = \frac{1}{\left(\frac{1}{L_1^{10/9}} + \frac{1}{L_2^{10/9}} + \cdots \frac{1}{L_n^{10/9}}\right)^{9/10}}$$

L=rating life of entire bearing system
$L_1, L_2, L_3 \ldots L_n$=rating life of each bearing

Basic Static Load Rating

When a certain static load is applied to a bearing, a local permanent deformation of an indent shape occurs in the contact portion between the balls and raceway surface. This permanent deformation causes a poor rotating condition that also increases noise and vibrations, therefore, the basic static load rating C_o is defined as follows as a reference of the acceptable static load. The basic static load rating of a ball bearing is the static load where the calculated contact stress becomes 4200 MPa (429kgf/mm^2) in the contact portion between the balls and raceway, and the sum of the permanent deformation produced between the balls and raceway surface becomes about 1/10000 of the ball diameter. The value of the basic static load rating C_o is expressed as C_{or} for radial bearings and C_{oa} for thrust bearings. In addition, the C_o of duplex bearings that consist of two single-row radial bearings with adjusted standouts is converted by twice that of a single-row bearing.

Calculation of Bearing Load

The loads applied to the bearings include drive loads, such as belts and gears, loads that occur in a machine during operation, and the self-weight of equipment supported by bearings. When a bearing is used, it is difficult to obtain the entire load accurately as the bearing load, because different levels of vibration and impact loads are applied. Normally, the load is obtained by multiplying the various factors based on the experience acquired conventionally with the calculated load value obtained theoretically.

(1) Load factor, gear factor and belt factor

The radial load and axial load applied to a bearing can be obtained by a theoretical calculation. However, the actually applied load becomes larger than the calculated value due to the vibration and impact of the equipment, therefore the load is obtained by multiplying the factors as follows.

Gear drive	$F=f_w \cdot f_g \cdot F_c$
Belt and chain drive	$F=f_w \cdot f_b \cdot F_c$

F: actually applied load (N)
F_c: theoretically calculated load (N)
f_w: load factor
f_g: gear factor
f_b: belt factor

●Load factor f_w

Operating Conditions	Examples	f_w
No impact	Motors, machine tools, meters, conveyors	1～1.2
Light impact	Fans, cranes, compressors, pumps, elevators, paper-making machines	1.2～1.5
Strong impact	Rolling mills, crushers, drop hammers, vibrating filters	1.5～3

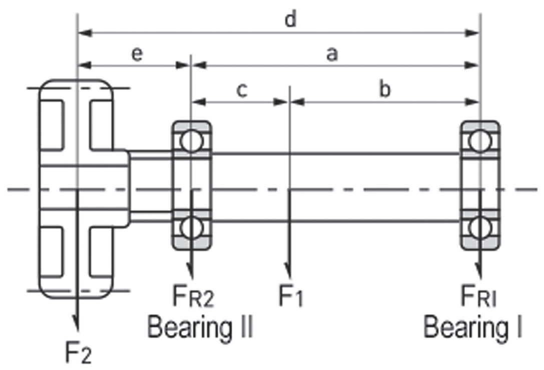
●Gear factor f_g

Type of Gears	f_g
Precision gears [Pitch error ≦0.02mm, shape error ≦0.02mm]	1.0～1.1
Ordinary gears [Pitch error≦0.1mm, shape error ≦0.1mm]	1.1～1.3

●Belt factor f_b

Type of Belts	f_b
Flat belts (without tension pulley)	4.0～5.0
Flat belts (with tension pulley)	2.5～3.0
V-belts	2.0～2.5
Toothed belts	1.3～2.0
Chains	1.2～1.5

(2) Load distribution on bearings



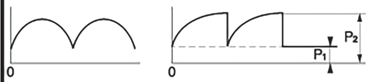
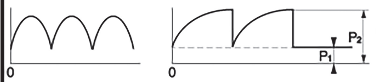
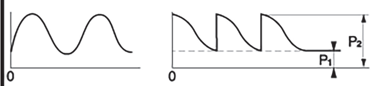
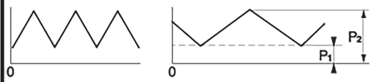
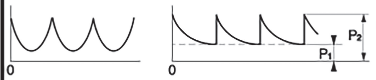
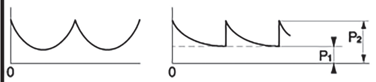
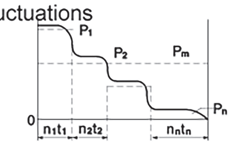
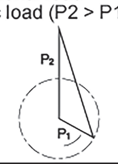
As shown in the figure, when radial loads F_1 and F_2 are applied, the load distributed on Bearing I and Bearing II can be obtained by the following equation.

$F_{R1}=c/a \times F_1 - e/a \times F_2$

$F_{R2}=b/a \times F_1 + d/a \times F_2$

(3) Average load of fluctuating load

When the scale and direction of the load applied to a bearing fluctuates, it is necessary to obtain the average load so that it becomes equal to the bearing life under its loading condition.

Load Patterns		P_m=A P_2+B P_1					
	P_1/P_2	0	0.2	0.4	0.6	0.8	1.0
1. Circular and elliptical shapes 	A	0.84	0.83	0.82	0.81	0.79	0.78
	B	0.16	0.17	0.18	0.19	0.21	0.22
2. Sine and cosine shapes 	A	0.75	0.73	0.70	0.68	0.66	0.64
	B	0.25	0.27	0.30	0.32	0.34	0.36
3. Sine and cosine shapes 	A	0.68	0.64	0.60	0.56	0.53	0.50
	B	0.32	0.36	0.40	0.44	0.47	0.50
4. Linear 	A	0.63	0.60	0.57	0.54	0.52	0.50
	B	0.37	0.40	0.43	0.46	0.48	0.50
5. Sine and cosine shapes 	A	0.56	0.50	0.45	0.42	0.38	0.36
	B	0.44	0.50	0.55	0.58	0.62	0.64
6. Circular and elliptical shapes 	A	0.38	0.32	0.27	0.25	0.23	0.22
	B	0.62	0.68	0.73	0.75	0.77	0.78
7. Gradual fluctuations 	$P_m=\sqrt[3]{\dfrac{P_1^3n_1t_1+P_2^3n_2t_2+\cdots\cdots P_n^3n_nt_n}{n_1t_1+n_2t_2+\cdots\cdots+n_nt_n}}$ $n_m=\dfrac{n_1t_1+n_2t_2+\cdots+n_nt_n}{t_1+t_2+\cdots+t_n}$						
8. Active state of static load and rotational load at the same time P1: Rotational load P2: Static load (P2 > P1) 	$P_m=\dfrac{P_1^2+P_1P_2+P_2^2}{P_1+P_2}$						
9. Oscillating load θ_0: Minimum critical oscillating angle θ : Actual oscillating angle ($\theta>\theta_0$) 	$P_m=\left(\dfrac{\theta}{180}\right)^{1/3}\cdot P$ (Note: $\theta \geqq \theta_0=\dfrac{200}{Z}$ Z = number of balls)						

Dynamic Equivalent Load

Although the load condition is not constant when a bearing is actually used, there are many cases where the load is a combination of the radial load and axial load. In such a case, it is necessary to calculate the load so that the direction and scale become constant. The calculated virtual load is called dynamic equivalent load P, and is expressed as P_r for radial bearings and P_a for thrust bearings.

(1) Radial bearings

Bearing Types		Axial Load Ratio	Single-Row Bearings				Double-Row Bearings				e	
			$\frac{F_a}{F_r}\leq e$		$\frac{F_a}{F_r}>e$		$\frac{F_a}{F_r}\leq e$		$\frac{F_a}{F_r}>e$			
			X	Y	X	Y	X	Y	X	Y		
Deep groove ball bearings		$\frac{F_a}{iZD_w^2}$										
		0.172	1	0	0.56	2.3	1	0	0.56	2.3	0.19	
		0.345				1.99				1.99	0.22	
		0.689				1.71				1.71	0.26	
		1.03				1.55				1.55	0.28	
		1.38				1.45				1.45	0.3	
		2.07				1.31				1.31	0.34	
		3.45				1.15				1.15	0.38	
		5.17				1.04				1.04	0.42	
		6.89				1				1	0.44	
Angular contact ball bearings		$\frac{F_a}{ZD_w^2}$									Single-row bearings	Double-row bearings
	α=5°	0.172	1	0	0.56	2.3	1	2.78	0.78	3.74	0.19	0.23
		0.345				1.99		2.4		3.23	0.22	0.26
		0.689				1.71		2.07		2.78	0.26	0.3
		1.03				1.55		1.87		2.52	0.28	0.34
		1.38				1.45		1.75		2.36	0.3	0.36
		2.07				1.31		1.58		2.13	0.34	0.4
		3.45				1.15		1.39		1.87	0.38	0.45
		5.17				1.04		1.26		1.69	0.42	0.5
		6.89				1		1.21		1.63	0.44	0.52
	α=10°	0.172	1	0	0.46	1.88	1	2.18	0.75	3.06	0.29	
		0.345				1.71		1.98		2.78	0.32	
		0.689				1.52		1.76		2.47	0.36	
		1.03				1.41		1.63		2.29	0.38	
		1.38				1.34		1.55		2.18	0.4	
		2.07				1.23		1.42		2	0.44	
		3.45				1.1		1.27		1.79	0.49	
		5.17				1.01		1.17		1.64	0.54	
		6.89				1		1.16		1.63	0.54	
	α=15°	0.172	1	0	0.44	1.47	1	1.65	0.72	2.39	0.38	
		0.345				1.4		1.57		2.28	0.4	
		0.689				1.3		1.46		2.11	0.43	
		1.03				1.23		1.38		2	0.46	
		1.38				1.19		1.34		1.93	0.47	
		2.07				1.12		1.26		1.82	0.5	
		3.45				1.02		1.14		1.66	0.55	
		5.17				1		1.12		1.63	0.56	
		6.89				1		1.12		1.63	0.56	
	α=20°	—	1	0	0.43	1	1	1.09	0.7	1.63	0.57	
	α=25°	—			0.41	0.87		0.92	0.67	1.41	0.68	
	α=30°	—			0.39	0.76		0.78	0.63	1.24	0.8	
	α=35°	—			0.37	0.66		0.66	0.6	1.07	0.95	
	α=40°	—			0.35	0.57		0.55	0.57	0.93	1.14	
	α=45°	—			0.33	0.5		0.47	0.54	0.81	1.34	

Dynamic equivalent radial load P_r of a radial bearing is expressed by the following equation.

$$P_r = X \times F_r + Y \times F_a$$

P_r=dynamic equivalent radial load (N)
F_r=radial load (N)
F_a=axial load (N)
i=number of rows of balls
X=radial load factor
Y=axial load factor
D_w=ball diameter (mm)
Z=number of balls per row

(2) Thrust bearings

Dynamic equivalent axial load P_a of a thrust bearing is expressed by the following equation.

$$P_a = F_a \text{ (when } \alpha = 90°)$$

※ Contact angle α of our thrust bearing is 90°.

Static Equivalent Load

The virtual load of the combination of the radial load and axial load that is received when the bearing is static (including very low speed rotations) which is calculated to ensure that the direction and scale become constant is called static equivalent load P_0 and is expressed as P_{0r} for radial bearings and P_{0a} for thrust bearings.

The higher value of static equivalent radial load P_{0r} of a radial bearing is used among the values calculated by the following two equations.

$$P_{0r} = 0.6 \times F_r + 0.5 \times F_a、 P_o = F_r$$

Static equivalent axial load P_{0a} of a thrust bearing is expressed by the following equation.

$$P_{0a} = F_a \text{ (when } \alpha = 90°)$$

※ Contact angle α of our thrust bearing is 90°.

Safety Factor

The acceptable static equivalent load of a bearing is determined by the basic static load rating, however, the usage limitations of a bearing differ by the operating conditions and required performance. Therefore, in order to examine the safety integrity, the value can be calculated by the following equation using an experiential safety factor.

$$f_s = C_0 / P_0$$

f_s=safety factor
C_0=basic static load rating (N)
P_0=static equivalent load (N)

Operating Conditions	f_s (min)
Normal operating conditions	1.0
Impact load	1.5
Quiet and high precision rotation is required	2.0

Applied Calculation for Life and Load

●Calculation Example 1

Assuming that the bearing bore diameter ≦ 10mm, outside diameter ≦ 20mm, and width ≦ 5mm are for the space to assemble a bearing, and the load condition is F_r (radial load) = 120 N and rotating speed n = 1200 min^{-1}, select the type of single-row deep groove ball bearing with a life factor f_h≧4.

Obtain speed factor f_n as follows

$$f_n = \left(\frac{33.3}{n}\right)^{1/3} = \left(\frac{33.3}{1200}\right)^{1/3} = 0.303$$

If C_r is obtained from the equation $\left(f_h = f_n \times \frac{C_r}{P}\right)$, the following equation holds:

$$C_r = \frac{f_h}{f_n} \times P = \frac{4}{0.303} \times 120 = 1584\text{N}$$

Bearings with such a basic dynamic load rating selected from the dimensions table are as shown in the table below:

Part No.	Bore Diameter (mm)	Outside Diameter (mm)	Width (mm)	Basic Dynamic Load Rating (N)
625	5	16	5	1730
697	7	17	5	1610
6800	10	19	5	1720

●Calculation Example 2

Select the bearing that has the smallest bore diameter, when selection conditions for the bearing are as follows: Material: SUJ2, Deep groove ball bearing: 60 series, Required life time: 10,000 hours or more, Radial load F_r=150N, Axial load F_a=20N, Rotating speed n = 5000 min^{-1}.

Calculate P_r (the temporary dynamic equivalent radial load) as follows:

$$\frac{F_a}{F_r} = \frac{20}{150} = 0.13$$

Since this is smaller than any "e" value in the table, the following equation can be considered: P_r=F_r=150N.

Obtain C_{min} (the minimum basic dynamic load rating for operating conditions) as follows:

$$C_{min} = P_r \times \left(L_{10h} \times \frac{n}{16667}\right)^{1/3}$$

$$= 150 \times \left(10000 \times \frac{5000}{16667}\right)^{1/3} = 2163\text{N}$$

The bearing number with the smallest bore diameter whose C_r is 2163N or higher and the material is SUJ2 in the 60 series will be 606.

Calculate the value of P_r (dynamic equivalent radial load of 606), and check that the P_r obtained first (temporary dynamic equivalent radial load) is correct.

The axial load ratio of 606 is as follows:

$$\frac{F_a}{iZD_w^2} = \frac{20}{1 \times 6 \times 3.5^2} = 0.272$$

From above, the following equation is obtained:

$$e = \frac{0.272 - 0.172}{0.345 - 0.172} \times (0.22 - 0.19) + 0.19 = 0.207$$

Thus, from

$\frac{F_a}{F_r} = 0.13 < e$, the equation $P_r = F_r = 150\text{N}$

is derived, which indicates that the temporary dynamic equivalent radial load obtained first is correct.

●Calculation Example 3

What is the average radial load when the following variable radial load is applied?

P_1=300N、n_1=1800min^{-1}、t_1=10(s)
P_2=100N、n_2=3000min^{-1}、t_2=15(s)
P_3=200N、n_3=1000min^{-1}、t_3=20(s)

Obtain P_m from Eq. (3) 7 of "Gradual fluctuations":

$$P_m = \sqrt[3]{\frac{300^3 \times 1800 \times 10 + 100^3 \times 3000 \times 15 + 200^3 \times 1000 \times 20}{1800 \times 10 + 3000 \times 15 + 1000 \times 20}}$$

$$\fallingdotseq 203\text{N}$$

●Calculation Example 4

What is the system life when the following radial rotational load and radial static load are applied to 6000HZZ, 6202HZZ and 6304HZZ?

Part No.	Radial Rotational Load (N)	Radial Static Load (N)
6000HZZ	100	250
6202HZZ	200	400
6304HZZ	500	800

Obtain P_m from Eq. (3) 8 of "Active state of static load and rotational load at the same time," and L_{10} from the equation for "Life equation (operating hours)":

In the case of 6000HZZ:

$$P_m = \frac{100^2+100\times250+250^2}{100+250} = 279N$$

As C_r of 6000HZZ is 3890N, the following equation holds:

$$L_{10} = \left(\frac{3890}{279}\right)^3 \times 10^6 = 2710\times10^6 \text{ rotations:}$$

L_{10}=for the following also can be obtained in the same way:

Part No.	P_m (N)	C_r (N)	L_{10} (rotation)
6202HZZ	467	6490	2684×10^6
6304HZZ	992	13500	2520×10^6

Thus, the following is obtained from the equation for the system life of multiple bearings

$$L = \frac{1}{\left(\frac{1}{(2710\times10^6)^{10/9}} + \frac{1}{(2684\times10^6)^{10/9}} + \frac{1}{(2520\times10^6)^{10/9}}\right)^{9/10}}$$

$$= 980.4\times10^6 \text{ rotations}$$

●Calculation Example 5

What is the lifetime L_{10h} when radial load 150 N is applied to 688ZZ, and oscillates 1,000 time per minute at an oscillating angle of 30°?

688ZZ uses 10 ϕ2-mm balls. C_r is 1260N.

$$\theta_0 \geqq \frac{200}{10} = 20^\circ \cdot\cdot\cdot \text{ minimun critical oscillating angle}$$

Since $\theta = 30^\circ > \theta_0 = 20^\circ$, it can be used.

Obtain P_m from Eq. (3) 9 of "Oscillating load":

$$P_m = \left(\frac{30}{180}\right)^{1/3} \times 150 = 83N$$

L_{10h} is obtained from the equation for life equation (operating hours):

$$L_{10h} = \left(\frac{1260}{83}\right)^3 \times \frac{16667}{1000} = 58309 \text{ hours}$$

●Calculation Example 6

What is the life time L_{10h}, L_{1h} where a stainless steel deep groove ball bearing 6706H 2RU is continuously operated at Radial load F_r = 100 N, Axial load F_a = 40 N, Speed n = 1800 min^{-1}? Also, what is the grease life when 6706H 2RU is continuously operated at a bearing temperature of 80℃ under the same conditions?

For 6706H 2RU: C_r = 969 N, and C_{or} = 757 N
Ball used: D_w = 1.588 mm, Z = 24 balls
According to the table of Dynamic Equivalent Load (Radial Bearings - factors X and Y of deep groove ball bearings) in this section, it becomes:

$$\frac{F_a}{iZD_w^2} = \frac{40}{1\times24\times1.588^2} = 0.661$$

$$e = \frac{0.661-0.345}{0.689-0.345} \times (0.26-0.22)+0.22 = 0.257$$

$$\frac{F_a}{F_r} = \frac{40}{100} = 0.4 > e = 0.257$$

Therefore, $Y = \frac{0.661-0.345}{0.689-0.345} \times (1.71-1.99)+1.99 = 1.733$

According to X = 0.56, Y = 1.733 and the equation of dynamic equivalent radial load, the following equation holds:

$$P_r = 0.56\times100+1.733\times40 \fallingdotseq 125N$$

Therefore, the following is obtained from the equation for life equation (operating hours):

$$L_{10h} = \left(\frac{969}{125}\right)^3 \times \frac{16667}{1800} = 4313 \text{ hours}$$

L_{1h} can also be obtained as follows according to the reliability factor a_1 = 0.25 when the reliability is 99%:

$$L_{1h} = 0.25\times L_{10h} = 0.25\times4313 = 1078 \text{ hours}$$

When general purpose grease is applied, the grease life can be obtained according to Eq. (8) of "09. Lubrication":

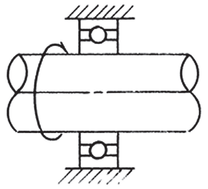
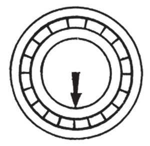
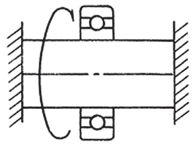
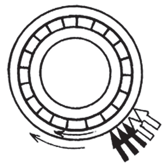
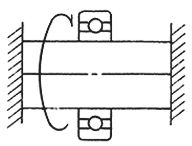
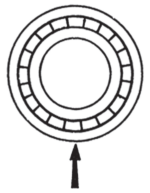
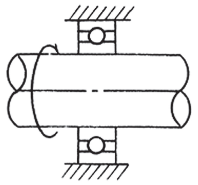
$$\log L = 6.1-4.4\times10^{-6}\times125000-3.125\times\left(\frac{125}{969}-0.04\right)$$
$$-\left(0.021-1.8\times10^{-8}\times125000\right)\times80$$
$$= 3.772$$
$$L = 10^{3.772} = 5916 \text{ hours}$$

07 > Fitting of Bearings

The Importance of Fitting

The function of a bearing can only be utilized to the full when it is fitted appropriately to a shaft and a housing. If there is insufficient interference on the fitting surface, the ring will become misaligned in the circumferential direction to the shaft or the housing. This phenomenon is called "creep," which may cause significant wear to the fitting surface, and damage the shaft or the housing. In some cases, this may even allow worn-off debris to enter the raceway, which may result in vibration and abnormal heating. In general, creep is generated on the ring where interference fit is used.

In order to prevent creep from taking place, necessary interference should be provided to the ring that receives the rotating load. Normally, interference is not provided to a ring that receives a static load. However, it is recommended to use an interference fit for both the inner and outer rings when using the bearing for applications subject to severe vibration.

Rotating ring	Load	Load conditions	Fitting
Inner ring 	Static 	Inner ring rotating load Outer ring static load	Inner ring interference fit Outer ring clearance fit
Outer ring 	Rotating 		
Outer ring 	Static 	Outer ring rotating load Inner ring static load	Inner ring clearance fit Outer ring interference fit
Inner ring 	Rotating 		
When load direction changes or there is an unbalanced load	Rotating or static	Indeterminate direction load	Inner and outer rings interference fit

Fitting between bearing and shaft

Conditions (steel solid shaft)		Shaft diameter range	Shaft tolerance class	
			Thin-section	Other
Inner ring rotating load or indeterminate direction load	Light load of 0.06 C_r or less and fluctuating load	d≦18 18≦d≦30 30≦d≦50	h5 h5 h5	js5 js5 js5
	Normal load of 0.06 to 0.12 C_r	d≦18 18≦d≦30 30≦d≦50	js5 js5 js5	j5 k5 k5
Outer ring rotating load	The inner ring must be able to travel over the shaft easily	Applicable to all shaft diameters	g5	g6
	The inner ring does not have to travel over the shaft easily	Applicable to all shaft diameters	h5	h6

Fitting between bearing and housing

Conditions (integrated housing)		Travel of outer ring in axial direction	Housing tolerance class	
			Thin-section	Other
Inner ring rotating load	Various loads	Can travel easily	H6	H7
	Light or normal load	Can travel easily	H7	H8
	Temperatures of inner ring and shaft increase	Can travel easily	G6	G7
	Precise rotation in light or normal load required	Cannot travel in principle	K5	K6
		Can travel	JS6	J6
	Quiet operation required	Can travel easily	H6	H6
Indeterminate direction load	Light or normal load	Can travel normally	JS6	J7
	Normal or heavy load	Cannot travel in principle	K5	K7
	Large impact load	Cannot travel	M5	M7
	Light or fluctuating load	Cannot travel	M5	M7
Outer ring rotating load	Normal or heavy load	Cannot travel	N5	N7
	Thin-section housing and heavy load or large impact load	Cannot travel	P6	P7

Fitting between miniature/small ball bearing (d < 10 mm) and shaft

Unit: μm

Load conditions		Bearing tolerance class	Single plane mean bore diameter deviation (Δ_{dmp})		Dimensional tolerance of bearing diameter		Fitting	
			Maximum	Minimum	Maximum	Minimum	Interference	Clearance
Inner ring rotating load	Mid to high speed Light to normal load	A5P、A7P、P5	0	−5	+2.5	−2.5	7.5	2.5
		P4	0	−4	+2.5	−2.5	6.5	2.5
	Low speed Light load	A5P、A7P、P5	0	−5	−2.5	−7.5	2.5	7.5
		P4	0	−4	−2.5	−7.5	1.5	7.5
Outer ring rotating load	Low to high speed Light load	A5P、A7P、P5	0	−5	−2.5	−7.5	2.5	7.5
		P4	0	−4	−2.5	−7.5	1.5	7.5

Fitting between miniature/small ball bearing (d < 10 mm) and housing

Unit: μm

Load conditions		Bearing tolerance class	Single plane mean outside diameter deviation(Δ_{Dmp})		Dimensional tolerance of housing bore diameter		Fitting	
			Maximum	Minimum	Maximum	Minimum	Interference	Clearance
Inner ring rotating load	Mid to high speed Light to normal load	A5P、A7P、P5(※1)、P4(※2)	0	−5	+5	0	0	10
		P5(18<D≦30)	0	−6	+5	0	0	11
		P4(18≦D)	0	−4	+5	0	0	9
	Low speed Light load	A5P、A7P、P5(※1)、P4(※2)	0	−5	+2.5	−2.5	2.5	7.5
		P5(18<D≦30)	0	−6	+2.5	−2.5	2.5	8.5
		P4(18≦D)	0	−4	+2.5	−2.5	2.5	6.5
Outer ring rotating load	Low to high speed Light load	A5P、A7P、P5(※1)、P4(※2)	0	−5	+2.5	−2.5	2.5	7.5
		P5(18<D≦30)	0	−6	+2.5	−2.5	2.5	8.5
		P4(18≦D)	0	−4	+2.5	−2.5	2.5	6.5

Note:
(1) applies to Class P5 (size: 18 ≦ D).
(2) applies to Class P4 (size: 18 < D ≦ 30).

Shaft dimensional tolerance

※ Single plane mean bore diameter deviation of bearing (P0 class)

Unit: μm

Diameter classification		Δ_{dmp} (※)	d6	e6	f6	g5	h5	h6	h7	h8	h9	h10	js5	js6	j5	j6	j7	k5	k6	k7	m5	m6	n6	p6	r6	r7
More than	Or less																									
3	6	0 −8	−30 −38	−20 −28	−10 −18	−4 −9	0 −5	0 −8	0 −12	0 −18	0 −30	0 −48	±2.5	±4	+3 −2	+6 −2	+8 −4	+6 +1	+9 +1	+13 +1	+9 +4	+12 +4	+16 +8	+20 +12	+23 +15	+27 +15
6	10	0 −8	−40 −49	−25 −34	−13 −22	−5 −11	0 −6	0 −9	0 −15	0 −22	0 −36	0 −58	±3	±4.5	+4 −2	+7 −2	+10 −5	+7 +1	+10 +1	+16 +1	+12 +6	+15 +6	+19 +10	+24 +15	+28 +19	+34 +19
10	18	0 −8	−50 −61	−32 −43	−16 −27	−6 −14	0 −8	0 −11	0 −18	0 −27	0 −43	0 −70	±4	±5.5	+5 −3	+8 −3	+12 −6	+9 +1	+12 +1	+19 +1	+15 +7	+18 +7	+23 +12	+29 +18	+34 +23	+41 +23
18	30	0 −10	−65 −78	−40 −53	−20 −33	−7 −16	0 −9	0 −13	0 −21	0 −33	0 −52	0 −84	±4.5	±6.5	+5 −4	+9 −4	+13 −8	+11 +2	+15 +2	+23 +2	+17 +8	+21 +8	+28 +15	+35 +22	+41 +28	+49 +28
30	50	0 −12	−80 −96	−50 −66	−25 −41	−9 −20	0 −11	0 −16	0 −25	0 −39	0 −62	0 −100	±5.5	±8	+6 −5	+11 −5	+15 −10	+13 +2	+18 +2	+27 +2	+20 +9	+25 +9	+33 +17	+42 +26	+50 +34	+59 +34

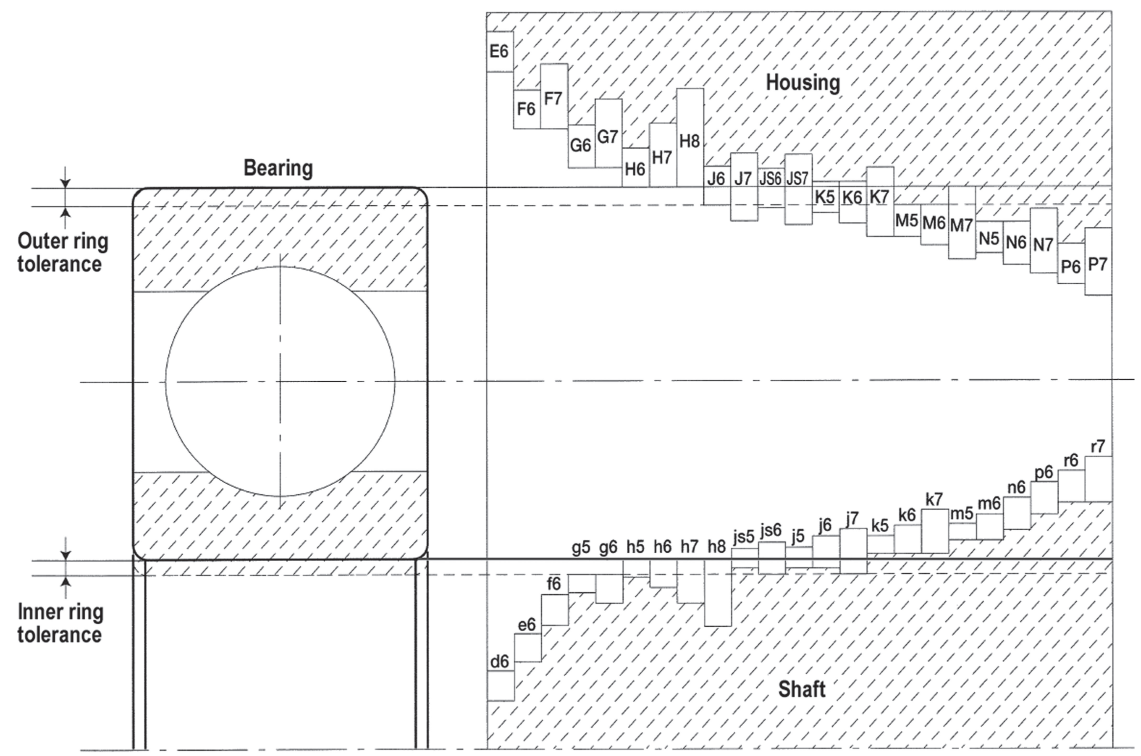
Housing bore dimensional tolerance

※Single plane mean outside diameter deviation of bearing (P0 class)

Unit: μm

Diameter classification		Δ_{Dmp} (※)	E6	F6	F7	G6	G7	H6	H7	H8	J6	J7	JS6	JS7	K5	K6	K7	M5	M6	M7	N5	N6	N7	P6	P7
More than	Or less																								
10	18	0 −8	+43 +32	+27 +16	+34 +16	+17 +6	+24 +6	+11 0	+18 0	+27 0	+6 −5	+10 −8	±5.5	±9	+2 −6	+2 −9	+6 −12	−4 −12	−4 −15	0 −18	−9 −17	−9 −20	−5 −23	−15 −26	−11 −29
18	30	0 −9	+53 +40	+33 +20	+41 +20	+20 +7	+28 +7	+13 0	+21 0	+33 0	+8 −5	+12 −9	±6.5	±10.5	+1 −8	+2 −11	+6 −15	−5 −14	−4 −17	0 −21	−12 −21	−11 −24	−7 −28	−18 −31	−14 −35
30	50	0 −11	+66 +50	+41 +25	+50 +25	+25 +9	+34 +9	+16 0	+25 0	+39 0	+10 −6	+14 −11	±8	±12.5	+2 −9	+3 −13	+7 −18	−5 −16	−4 −20	0 −25	−13 −24	−12 −28	−8 −33	−21 −37	−17 −42
50	80	0 −13	+79 +60	+49 +30	+60 +30	+29 +10	+40 +10	+19 0	+30 0	+46 0	+13 −6	+18 −12	±9.5	±15	+3 −10	+4 −15	+9 −21	−6 −19	−5 −24	0 −30	−15 −28	−14 −33	−9 −39	−26 −45	−21 −51

Correlation diagram of shaft/housing and bearing



Calculating the Fit

The optimum fit should be selected for each application after considering a number of conditions such as the load size, rotation conditions, temperature conditions, and how the bearing is mounted/dismounted. Be sure to allow a greater interference than normal when a bearing is mounted on a thin housing, soft material, or a hollow shaft.

(1) Load size and interference

The interference between the shaft and the inner ring decreases when a radial load is applied. The amount of decrease can be obtained by the following equations, and the larger value should be adopted.

$$\Delta d_F = 0.08 \times (d/B \times F_r)^{0.5}/1000 \text{ (mm)}$$

$$\Delta d_F = 0.02 \times F_r/B/1000 \text{ (mm)}$$

(2) Impact of temperature of bearing and shaft/housing

The operation of the bearing generates temperature differences among the bearing's inner ring, outer ring, and balls, which cause a change in the interference with the shaft/housing. When the temperature difference between the bearing's interior and around the housing is ΔT, the temperature difference between the shaft and the bearing's fitting surface is assumed to be (0.1—0.15)×ΔT. Therefore, the amount of decrease of the inner ring's interference at this temperature (Δd_T) can be obtained by the following equation:

$$\Delta d_T = (0.1 \sim 0.15) \times \Delta T \times a \times d \fallingdotseq 0.0015 \times \Delta T \times d/1000 \text{ (mm)}$$

Conversely, the interference between the outer ring and the housing may increase due to differences in temperature and the rate of expansion. When using a housing material with a large coefficient of linear expansion, such as aluminum or zinc, typically the interference increases at a low temperature.

(3) Effective interference and finish of fitting surface

The roughness of a fitting surface is compressed due to fitting, resulting in smaller degree of effective interference than nominal. The amount of decrease from the nominal interference varies depending on how the fitting surface is finished. In general, however, the effective interference can be obtained by the following equations:

$$\text{[Ground shaft]} \ldots \Delta d = d/(d+2) \times \Delta d_a \text{ (mm)}$$

$$\text{[Turned shaft]} \ldots \Delta d = d/(d+3) \times \Delta d_a \text{ (mm)}$$

After merging the above equations, the nominal interference required for the inner ring and the shaft with inner ring rotating load can be obtained by the following equation:

$$\Delta d_a \geqq (\Delta d_F + \Delta d_T) \times ((d+3)/d \text{ or } (d+2)/d) \text{ (mm)}$$

(4) Surface pressure and maximum stress of fitting surface

If a bearing is mounted with interference, the ring will not break and remain secure provided the circumferential direction stress of the fitting surface is 120 MPa (12 kgf/mm^2) or less.

	Surface pressure P_m (MPa)
Shaft and inner ring	(Hollow shaft) $P_m = (E \times \Delta d_b \times (1-(d/d_b)^2) \times (1-(d_0/d)^2))/(2 \times d \times (1-(d_0/d_b)^2))$ (Solid shaft) $P_m = E \times \Delta d_b/(2 \times d) \times (1-(d/d_b)^2)$
Housing and outer ring	($D_h \neq \infty$) $P_m = (E \times \Delta D_a \times (1-(D_a/D)^2) \times (1-(D/D_h)^2))/(2 \times D \times (1-(D_a/D_h)^2))$ ($D_h = \infty$) $P_m = E \times \Delta D_a/(2 \times D) \times (1-(D_a/D)^2)$
	Circumferential direction stress δ_t (MPa)
Shaft and inner ring	(Hollow shaft) $\delta_t = (E \times \Delta d_b \times (1+(d/d_b)^2) \times (1-(d_0/d)^2))/(2 \times d \times (1-(d_0/d_b)^2))$ (Solid shaft) $\delta_t = E \times \Delta d_b/(2 \times d) \times (1+(d/d_b)^2)$
Housing and outer ring	($D_h \neq \infty$) $\delta_t = E \times \Delta D_a \times (1-(D/D_h)^2)/(D \times (1-(D/D_h)^2))$ ($D_h = \infty$) $\delta_t = E \times \Delta D_a/D$

(5) Press-in force and pull-out force

The press-in force and pull-out force can be obtained by the following equation based on surface area, surface pressure and the coefficient of friction of the fitting surface.

$$K_p = \pi \times \mu \times P_m \times B \times (d \text{ or } D) \text{ (N)}$$

When the inner ring is pressed into the shaft, or when the outer ring is pressed into the housing…μ=0.12
When the inner ring is pulled out from the shaft, or when the outer ring is pulled out from the housing…μ=0.18

●Meaning of symbols

- Δd_F=Amount of decreased interference due to load (mm)
- d=Nominal bearing bore diameter (mm)
- B=Nominal bearing width (mm)
- F_r=Radial load (N)
- Δd_T=Amount of decreased interference due to temperature difference (mm)
- ΔT=Temperature difference between bearing's interior and around the housing (℃)
- a=Coefficient of linear expansion (1/℃)
- Δd=Effective interference (mm)
- Δd_a=Nominal interference (mm)
- E=Steel's modulus of longitudinal elasticity=208000 (MPa)
- C_{or}=Basic static load rating (N)
- Δd_b=Inner ring's effective interference (mm)
- d_o=Hollow shaft's bore diameter (mm); in the case of solid shaft d_o = 0 (mm)
- D_a=Outer ring's raceway diameter (mm); generally D_a = (4×D+d)/5 (mm)
- D=Nominal bearing outer diameter (mm)
- D_h=Housing outer diameter (mm); for rigid body D_h=∞
- K_p=Press-in force or pull-out force (N)
- μ=Fitting surface's coefficient of friction
- d_b=Inner ring's raceway diameter (mm); generally d_b= (D+4×d)/5 (mm)

Figure 1 shows the minimum interference required to prevent the occurrence of creep for the radial load ratio (F_r/C_{0r}), when a turned shaft is pressed into the extra-thin-section 67 series at ΔT=30℃.

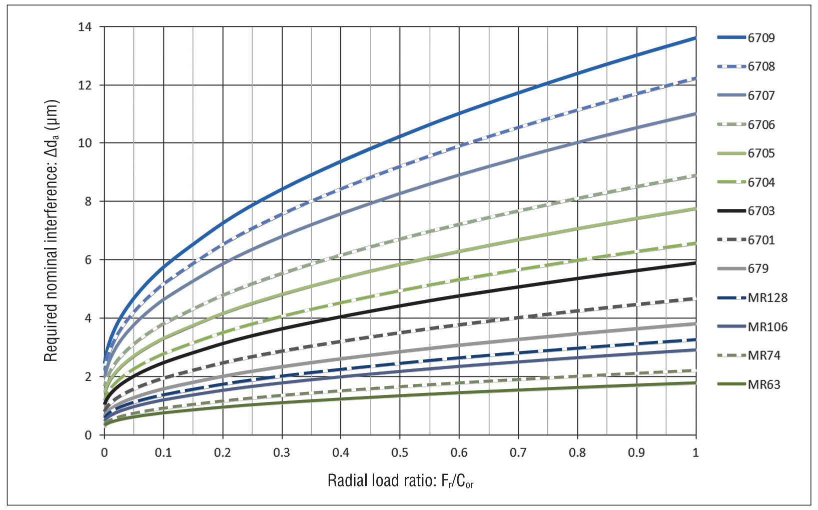


Figure 1: Radial load ratio and required nominal interference

Figure 2 shows the relation between the effective interference and the circumferential direction stress of the fitting surface, when the 67 series' inner ring is fitted with a solid shaft. The bearing will not break and will remain secure as long as the stress is $\sigma_t < 120$ (MPa). The points where each line graph intersects with the 120-MPa dashed line indicate the upper limit of effective interference.

Figure 3 shows the press-in force required under the same fitting conditions. The pull-out force can be determined by multiplying the press-in force by 1.5.

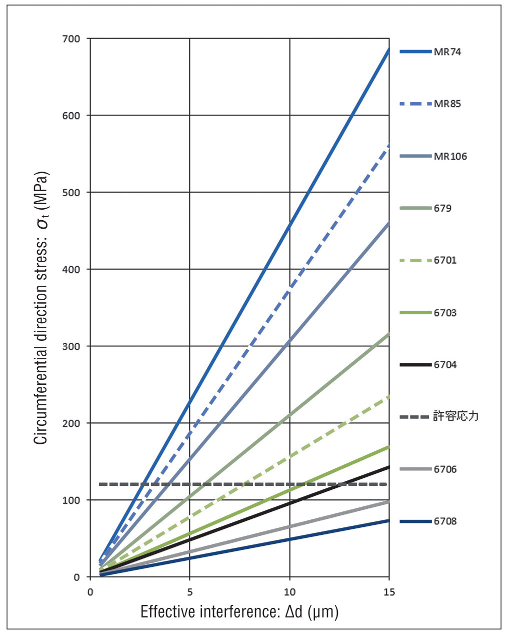


Figure 2: Effective interference and circumferential direction stress

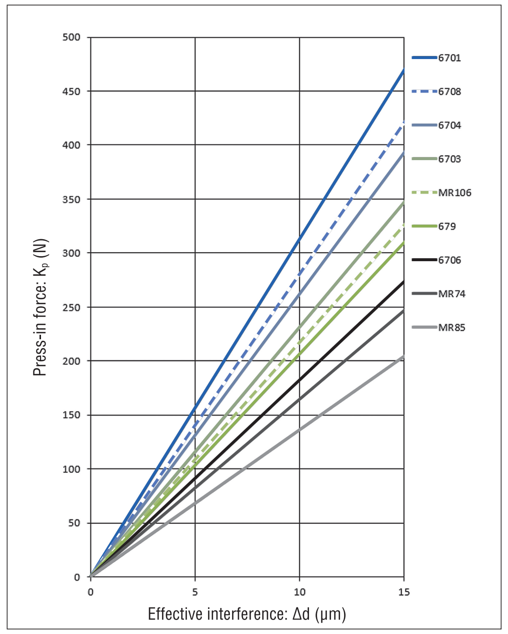


Figure 3: Effective interference and press-in force

※Pull-out force is determined by multiplying press-in force by 1.5

Precision and Roughness of Shaft and Housing

Normally, the shaft and the housing to be fitted to a bearing must satisfy the precision and surface roughness conditions below.

●Recommended precision of shaft and housing

Classification	Symbol	Shaft	Housing
Circularity	○	Half or less of the shaft diameter tolerance	Half or less of the housing bore diameter tolerance
Cylindricity	⌭	Half or less of the shaft diameter tolerance within the range of bearing width	Half or less of the housing bore diameter tolerance within the range of bearing width
Perpendicularity	⊥	3/10000 (0.017°) or less	
Roughness of fitting surface	Ra	0.8	1.6

●Correspondence table of surface roughness values

Arithmetic mean roughness (Ra)	Maximum section height (Rt)	Roughness no.	Triangle symbol
0.025	0.15	N1	▽▽▽▽
0.05	0.3	N2	
0.1	0.6	N3	
0.2	1.2	N4	
0.4	2.4	N5	▽▽▽
0.8	4.8	N6	
1.6	9.6	N7	
3.2	19	N8	▽▽
6.3	38	N9	
12.5	75	N10	▽
25	150	N11	
(50)	(300)	N12	
(100)	(600)	N13	

●Type and symbol of geometric tolerance

Type		Symbol
Shape	Straightness	⏤
	Flatness	⏥
	Circularity	○
	Cylindricity	⌭
	Line profile	⌒
	Surface profile	⌓
Direction	Parallelism	//
	Perpendicularity	⊥
	Inclination	∠
Position	Positionality	⌖
	Coaxiality	◎
	Symmetry	⌯
Swing		↗

Sort Categories of Bore/Outer Diameter Dimensions

For applications where an excess of or shortage of interference may become a problem, upon your request, we can deliver the products sorted into two categories each for bore and outer diameter dimensions, as shown below.

TOLERANCES OF BORE DIAMETER (μm) \ TOLERANCES OF OUTER DIAMETER (μm)		0 ~ -D/2	-D/2 ~ -D	0 ~ -D
	MARK	1	2	0
0 ~ -d/2	1	C11	C12	C10
-d/2 ~ -d	2	C21	C22	C20
0 ~ -d	0	C01	C02	

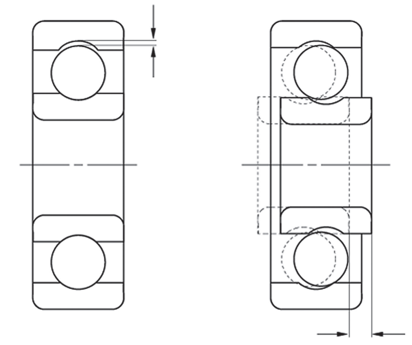
(ZC3 groups C11, C12, C21, C22; ZC1 groups C10, C20; ZC2 groups C01, C02)

Remarks:
1. Applied to P5, P4, ABEC5P, and ABEC7P bearings
2. D=Lower limit of outer diameter dimensional tolerance
3. d=Lower limit of bore diameter dimensional tolerance
4. Let us know your requested details by selecting one option from below:
ZC1...Sort only bore diameter into two categories
ZC2...Sort only outer diameter into two categories
ZC3...Sort both bore and outer diameters into two categories

08 > Internal Clearance of Bearings

Internal Clearance and Standard Values

Internal Clearance of Bearings



RADIAL INTERNAL CLEARANCE

AXIAL INTERNAL CLEARANCE

Internal clearance is the space among a bearing's outer ring, inner ring, and balls. Generally speaking, the amount of vertical movement of the outer ring with the inner ring fixed is called the "radial internal clearance," and the amount of horizontal movement is called the "axial internal clearance." The amount of internal clearance during the bearing's operation is an important factor that impacts performance such as noise, vibration, heat generation, and fatigue life.

Deep groove ball bearings are usually classified by their radial internal clearance. In the actual clearance measurement, a designated load is applied to achieve stable results. As elastic deformation of the bearing occurs during the measurement, which makes the results larger than the true clearance, a correction (reduction) is made to obtain the true clearance.

●Radial internal clearance of small/miniature bearings

Unit: μm

Clearance symbol		MC1	MC2	MC3	MC4	MC5	MC6
Clearance	Minimum	0	3	5	8	13	20
	Maximum	5	8	10	13	20	28

Remarks:
1. Standard clearance is MC3.
2. The correction in the following table should be made when using the values above as measurement clearance.

Unit: μm

Clearance symbol	MC1	MC2	MC3	MC4	MC5	MC6
Correction	1	1	1	1	2	2

Remarks: The measurement load is:
1. For miniature bearings ... 2.5N (0.25kgf)
2. For small bearings ...4.4N (0.45kgf)

●Radial internal clearance of standard deep groove ball bearings

Unit: μm

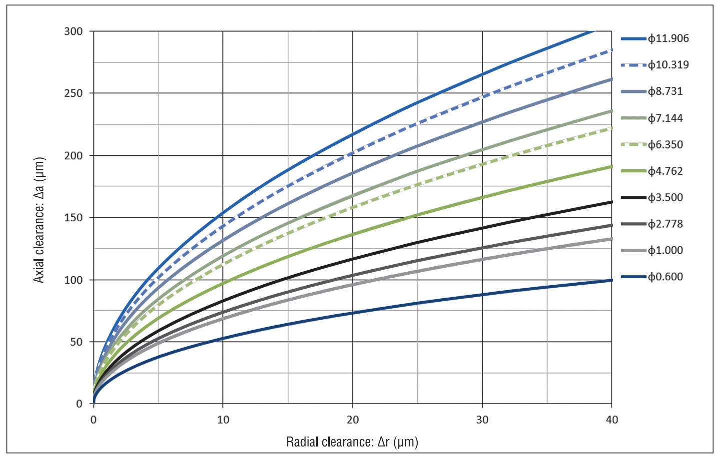
Nominal bearing bore diameter d (mm)		Radial internal clearance				
More than	Or less	C2	C0	C3	C4	C5
2.5	6	0~7	2~13	8~23	14~29	20~37
6	10	0~7	2~13	8~23	14~29	20~37
10	18	0~9	3~18	11~25	18~33	25~45
18	24	0~10	5~20	13~28	20~36	28~48
24	30	1~11	5~20	13~28	23~41	30~53
30	40	1~11	6~20	15~33	28~46	40~64
40	50	1~11	6~23	18~36	30~51	45~73
50	65	1~15	8~28	23~43	38~61	55~90
65	80	1~15	10~30	25~51	46~71	65~105
80	100	1~18	12~36	30~58	53~84	75~120

Nominal bearing bore diameter d (mm)		Measurement load	Clearance correction (μm)					
			C2		C0	C3	C4	C5
More than	Or less	N (kgf)	Min.	Max.	Common	Common	Common	Common
2.5	18	24.5 (2.6)	3	4	4	4	4	4
18	50	49 (5)	4	5	6	6	6	6
50	80	147 (15)	6	8	8	9	9	9

Remarks:
1. Standard clearance is C0.
2. Corrections in the table above should be made when using the values above as measurement clearances.
3. For the correction of C2 clearance, be sure to apply the minimum values to minimum clearance, and the maximum values to maximum clearance.

Relation between Radial Internal Clearance and Axial Internal Clearance

The axial internal clearance is determined based on the values of ball diameter, inner/outer ring raceway radius, and radial internal clearance. It is risky to select a bearing with a small radial internal clearance or a fitting with a large interference with the aim of achieving a smaller axial internal clearance after mounting.



Correlation between radial clearance and axial clearance according to ball diameter

$\Delta_a \doteqdot 2\times(\Delta_r\times(r_o+r_i-D_w))^{0.5}$

Δ_a=Axial internal clearance (mm)

Δ_r=Radial internal clearance (mm)

D_w=Ball diameter (mm)

r_o=Outer ring raceway radius (mm)

r_i=Inner ring raceway radius (mm)

Selection of Bearing Clearance

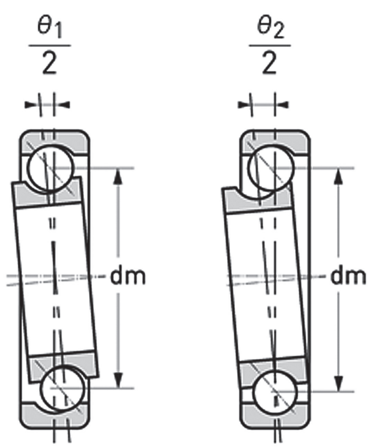
Theoretically, the longest bearing life can be achieved by setting the clearance during operation to a slightly negative value. However, it is also known that the life becomes significantly shorter when the negative clearance exceeds this value, even to the slightest degree. Therefore, normal practice is to select an initial clearance so that it becomes slightly positive (away from zero). Generally, MC3 is selected for miniature/small bearings, and C0 is selected for standard bearings.

●Selection criteria for radial internal clearance

Conditions of use	Selected clearance
Clearance fit is used for both inner and outer rings; small axial load; rigidity in the axial direction is not required; clearance should be reduced without applying preload; vibration and noise should be reduced; and low-speed rotation.	MC1、MC2、C2
Friction torque should be decreased; normal axial load; normal rigidity in the axial direction; slight interference fit is used for the inner ring, and clearance fit is used for the outer ring; and mid- and low-speed rotation.	MC3、MC4、C0
Friction torque should be made particularly small; large axial load; rigidity in the axial direction is required; heavy load or impact load that requires interference; the inner ring's temperature is high, or the outer ring's temperature is low; and large shaft deflection.	MC5、MC6、C3、C4、C5

Relation between Radial Internal Clearance and Angular Clearance

Internal Clearance of Bearings



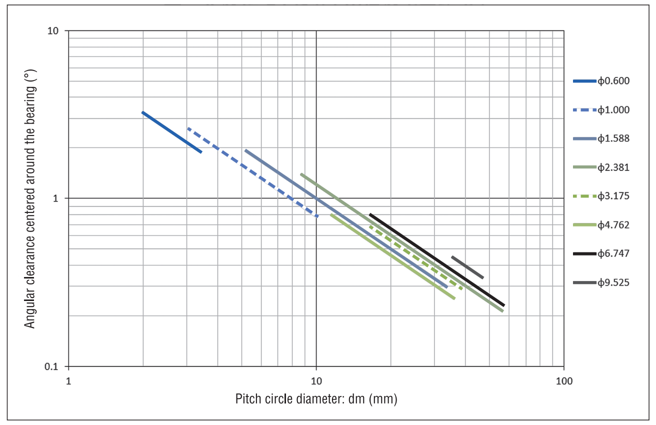
Inclination around the center of the bearing

Inclination around the center of the bottom ball

During the actual use of a bearing, it may receive a moment load as a result of factors such as shaft deflection due to load and the housing's cylindricity. At this time, an inclination called the "angular clearance" is generated at the inner and outer rings. If the allowable angular clearance determined for each bearing is exceeded, this may cause an abnormal stress between the raceway and the ball, which will result in high temperatures or flaking.

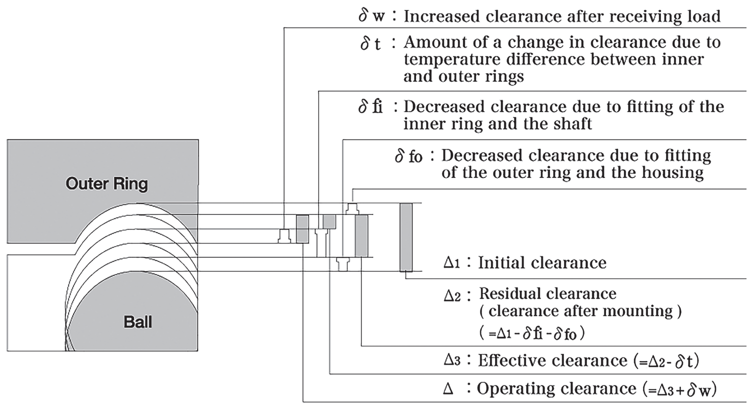
Angular clearance refers to an angle that may be freely inclined when either the inner or outer ring is fixed, and when the ring that is not fixed is tilted to the left or right. The inclination around the center of the bearing is defined as θ_1, and the inclination around the center of the bottom ball is defined as θ_2. θ_1 is significantly larger than θ_2. The angular clearance must be taken into account when designing the device and installing the bearing.

$\theta_1 = 2\times\tan^{-1}(2\times(\Delta_r\times(r_o+r_i-D_w))^{0.5}/dm)$
$\theta_2 = 2\times\tan^{-1}((\Delta_r\times(r_o+r_i-D_w))^{0.5}/dm)$
θ_1=Angular clearance around the center of the bearing
θ_2=Angular clearance around the center of the bottom ball
dm=Pitch circle diameter (mm); generally dm = (D+d)/2



Pitch circle diameter and angular clearance according to ball diameter

Calculation of Clearance



(1) Operating clearance: Δ

Operating clearance refers to a clearance with elastic deformation caused by load and fitting during bearing operation at a constant temperature.

$$\Delta = \Delta_1 - (\delta_t + \delta_f) + \delta_w \text{ (mm)}$$

(2) Decreased clearance due to temperature difference between inner and outer rings: δ_t

Under normal operating conditions, the balls will have the highest temperature, followed by the inner ring, with the outer ring at the lowest temperature. It is difficult to measure the temperature of the balls, which is deemed to be identical to that of the inner ring for the sake of practical convenience.

$$\delta_t \fallingdotseq a\times\Delta T\times D_a \text{ (mm)}$$

(3) Decreased clearance due to fitting: δ_f

When the bearing is mounted on a shaft or the housing with interference, the outer ring will contract, while the inner ring will expand, resulting in a decrease in the bearing's internal clearance.

$$\delta_f = \delta f_i + \delta f_o = \Delta d_b\times d/d_b\times((1-(d_o/d)^2)/(1-(d_o/d_b)^2)) + \Delta D_a\times D_a/D\times((1-(D/D_h)^2)/(1-(D_a/D_h)^2)) \text{ (mm)}$$

(4) Increased clearance after receiving load: δ_w

When a load is applied to the bearing, the internal clearance increases due to elastic deformation.

$$\delta_w = C\times((0.51\times F_r)/(Z\times\cos\alpha))^{(2/3)}\times(1/D_w)^{(2/3)} \text{ (mm)}$$

The contact angle α at this time can be obtained by the following equation:

$$\cos\alpha_o/\cos\alpha = 1 + C/(2\times m-1)\times(F_a/(9.8\times Z\times D_w^2\times\sin\alpha))^{(2/3)}$$
$$1-\cos\alpha_0 = \Delta_r/(2\times D_w\times(2\times m-1))$$

●Meaning of symbols

ΔT=Temperature difference between inner and outer rings (℃); generally ΔT=5 to 10℃

D_a=Outer ring's raceway diameter (mm); generally D_a=((4×D+d)/5)

Δd_b=Inner ring's effective interference (mm)

d_o=Hollow shaft's bore diameter (mm); in the case of solid shaft d_o=0

ΔD_a=Outer ring's effective interference (mm)

d_b=Inner ring's raceway diameter (mm); generally d_b=((D+4×d)/5)

d=Nominal bearing bore diameter (mm)

D=Nominal bearing outer diameter (mm)

D_h=Housing outer diameter (mm)

Z=Number of balls

D_w=Ball diameter (mm)

α=Contact angle (°)

α_o=Initial contact angle (°)

Δ_r=Radial internal clearance (mm)

F_a=Axial load (N)

F_r=Radial load (N)

m=Average of inner/outer ring raceway groove curvature (mm)

a=Coefficient of linear expansion (1/℃); when bearing steel is used: a=12.5×10^{-6} when stainless steel is used: a=10.1×10^{-6}

C=Contact elastic modulus

Application category	C	m
Standard bearings	0.00218	0.525
Instrument bearings	0.00287	0.560

Axial Load and Axial Displacement, and Change in Contact Angle

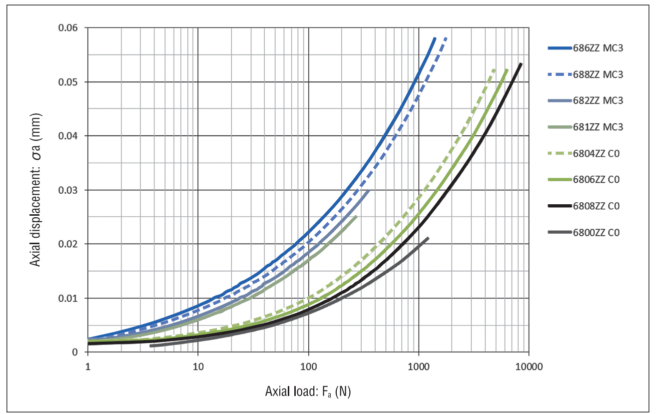
When the ball bearing receives an axial load, axial displacement takes place due to elastic deformation, and the contact angle becomes larger than the initial contact angle.

(1) Axial load: F_a

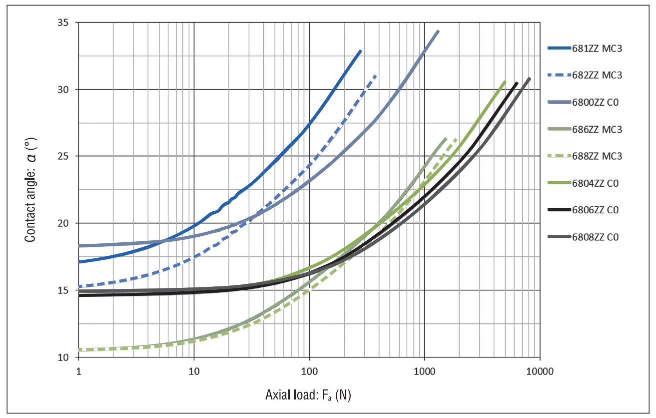
$$F_a = 9.8 \times Z \times \sin\alpha \times D_w^2 \times (\cos\alpha_0/\cos\alpha - 1)^{(3/2)} \times ((2 \times m - D_w)/(C \times D_w))^{(3/2)} \ (N)$$

(2) Axial displacement: δ_a

$$\delta_a = C/\sin\alpha \times (1/D_w)^{(1/3)} \times (F_a/(Z \times \sin\alpha))^{(2/3)} \ (mm)$$



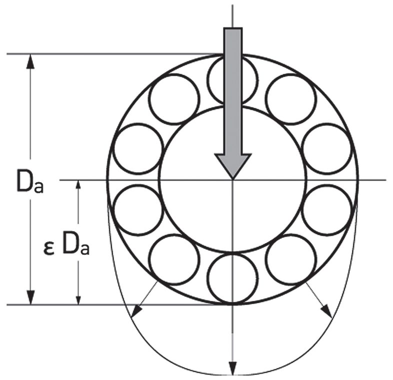
Axial load and axial displacement



Axial load and change in contact angle

Radial Clearance and Bearing Fatigue Life

Load distribution at ε=0.5

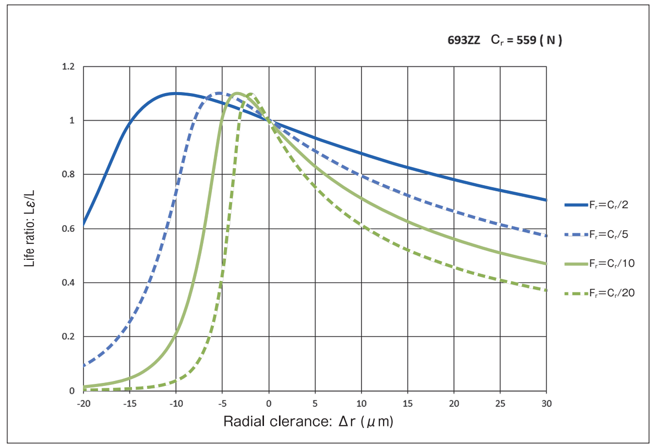


Normally, the radial clearance used for calculating the life of bearings is $\Delta_r = 0$, where the load distribution within the bearing can be represented by a load factor of $\varepsilon = 0.5$. In this case, almost half of the balls receive the load. The load factor and the bearing fatigue life change based on the change of the radial clearance.

In the case of a deep groove ball bearing, the following relational equation is formulated between the radial clearance Δ_r and the load factor ε, and the function $F(\varepsilon)$. $L\varepsilon$ can be obtained from the relation between $F(\varepsilon)$ and the life ratio $L\varepsilon/L$.

$$F(\varepsilon) = \Delta_r \times D_w^{(1/3)} / (C \times (F_r/Z)^{(2/3)})$$

As shown in the example figure below, the longest life can be achieved when the clearance value is slightly negative. The figure also shows that as the clearance increases, the number of balls that receive the load decreases, which results in a shorter life.



Radial clearance and bearing fatigue life

$L\varepsilon$=Bearing life when radial clearance is Δ_r

L=Bearing life when radial clearance is Δ_r=0

ε	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
F(ε)	33.7	10.2	4.05	1.41	0	−0.86	−1.44	−1.86	−2.2	−2.49
Lε/L	0.29	0.55	0.74	0.89	1	1.07	1.1	1.09	1.04	0.95

ε	1.2	1.5	1.8	2	2.5	3	4	5	7	10
F(ε)	−3.1	−3.88	−4.6	−5.05	−6.11	−7.09	−8.87	−10.5	−13.3	−17.2
Lε/L	0.64	0.37	0.22	0.16	0.078	0.043	0.017	0.008	0.004	0.001

Purpose of Lubrication

The life and performance of bearings change significantly depending on the selected lubrication methods and lubricants, so they must be chosen appropriately considering the conditions of use. Lubrication has the following effects:

(1) Decreased friction and wear

Lubrication decreases the rolling friction between the raceway surface and the balls, the sliding friction between the balls and the cage, and the sliding friction between the cage and the raceway guide surface.

(2) Removal of generated heat

Lubrication removes the frictional heat caused internally by rotation as well as other heat transmitted from outside, and prevents the heating of bearings and the deterioration of lubricants.

(3) Relaxation of stress and extension of fatigue life

Forming an appropriate lubricant film on the rolling contact surface during rotation relaxes the stress concentrated due to impact load, and extends the bearing's fatigue life.

(4) Rust-resistant and dust-resistant effect

Lubrication prevents the generation of rust on the balls, rings, and cage, and the intrusion of dust, foreign matter, and moisture into the bearing.

Requirements of a Lubricant

(1) Low friction and wear.
(2) High thermal stability and good thermal conductivity.
(3) High-strength lubricant film.
(4) Free of corrosive properties.
(5) Free of dust and moisture.
(6) Maintains viscosity suited to the conditions of use.

●Comparison between oil lubrication and grease lubrication

Item	Oil lubrication	Grease lubrication
Rotational speed	From low speed to high speed	Low speed and medium speed
Lubrication performance	Excellent	Good
Cooling effect	Good	None
Torque	Relatively small	Relatively large
Lubricant life	Long	Relatively short
Lubricant replacement	Easy	Difficult
Lubricant leakage	Not suited for places vulnerable to oil leaks	Small leakage contamination
Dust filtration	Easy	Difficult
Sealing device	Complicated	Simple

Standard Lubricants

The standard lubricants below are used unless specified otherwise:

Lubricant	Standard grease	Standard oil
Brand	Multemp SRL	AeroShell Fluid 12
Abbreviation	SRL	AF2
Manufacturer	Kyodo Yushi	Shell Lubricants Japan
Operating temperature range	−50 to 150℃	−54 to 135℃
Specific gravity	0.93	0.92

※Force-feed lubrication (oil bath, drip feeding, splash, circulation, and jet, etc.) should be performed as necessary when oil is used.

Grease

Grease is a semisolid lubricant that consists of base oil, thickener, and additive. Based on the combinations of these materials, you must select a grease that suits your application.

(1) Base oil

In general, the base oil of grease is mainly made from mineral oil. Synthetic oil, including silicone oil, diester oil, and fluorinated oil, is also used to improve the grease's heat resistance and low-temperature fluidity.

(2) Thickeners

Thickeners can be roughly classified into the soap type or the non-soap type, and have an impact on properties such as mechanical stability, water resistance, and operating temperature range.

(3) Additives

Various additives may be added depending on the purpose of use.
・An extreme pressure additive improves impact load and heavy load properties.
・An antioxidant prevents degradation due to oxidation caused when the grease is not resupplied for a long period of time.
・A corrosion inhibitor prevents the generation of rust on and around the bearings.

(4) Consistency

Consistency refers to the hardness of the grease, and it is measured by how deep a metal cone with a specified weight penetrates into the grease in five seconds, in 0.1-mm units. Larger numbers indicate that the grease is softer.

●Consistency and consistency number of grease

NLGI NO.	00	0	1	2	3	4
Worked penetration (25℃, 60 times)	400 – 430	355 – 385	310 – 340	265 – 295	220 – 250	175 – 205
Application	For intensive degreasing	For intensive degreasing	For intensive degreasing and low-temperature use	For general use	For general and high-temperature use	For high-temperature use
Condition	Semi-fluid	Very soft	Soft	Normal	Firm	Very firm

(5) Dropping point

Dropping point refers to the temperature at which the grease starts to drip from a hole with a specified size after the grease is heated to a fluid state. A higher dropping point indicates that the grease can be used at a higher maximum temperature environment.

(6) Mixing different types of grease

When different types of grease that contain different base oil, thickeners, and additives are mixed, their properties will change. Therefore, in principle, grease products from different brands should not be mixed.

●Types of grease that may or may not be mixed (reference)

Base oil	Ester oil	Mineral oil	Synthetic hydrocarbon oil	Silicone oil	Polyglycol oil	Fluorine oil
Ester oil	Yes	Yes	Yes	No	Yes	No
Mineral oil	Yes	Yes	Yes	No	No	No
Synthetic hydrocarbon oil	Yes	Yes	Yes	No	No	No
Silicone oil	No	No	No	Yes	No	No
Polyglycol oil	Yes	No	No	No	Yes	No
Fluorine oil	No	No	No	No	No	Yes

Thickener	Lithium soap	Calcium soap	Aluminium soap	Urea
Lithium soap	Yes	No	No	Yes
Calcium soap	No	Yes	No	Yes
Aluminium soap	No	No	Yes	No
Urea	Yes	Yes	No	Yes

(7) Amount of filled grease

We categorize the amount of filled grease according to the usage conditions as shown in the table below. The standard products are filled with grease G, L, or Q below, as defined in advance for each product model.

Grease amount symbol	Amount of filled grease (%)	Usage conditions	
		Speed	Load
F	90±10	Low	Heavy
M	70±10	Low	Heavy
S	50±10	Low	Normal
G	40±10	Medium	Normal
L	30±10	Medium	Normal
Q	25±5	Medium	Normal
K	20±5	High	Light
Y	15±5	High	Light
X	10±5	High	Light

(8) Grease life (reference)

The life of grease used in a sealed/shielded bearing can be obtained by the following equation:

$$\log L = 6.1 - 4.4\times10^{-6}\times dm\times n - 3.125(P_r/C_r - 0.04) - (0.021 - 1.8\times10^{-8}\times dm\times n)\times T$$

(a) Applies when $T \leqq 120$℃
However, T=50℃ where $T < 50$℃

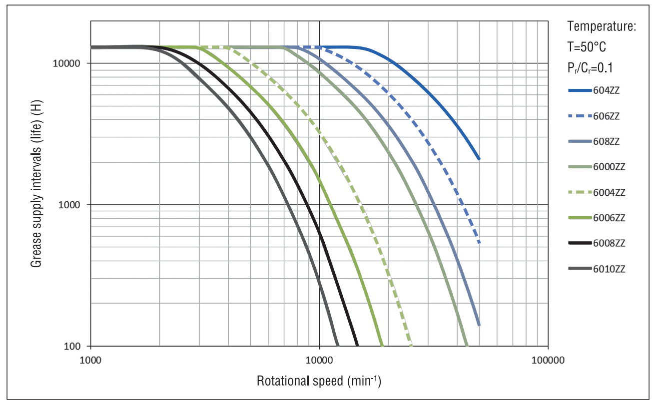
(b) Applies when $dm\times n \leqq 5\times10^5$
However, $dm\times n = 1.25\times10^5$ where $dm\times n < 1.25\times10^5$

(c) Applies when $P_r/C_r \leqq 0.16$
However, $P_r/C_r = 0.04$ where $P_r/C_r < 0.04$

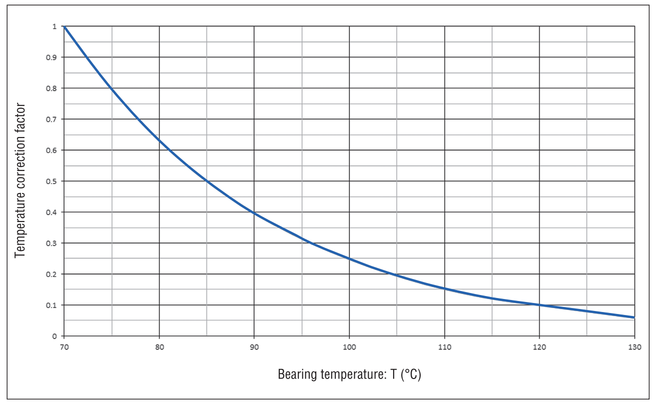
- L=Grease life (h)
- dm=(D+d)/2 (mm)
- n=Rotational speed (min^{-1})
- P_r=Dynamic equivalent radial load (N)
- C_r=Basic dynamic load rating (N)
- T=Bearing operating temperature (℃)

(9) Grease relubrication intervals

Even when a high-quality grease is used, its properties will deteriorate and its lubrication performance will decrease depending on the usage conditions, such as the load, rotational speed, temperature, and ambient atmosphere, so you must supply or replace the grease in a timely manner. In general, it is desirable to replace the grease once a year at an operating temperature of 50℃, and two or three times a year at a temperature higher than 100℃, even when the grease is heat resistant. The figure below, titled Rotational speed and relubrication intervals (life), shows the relationship between the rotational speed and the relubrication intervals by bearing bore diameter. The figure below, titled Bearing temperature and correction factor for calculating relubrication intervals, indicates the relationship between the bearing temperature (above 70℃) and the correction factor, and this value should be multiplied by the relubrication interval.



Rotational speed and relubrication intervals (life)



Bearing temperature and correction factor for calculating relubrication intervals

●Properties of different types of grease

Properties			Appearance	Dropping point	Operating temperature range (℃)	Water resistance	Mechanical stability	Remarks
General name	Thickener	Base oil						
General-purpose grease	Li soap	Mineral oil	Butter-like	170 to 190	−30 to +120	Good	Good	Common general-purpose grease widely used for medium- and small-sized ball bearings.
Diester grease		Diester oil	Fiber-like or butter-like		−50 to +130			Suited for low-temperature applications.
Silicone grease		Silicone oil		220 to 260	−50 to +180			Wide operating temperature range from low to high, mainly used in light-load applications ($P/C_r \leqq 3\%$).
Cup grease	Ca soap	Mineral oil	Butter-like	80 to 100	−10 to +70	Good	Relatively good	Includes a small amount of water as structure stabilizer. Not suited for high-temperature applications.
Fiber grease	Na soap	Mineral oil	Fiber-like or butter-like	160 to 180	0 to +110	Bad (emulsification)	Good	Emulsifies with water and becomes unusable. May be used in relatively-high-temperature applications.
Mobile grease	Al soap	Mineral oil	Thread-like or butter-like	70 to 90	−10 to +80	Good	Relatively good	Highly adhesive and suited for use in locations subject to vibrations.
Mixture grease	Ca+Na soap, etc.	Mineral oil	Butter-like	150 to 180	−10 to +120	Bad (when Na is used)	Good	Applied to large-sized bearings.
Composite grease	Li composite soap, etc.	Mineral oil	Fiber-like or butter-like	180 to 300	−20 to +130	Good	Good	Suited for high-temperature and high-load applications.
Non-soap grease	Benton	Mineral oil or synthetic oil	Butter-like	230 and higher	−10 to +150	Good	Good	Suited for high-temperature and high-load applications.
	Silica gel					Relatively good	Relatively good to bad	Has low water resistance.
	Urea					Good	Good	Suited for high-temperature applications.

Lubricant Oil

Mineral oil and synthetic oil generally have high-strength lubricant film, high oxidation stability, and rust-resistant properties, so these oils are used to lubricate the bearings. A lubricant oil with an appropriate viscosity for the relevant usage conditions must be selected. The desirable kinematic viscosity at the bearing's operating temperature is $13mm^2/s$ or higher.

If the viscosity of the lubricant oil is too low, this will cause an oil film shortage, resulting in wear and/or seizure. On the other hand, if the viscosity too high, this will increase the torque and generate heat. In general, high-viscosity oil should be used for high-load and high-operating-temperature applications, and low-viscosity oil should be used for high-speed applications.

As with grease, you should carefully consider when to replace the lubricant oil and whether to mix it with different brands.

●Lubricant oil selection criteria

Bearing operating temperature (℃)	dn value	ISO viscosity grade (VG) of the lubricant oil	
		Normal load	Heavy load or impact load
−30～0	Up to the limiting speed	15, 22, 32	32, 46
0～60	Up to 15000	32, 46, 68	100
	15000～80000	32, 46	68
	80000～150000	22, 32	32
	150000～500000	10	22, 32
60～100	Up to 15000	150	220
	15000～80000	100	150
	80000～150000	68	100, 150
	150000～500000	32	68
100～150	Up to the limiting speed	320	

Remarks:
1. In general, high-viscosity lubricant oil should be used for heavy-load and low-speed applications.
2. The figures in this table apply to oil bath and circulation lubrication systems.
3. The dn value is: bearing bore diameter d (mm) × rotational speed n (min^{-1}).
4. When using oil lubrication, an appropriate lubrication method for the application (such as oil bath, drip feeding, splash, circulation, oil mist, and jet, etc.) must be implemented.

10 > Limiting Speed of Bearings

Each bearing has its own rotational speed limit. The empirical speed limit up to which the bearing can continue to operate stably without causing any problems, even when the bearing's internal friction generates heat, is called the "limiting speed." The limiting speed varies according to the conditions such as the types of bearings and cages, lubrication method, bearing load, and cooling conditions around the bearing.

The limiting speed of bearings that use the contact rubber seals (2RS) is limited by the circumferential velocity at the seal contact part, so can be lower than that of the non-contact-type bearing.

When the bearing is operated under a large load, the limiting speed must be made smaller. When the bearing is not used under normal load conditions, the limiting speed must be multiplied by the correction factor shown in the table below ($C_r/P<12$ and $F_a/F_r>0.2$).

The limiting speed of duplex bearings is about 20% of the limiting speed of a single bearing. When a nylon cage is used, the limiting speed may be 1.5 times faster, compared to when a steel cage is used for the bearing.

●Correction of limiting speed according to the bearing's load

C_r/P	5	6	7	8	9	10	11	12
Correction factor	0.72	0.79	0.85	0.9	0.93	0.96	0.98	1

●Correction of limiting speed under combined load

F_a/F_r	0.25	0.5	0.75	1	1.25	1.5	1.75	2
Correction factor	1	0.95	0.93	0.91	0.89	0.88	0.87	0.86

In addition, the limiting speed must be multiplied by the correction factor in the table below to obtain the final limiting speed, depending on whether the bearing uses outer ring rotation or inner ring rotation, and whether the lubricant is grease or oil.

●Correction of limiting speed depending on the rotating ring and lubricant

Lubricant	Rotating ring	
	Outer ring	Inner ring
Grease	0.6	1
Oil	0.8	1

You may want to refer to the usage conditions below when the sealing device is embedded in the shaft or the housing (not in the bearing itself), and when nitrile rubber seal is used.

●Usage conditions of nitrile rubber seals

Shaft diameter (mm)	≦10	≦20	≦30	≦40
Shaft circumferential velocity (m/s)	≦8	≦10	≦12	≦14
Shaft surface roughness (Rt)	≦3.2	≦2.4	≦1.6	≦0.8
Shaft surface hardness (HRC)	For low speed≧35, for high speed≧50			
Operating temperature range (℃)	−40～+120			

11 > Friction Torque

Friction Torque (reference)

The friction torque of a rolling bearing changes according to the bearing load and lubrication conditions. Furthermore, when grease is used as the lubricant, grease resistance is added to the bearing's friction torque. If the bearing's load is normal ($C_r/P>12$ and $F_a/F_r<0.2$) and the bearing is well lubricated (oil lubrication), the bearing's friction torque during operation can be obtained by the following equation:

$$M=\mu\times P_r\times d/2$$

M=Friction torque (N・mm)
μ=Coefficient of friction
P_r=Radial load (N)
d=Bearing bore diameter (mm)

Bearing Type	Coefficient of friction: μ
Deep groove ball bearing	0.0013
Angular contact ball bearing	0.0015
Thrust ball bearing	0.0011

Temperature Increase

When the bearing is used, its temperature increases due to rotational friction and the grease's agitation resistance. In general, the temperature increases rapidly at the beginning of operation, but the temperature eventually becomes steady due to factors such as the dissipation of heat from the shaft and the housing, and the cooling effect achieved by the lubrication. If the temperature increase continues for a long period of time, this will result in a shorter life owing to factors such as decreased bearing clearance, decreased rotational accuracy, and degraded lubricant.

Therefore, when such a state is detected, you must review and reconsider the selected bearing specifications, the setup and structure around the bearing, the lubricant and lubrication method, and other factors.

12 > Preload

Preload may be applied when a high dynamic rotational accuracy is required of the bearing, and when low vibration and noise, and a high impact resistance are required. Preload can be applied by inserting a spring, shim, or spacer, or by grinding the face of the outer or inner ring to achieve the desirable preload amount of the two bearings.

(1) Back-to-back duplex (DB)

- As the line of action faces outward, a high moment load resistance is achieved.
- As the positioning in the radial and axial directions are accurate, the displacement may be controlled easily.

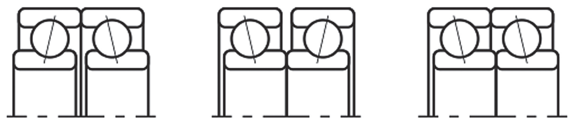
(2) Face-to-face duplex (DF)

- As the line of action faces inward, the moment load resistance becomes smaller than the DB duplex, but the shaft inclination can be absorbed easily.
- As the positioning in the radial and axial directions are accurate, the displacement may be controlled easily.

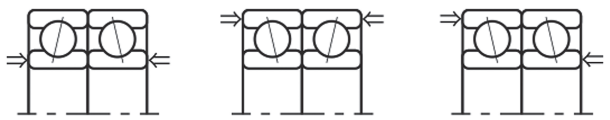
(3) Tandem duplex (DT)

- This is used to increase the load capacity and rigidity. However, as the tandem duplex can receive radial load and unidirectional axial load only, the axial load in the opposite direction must be received by using another bearing.

Before mounting



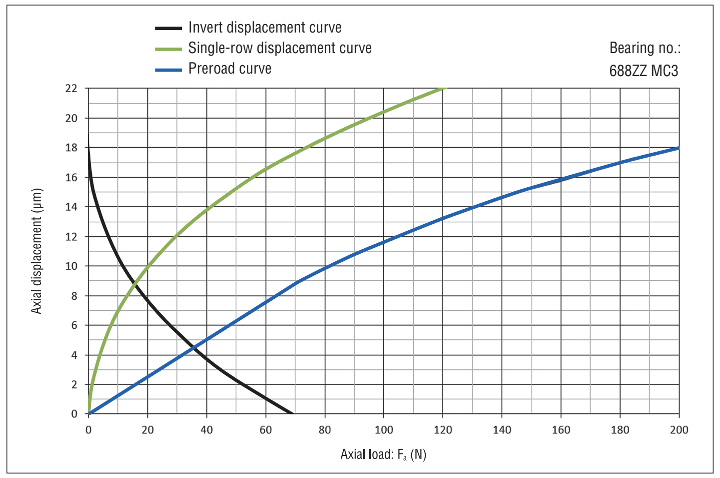
After mounting



●Standard preload amount

Preload category	Preload amount		Features
	Miniature and small bearing	Standard bearing	
Slight preload (S)	0.50%×C_r	0.15%×C_r	Bearing rigidity not required, emphasis on low torque
Light preload (L)	1.25%×C_r	0.58%×C_r	Bearing rigidity and low torque are both required
Medium preload (M)	1.75%×C_r	1.28%×C_r	Emphasis on bearing rigidity, relatively high torque
Heavy preload (H)	2.50%×C_r	2.64%×C_r	Emphasis on bearing rigidity, high torque

※Cr = Basic dynamic load rating (N)



Axial load and axial displacement of duplex bearings

13 > Basic Rules for Selecting and Handling Bearings

Selection of Bearings

(1) The performance of a thin-section bearing heavily relies on the accuracy of the shaft and housing. The accuracy around the bearing must fully meet the conditions indicated in the fittings chart. Particularly, if you have any questions regarding the use of 6700 and 6800 series products, feel free to consult with us.

(2) If you are planning to use a bearing with a snap-type (W) cage for high-acceleration, heavy-load, and impact-load applications, for the vertical shaft, and/or with force-feed oil lubrication, and if you have any questions, feel free to consult with us.

(3) You must select the fitting, clearance, lubrication method, and lubricant carefully by fully taking into account the rotational speed, load, and temperature, in order to prevent anomalies such as seizure, premature flaking, and large noise from taking place.

(4) Full complement ball bearings are suited for low-speed and heavy-radial-load applications. You must fully comply with the usage conditions because the balls may fall out of the slot groove with a relatively small axial load.

Handling and Storage of Bearings

(1) In order to prevent the formation of rust, bearings should be stored in an environment at a temperature of around 20℃ and a humidity of 65% or less. Do not place them directly on the floor (it is desirable to store the bearings on a shelf at least 30 cm above floor), avoid direct sunlight and contact with cold wall surfaces.

(2) The bearings should be handled in a clean environment, making sure any sweat or dirt from your hands do not get attached. Also, bearings should be handled by those with extensive knowledge on bearings, based on the defined work standard. Above all, the bearings must be handled carefully to avoid any damage, indentation, and chipping.

(3) Placing the bearings in an acidic atmosphere may result in rust and discoloration. Also, if you use cotton work gloves or waste cloth to wipe the bearing, shaft, or housing, dust may enter the bearing or the fitting, which may cause anomalies. Make sure to avoid these situations.

Mounting

(1) Precautions before mounting

a) The bearing should be mounted in a clean environment, using clean mounting jigs and tools.

b) When mounting a new bearing, do not open its package until immediately before the mounting process.

c) Make sure to seal the container of the oil or grease to be used.

d) Wash the shaft and housing, and check in advance that they are free of any damage, indentation, and deformation.

e) When using grease lubrication, use the bearing directly without washing it.

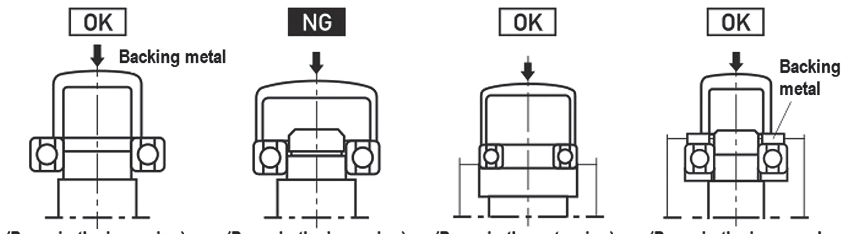
f) When using an open bearing, wash off the corrosion inhibiting oil and apply an appropriate lubricant before use.
Feel free to consult with us if you wish to have the product filled with a lubricant before shipping.

(2) Shaft and housing inspection

a) Check whether the dimensions, accuracy, and finish surface roughness of the shaft and housing are in accordance with the designated specifications. If the fitting surface is too rough, the fitting may loosen during use, which may cause creep. If the roundness of the corners is larger than the bearing chamfer r_{smin}, or the shoulder surface is inconsistent, the bearing cannot be mounted perpendicularly, which will cause a large moment load and deviated rotation, resulting in a shorter life.

b) The shaft length changes depending on the temperature; therefore, when two or more bearings are mounted on a shaft for use, the normal practice is to fix one bearing and allow another bearing to move within the housing. If this is the case, you must check that the clearance in the axial direction allows this bearing to move.

How to Mount a Bearing



(Press in the inner ring) (Press in the inner ring) (Press in the outer ring) (Press in the inner and outer rings simultaneously)

(1) Inner ring interference fit

A press machine should be used to press in small bearings with inner ring rotating load and small interference. When a large interference and/or a large bearing are used, shrink fit should be performed at a temperature of 120℃ or less either in oil or by using an induction-heating device, etc.

(2) Outer ring interference fit

A press machine should be used to press in small bearings with outer ring rotating load and small interference. When a large interference and/or a large bearing are used, cooling fit should be performed, using dry ice and the like. In this case, you must consider introducing waterproofing measures to prevent rusting.

(3) Outer and inner rings' interference fit

When the outer and inner rings must be pressed in at the same time, a backing metal should be used to enable simultaneous contact of the inner/outer rings' faces. Before the press-in process, you may want to apply high-precision oil onto the fitting surfaces of the shaft and housing.

Operation Check

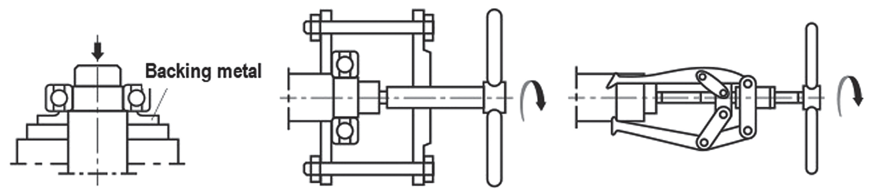
(1) Small devices should be rotated manually to check that they are free of any excessive torque, uneven rotation, and snags.

(2) Devices that cannot be rotated manually should be started with no load and immediately switched to coasting, then you should perform the checks as with (1) above.

(3) If no anomalies are found in (1) or (2) above, conduct a powered trial run where the power is increased slowly from no load and low speed to standard rotation. Here, you should check that there are no anomalies in terms of temperature rise and vibrations.

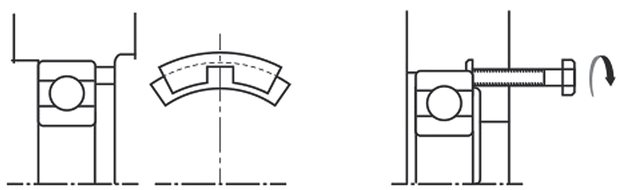
How to Remove a Bearing

(1) In case you may need to remove the interference fit bearing in the future with an aim to reuse it or investigate the cause of a defect, you should design and create a dedicated jig so that you will be able to remove the bearing easily without causing any damage.



(a) Removal using a press machine (b) Removal using a pull-out jig (c) Removal using a pull-out jig

(2) When using a press machine to remove the inner ring of the interference fit, you should place a backing metal against the inner ring. In addition, if a shaft design that can be grappled is employed, you may be able to use a puller to remove the bearing.


(d) Notch for removal (e) Bolt hole and bolt for removal

(3) For removal of the outer ring of the interference fit, it is recommended to create a bolt screw hole or a notch at the shoulder of the housing.

14 > Problems in Bearings, and their Causes and Remedies

Operational Abnormality		Cause	Remedy
Noise	High-pitched metallic noise	Poor lubrication	Use the correct amount of appropriate lubricant
		Insufficient clearance	Ensure proper clearance
		Poor mounting	Check the accuracy of the shaft and housing, as well as the mounting method
		Excessive load	Check the fitting and preload
	Low-pitched metallic noise	Indentation on raceway surface	Avoid the impact load when dropped or during mounting
	Regular noise	Rust and/or damage	Check the sealing device, and use clean lubricant
		Flaking on raceway surface	Use appropriate fitting, clearance, lubrication and mounting method
	Irregular noise	Intrusion of foreign matter	Check the sealing device, and use clean lubricant
		Excessive clearance	Ensure proper clearance
		Ball damage and ball flaking	Ensure proper clearance and load
	Noise that changes over time	Change in clearance due to rising temperature	Check the shaft and housing materials, and ensure proper clearance
		Ongoing abnormality on the raceway	Use appropriate fitting, clearance, lubrication and mounting method
Heavy vibration		Raceway and ball flaking	Use appropriate fitting, clearance, lubrication and mounting method
		Intrusion of foreign matter	Check the sealing device, and use clean lubricant
		Excessive clearance	Ensure proper clearance
		Poor mounting	Adjust the perpendicularity of the shaft and housing shoulders
Abnormal temperature rise		Insufficient clearance	Ensure proper clearance
		Poor mounting	Check the accuracy of the shaft and housing, as well as the mounting method
		Excessive load	Check the clearance, fitting, and preload
		Poor lubrication	Use the correct amount of appropriate lubricant
		Creep	Check the fitting, and adjust the shaft and housing
Leakage and discoloration of lubricant		Too much grease	Use the correct amount of appropriate lubricant
		Intrusion of foreign matter	Check the sealing device, wash the parts around the bearing, and replace the bearing

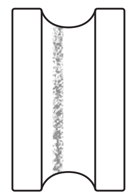
15 > Damage to Bearings, and its Causes and Remedies

Inappropriate handling or use of bearings often results in damage and a shortened life. This section highlights the common causes of trouble and preventative remedies.

Damage	Damage Symptoms	Cause	Remedy
Flaking	Flaking over the entire circumference on one side of the raceway	Abnormal axial load	Use clearance fit for the outer ring of the non-fixed bearing
	Ball-pitch flaking on the raceway	Impact load during mounting	Carefully mount the bearing
		Rust generated during downtime	Apply rust-proof treatment when a long downtime is scheduled
	Premature flaking on the raceway surface and ball surface (Figure 1)	Excessive load	Ensure proper load condition
		Insufficient clearance	Ensure proper clearance and fitting
		Poor lubrication	Use the correct amount of appropriate lubricant
		Poor mounting	Check the accuracy of the shaft and housing, as well as the mounting method
		Rust	Store and handle with care
	Flaking inclined toward the raceway (Figure 2)	Poor mounting and shaft alignment (centering)	Mount and align (center) the bearings properly
		Shaft deflection	Select a bearing with a large clearance
		Poor accuracy of shaft and housing	Adjust the perpendicularity of the shaft and housing
	Flaking at the symmetric position of the raceway	Poor housing accuracy	Adjust the accuracy on the surface of the housing bore diameter
Indentation	Ball-pitch indentations or dents on the raceway (Figure 3)	Impact load during mounting or when dropped	Handle with care
		Excessive load when the bearing is stopped or during low-speed rotation	Check the static load
	Indentation on the raceway and ball surface	Intrusion of sand, metallic dust, etc.	Clean the shaft and housing, and check the sealing device
Seizure	Discoloration of raceway and ball surface	Excessive load	Ensure proper clearance and fitting
		Insufficient clearance	Ensure proper clearance
		Poor lubrication	Use the correct amount of appropriate lubricant
		Poor mounting	Check the mounting method and relevant components
Smearing	Softening and adhesion to raceway and ball surface (Figure 4)	Poor lubrication	Use the correct amount of appropriate lubricant
		Sliding of balls	Apply proper preload
Electrolytic corrosion	Corrugated electrolytic corrosion of the raceway (Figure 5)	Sparking resulting from an electric current passing through the bearing	Ground and/or insulate the bearing
Breakage	Cracked or chipped raceway surface (Figure 6)	Excessive impact load	Apply appropriate load conditions
		Excessive interference	Ensure proper fitting
		Developed flaking or seizure	Adjust the shaft and sleeve
	Cracked or chipped balls	Excessive impact load	Check the mounting method and load condition
		Excessive clearance during use	Check the fitting and bearing clearance
	Broken cage (Figure 7)	Moment load	Handle with care
		Impact due to high-speed and high-acceleration rotation	Check the rotation conditions
		Inappropriate lubrication	Check the lubricant and lubrication methods
		Foreign matter has become entangled	Improve the sealing device
Galling	Galling on the raceway and ball surface (Figure 8)	Inappropriate lubrication (solid grease or insufficient grease)	Refill with an appropriate amount of soft grease
		Heavy acceleration at the start of use (ball slippage)	Avoid sudden acceleration

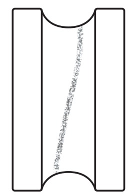
Damage	Damage Symptoms	Cause	Remedy
Wear	Abnormal wear of raceway, balls, and cage (Figure 9)	Intrusion of foreign matter	Improve the sealing device
		Rust	Store and handle with care
		Poor lubrication	Use the correct amount of appropriate lubricant
	Galling wear on the fitting surface: creep (Figure 10)	Insufficient interference	Ensure proper fitting
		Insufficient sleeve fastening	Fasten the sleeve appropriately
	Red wear on the fitting surface: fretting (Figure 11)	Small clearance on fitting surface	Increase interference
	Ball-pitch fretting on the raceway: false brinelling	Vibrations when the bearing is not used, such as during transportation	Fix the shaft and housing
		Rocking movement with a small amplitude	Use oil as lubricant, and apply preload
Rust and corrosion	Rust on the bearing surface and/or within the bearing	Poor storage conditions	Store and handle with care
		Condensation of moisture contained in air	Store and handle with care
	Rust on fitting surface (Figure 12)	Fretting	Increase interference
		Variable load	Apply oil on the fitting surface
	Corrosion	Intrusion of acid, alkali, or gas	Check the sealing device
		Chemical action of lubricant	Check the lubricant

Flaking



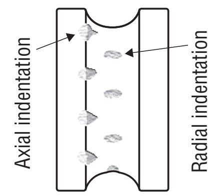
(Figure 1)

Poor mounting



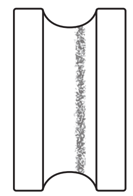
(Figure 2)

Indentation



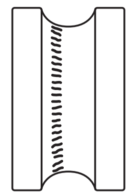
(Figure 3)

Smearing



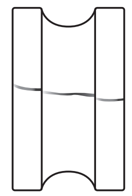
(Figure 4)

Electrolytic corrosion



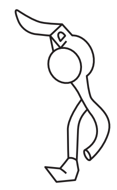
(Figure 5)

Crack



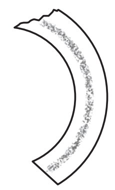
(Figure 6)

Broken cage



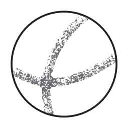
(Figure 7)

Galling



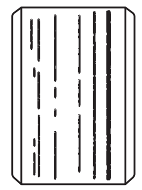
(Figure 8)

Ball scratches



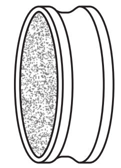
(Figure 9)

External creep



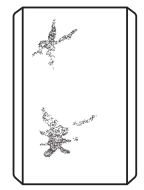
(Figure 10)

Fretting



(Figure 11)

Rust

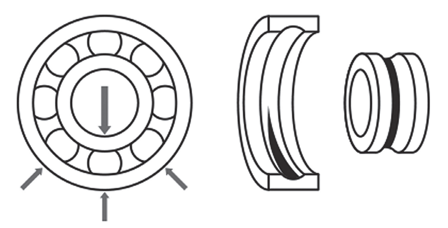


(Figure 12)

Rolling Tracks and How Load is Applied

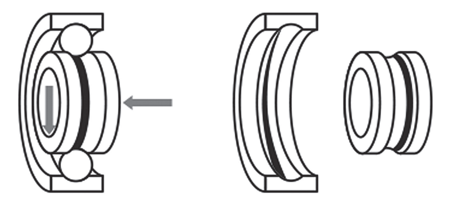
When a bearing rotates with a load applied, the rolling contact between the balls and the bearing rings will generate rolling tracks on the raceway surface of both inner and outer rings. The outline of rolling tracks and how the load is applied can be roughly summarized as shown in the eight figures below. Most of the damage to bearings at an early stage is caused by factors such as unexpected excessive load and mounting errors. Disassembling the bearing and looking at their rolling tracks will enable you to estimate the amount and direction of the load applied as well as the rotating rings, which will provide you with a clue on how to set appropriate load conditions.

Unidirectional radial load (Inner ring: rotational, and outer ring: static)



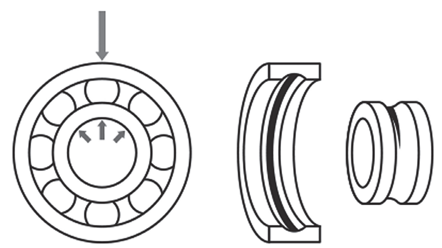
Inner ring: The rolling track is observed at the center of the raceway over the entire circumference. The track has an even width throughout.
Outer ring: The rolling track is observed at the center of the raceway. The track is widest in the radial load direction, while it becomes narrower the farther it is from the load direction.

Unidirectional radial/axial loads (combined load) (Inner ring: rotational, and outer ring: static)



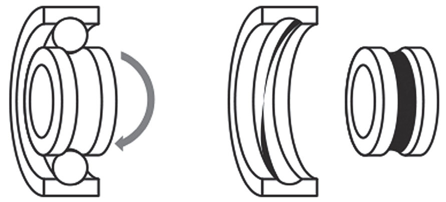
Inner ring: The rolling track is deflected to the axial load direction, and is observed over the entire circumference of the raceway surface. The track has an even width throughout.
Outer ring: The rolling track is deflected to and is widest in the axial load direction. This may be observed either over the entire circumference, or just in some parts discontinuously.

Unidirectional radial load (Inner ring: static, and outer ring: rotational)



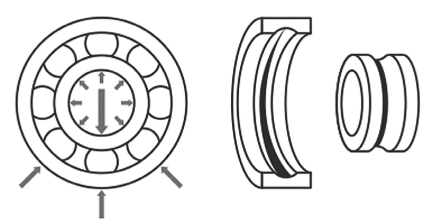
Inner ring: The rolling track is observed at the center of the raceway. The track gets widest in the radial load direction, while it becomes narrower the farther it is from the load direction.
Outer ring: The rolling track is observed at the center of the raceway over the entire circumference. The track has an even width throughout.

Moment load (Inner ring: rotational, and outer ring: static)



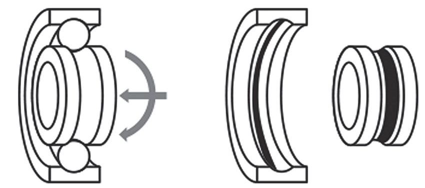
Inner ring: The rolling track is observed at the center of the raceway over the entire circumference. The track has an even width throughout.
Outer ring: The rolling track is inclined diagonally with a fluctuating width.

Unidirectional radial load with radial preload (or negative operating clearance) (Inner ring: rotational, and outer ring: static)



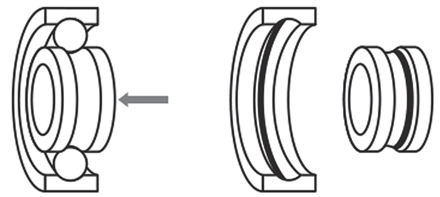
Inner ring: The rolling track is observed at the center of the raceway over the entire circumference. The track has an even width throughout.
Outer ring: The rolling track can be observed at the center of the raceway either over the entire circumference, or just in some parts discontinuously. The track is widest in the radial load direction.

Axial load and moment load (Inner ring: rotational, and outer ring: static)



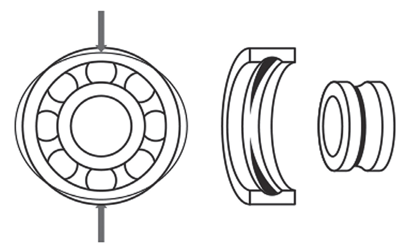
Inner ring: The rolling track is deflected to the axial load direction, and is observed over the entire circumference of the raceway surface. The track has an even width throughout.
Outer ring: The rolling track is deflected to the axial load direction and is inclined diagonally, and is observed over the entire circumference of the raceway surface. The track has an even width throughout.

Unidirectional axial load (Inner ring: rotational, and/or outer ring: rotational)



Inner ring: The rolling track is deflected to the axial load direction, and is observed over the entire circumference of the raceway surface. The track has an even width throughout.
Outer ring: The rolling track is deflected to the axial load direction, and is observed over the entire circumference of the raceway surface. The track has an even width throughout.

When the outer ring is deformed to oval shape (Inner ring: rotational, and outer ring: static)



Inner ring: The rolling track is observed at the center of the raceway over the entire circumference. The track has an even width throughout.
Outer ring: The rolling track is widest where the raceway is compressed. The length in the circumferential direction changes depending on the amount of deformation and the bearing's initial radial internal clearance.

16 > Main Lubricants

Main Oil Brands and Performances

Code	Brand	Manufacturer	Base oil	Flash point(℃)	Pour point(℃)	Kinematic viscosity (mm^2/s)	Specific gravity	Operating temperature (℃)	Features and applications
AF2	AeroShell Fluid 12 (standard oil)	Shell Lubricants Japan	Diester	220	-60 or less	11000(−54℃)、8.2(54℃)	0.93	−54 to +135	Low volatility, for aircraft gyroscopes and electronic devices
WL2	WINSOR L 245 X	Fuchs Lubritech	Diester	227	−65	13.02(40℃)	0.92	−50 to +80	Oxidation-resistant and wear-resistant, for electric motors and measuring instruments
KAZ	Krytox 143AZ	Chemours	Fluorinated	—	−55	22.8(40℃)、4.1(100℃)	1.91	−57 to +149	For home appliances, office equipment and aerospace applications, inert
PD8	Isoflex PDP38	Klüber Lubrication	Diester	200	−70	12.0(40℃)、3.2(100℃)	0.92	−65 to +100	Low temperature, for home appliances and precision equipment

Main Grease Brands and Performances

Code	Brand	Manufacturer	Base oil	Thickener	Dropping point (℃)	Worked penetration (25℃, 60 times)	Base oil kinematic viscosity (mm^2/s)	Specific gravity	Color	Operating temperature (℃)	Features and applications
SRL	Multemp SRL (standard grease)	Kyodo Yushi	Polyol Ester, Diester	Lithium	192	250	24.6(40℃)、4.9(100℃)	0.97	Light tan	−50 to +150	Low noise, long life, and low torque
PS2	Multemp PS No.2		Diester, Mineral	Lithium	190	275	15.3(40℃)、3.9(100℃)	0.91	White peach	−50 to +130	Low temperature, low torque, and low noise
SBM	Multemp SB-M		Synthetic hydrocarbon	Diurea	260	220	47.6(40℃)	0.85	Light tan	−40 to +200	Higher-temperature-resistant and longer-life version of Multemp SRL
RMS	Raremax Super		Mineral, Synthetic hydrocarbon	Diurea	255	260	10.5(100℃)	0.90	Light tan	−40 to +180	High temperature, low noise, oxidation-resistant, and corrosion-resistant, for motors
AV2	Shell Alvania Grease S2	Shell Lubricants Japan	Mineral	Lithium	181	283	131(40℃)、12.2(100℃)	0.90	Amber	−25 to +120	General multipurpose
AV3	Shell Alvania Grease S3		Mineral	Lithium	182	242	131(40℃)、12.2(100℃)	0.90	Amber	−20 to +135	General multipurpose
AG3	AeroShell Grease 33		Synthetic hydrocarbon, Ester	Lithium	216	297	14.2(40℃)、3.4(100℃)	1.00	Green	−73 to +121	Oxidation-resistant, corrosion-resistant and load-resistant
M3L	Molykote 33L Grease	DuPont Toray Specialty Materials	Silicone	Lithium	210	320	100(25℃)	1.00	White	−73 to +180	Oxidation-resistant, wide temperature range, low temperature, and water-resistant
M3M	Molykote 33M Grease		Silicone	Lithium	210	280	100(25℃)	1.00	White	−73 to +180	Oxidation-resistant, wide temperature range, low temperature, and water-resistant
M4M	Molykote 44M Grease		Silicone	Lithium	204	260	125(25℃)	1.00	White	−40 to +200	Low evaporation, oxidation-resistant, wide temperature range, low temperature, and water-resistant
G45	Molykote G-4500 FM Multi-Purpose Synthetic Grease		PAO	Aluminum complex	270	280	100(40℃)、14.4(100℃)	0.84	White	−40 to +150	Wide temperature range, for food machinery (NSF H1)
RL2	Cassida Grease RLS2	Fuchs Lubritech	Synthetic	Aluminum complex	240	280	150(40℃)、18(100℃)	0.88	White	−35 to +120	For food machinery (NSF H1)
GHY	Asonic GHY 72	Klüber Lubrication	Ester	Polyurea	250	265	72(40℃)、9.5(100℃)	0.95	Brown-yellow	−40 to +180	High temperature, low noise, and high speed
GLY	Asonic GLY 32		Synthetic hydrocarbon, Ester	Lithium	190	280	25(40℃)、5(100℃)	0.94	Light brown	−50 to +140	Low temperature, low torque, low noise, and high speed
HQ7	Asonic HQ 72-102		Ester	Polyurea	240	265	100(40℃)、12(100℃)	0.97	Light brown	−40 to +180	High temperature, low noise, and water-resistant

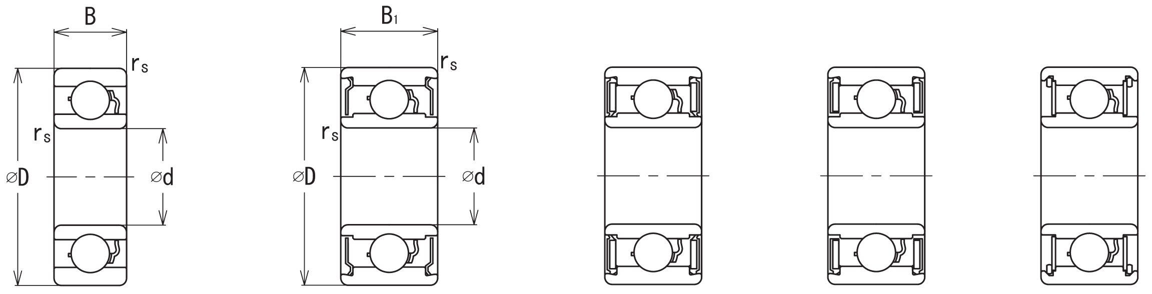
Code	Brand	Manufacturer	Base oil	Thickener	Dropping point (℃)	Worked penetration (25℃, 60 times)	Base oil kinematic viscosity (mm^2/s)	Specific gravity	Color	Operating temperature (℃)	Features and applications
B52	Isoflex TOPAS NB 52	Klüber Lubrication	Synthetic hydrocarbon	Barium	240	280	30(40℃)、5.9(100℃)	0.96	Light brown	−50 to +120	Load-resistant, heat-resistant, water-resistant, high speed, and supports electrical contact
L8A	Isoflex LDS 18 Special A		Ester, Mineral	Lithium	190	280	15.0(40℃)、3.5(100℃)	0.88	Yellow	−50 to +120	Low temperature, low torque, biodegradable, and high speed (dmn100×10^4)
SL8	Isoflex Super LDS 18-R		Ester, Mineral	Lithium	190	280	15.0(40℃)、3.5(100℃)	0.90	Yellow	−50 to +120	Low temperature, low torque, and high speed (dmn100×10^4)
NB5	Isoflex NBU 15		Synthetic hydrocarbon, Mineral, Ester	Barium	220	280	21(40℃)、4.5(100℃)	0.99	Light brown	−40 to +130	Load-resistant, wear-resistant, water-resistant, and high speed, for spindles
NB2	Staburags NBU 12		Mineral	Barium	220	260	220(40℃)、19(100℃)	0.99	Light tan	−15 to +150	Load-resistant, water-resistant, and chemical-resistant, for food machinery (NSF H2)
NB3	Staburags NBU 12/300 KP		Mineral	Barium	220	300	225(40℃)、19(100℃)	0.97	Light tan	−20 to +130	Load-resistant, water-resistant, and chemical-resistant
IMI	Barrierta IMI		PFPE	PTFE	—	280	200(40℃)、22(100℃)	1.95	White	−45 to +220	High temperature, low torque, high speed, and supports electrical contact
L55	Barrierta L55/2 H1		PFPE	PTFE	—	280	420(40℃)、40(100℃)	1.96	White	−40 to +260	High temperature, oxidation-resistant, and chemical-resistant, for food machinery (NSF H1)
E55	Barrierta JFE 552		PFPE	PTFE	—	280	NKL apparent viscosity: S	1.90	White	−35 to +260	High temperature, oxidation-resistant, and chemical-resistant
UH6	Klubersynth UH1 64-62		Synthetic hydrocarbon, Ester	Silica	—	280	65(40℃)、10(100℃)	0.92	Light brown	−40 to +140	Load-resistant, wear-resistant, and water-resistant, for food machinery (NSF H1)
K24	Krytox 240AC	Chemours	PFPE	PTFE	—	280	270(38℃)、26(99℃)	1.93	White	−34 to +288	High temperature, oxidation-resistant, and chemical-resistant, for food machinery (NSF H1)
K2Z	Krytox 240AZ		PFPE	PTFE	—	280	24.7(38℃)、4.2(99℃)	1.89	White	−57 to +149	Oxidation-resistant, chemical-resistant, for food machinery (NSF H1)
MG2	Mobilgrease 28	ExxonMobil	PAO	Organog Clay	307	293	29.3(40℃)、5.7(100℃)	0.95	Dark red	−54 to +177	Wide temperature range, wear-resistant
B32	Beacon 325J		Synthetic	Lithium	194	262	11.54(40℃)、3.204(100℃)	0.94	Beige	−50 to +120	Low temperature, low torque, low noise, and long life
PEM	Polyrex EM (Polyree EM)		Mineral	Polyurea	260	285	115(40℃)、12.2(100℃)	0.88	Blue	−20 to +180	Low-noise, for electric motors
CGA	RHEOLUBE 374C	Nye Lubricants	PAO	Lithium	260	193	60.7(40℃)、9.5(100℃)	0.87	Yellow-brown	−40 to +150	Wide temperature range, and high speed
AFF	AFF Grease	THK	Synthetic	Lithium	220	315	100(40℃)	0.98	Tan	−40 to +120	Anti-fretting and low-dust grease
NBF	NIGACE W (BF)	Nippon Grease	Mineral, Synthetic	Urea	250	255	—	0.88	Light tan	−30 to +150	Low noise and long life
RYC	ROYCO 22CF	LANXESS	PAO	Inorganic gel	232	283	—	0.88	Dark brown	−54 to +177	Wide temperature range, water-resistant and load-resistant

Note: When you are planning to use a bearing filled with an NSF H1 or H2 registered lubricant for food machinery, please consult with us because an additional cleanliness management procedure will be required in the assembly process.

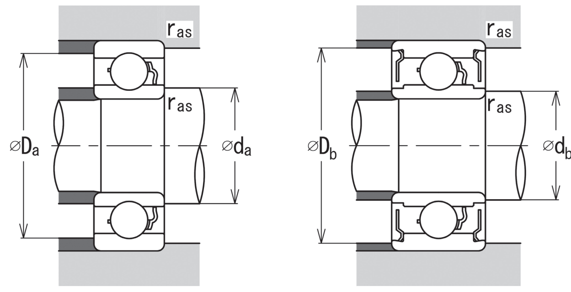
CONTENTS

Dimension Table

Extra-miniature/miniature/small bearings【SUJ2】



Open Shielded: ZZ Sealed: 2RS Sealed: 2RU Sealed: TTS



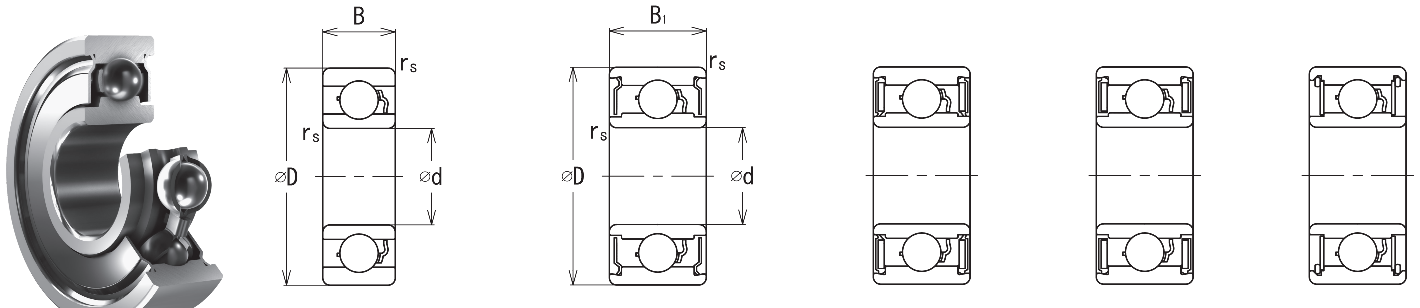
Abutment and fillet

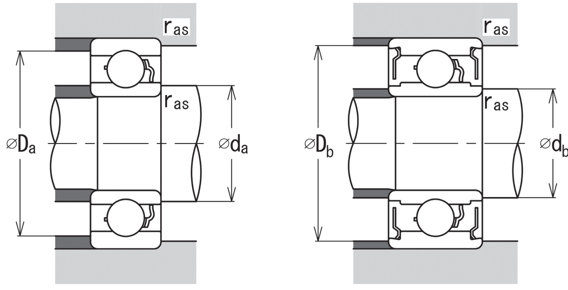
Bore diameter d		Outer diameter D		Width: Open B		Width: Shielded, Sealed B_1		Chamfer $r_{s\ (min)}$		Bearing number: Open	Bearing number: 2 Shields[2]	2 Seals[2]: 2RS	2 Seals[2]: 2RU	2 Seals[2]: TTS	Load rating: Cr	Load rating: Cor	Limiting speed[3]: Grease	Limiting speed[3]: Oil
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch						N		min^{-1}	
1.5	0.0591	4	0.1575	—	—	2	0.0787	0.05	0.002	—	**681XZZ**	—	—	—	112	33	105 000	124 000
		5	0.1969	2	0.0787	2.6	0.1024	0.15	0.0059	**691X**	**691XZZ**	—	—	—	238	69	94 000	111 000
2	0.0787	5	0.1969	1.5	0.0591	2.3	0.0906	0.08	0.0031	**682**	**682ZZ**	—	—	—	169	50	94 000	111 000
		5	0.1969	2	0.0787	2.5	0.0984	0.10	0.0039	**MR52**	**MR52ZZ**	—	—	—	169	50	94 000	111 000
		6	0.2362	2.3	0.0906	3	0.1181	0.15	0.0059	**692**	**692ZZ**	—	—	—	330	99	86 000	101 000
		6	0.2362	2.5	0.0984	—	—	0.15	0.0059	**MR62**	—	—	—	—	330	99	86 000	101 000
		7	0.2756	2.5	0.0984	—	—	0.15	0.0059	**MR72**	—	—	—	—	386	128	76 000	90 000
		7	0.2756	—	—	3.5	0.1378	0.15	0.0059	—	**602ZZS**	—	—	—	386	128	76 000	90 000
2.5	0.0984	6	0.2362	—	—	2.6	0.1024	0.08	0.0031	—	**682XZZ**	—	—	—	209	73	81 000	96 000
		7	0.2756	2.5	0.0984	3.5	0.1378	0.15	0.0059	**692X**	**692XZZS**	—	—	—	386	128	76 000	90 000
		8	0.3150	2.8	0.1102	4	0.1575	0.15	0.0059	**602X**	**602XZZ**	—	—	—	551	175	72 000	85 000
3	0.1181	6	0.2362	2	0.0787	2.5	0.0984	0.10	0.0039	**MR63**	**MR63ZZ**	—	—	—	209	73	81 000	96 000
		7	0.2756	2	0.0787	3	0.1181	0.10	0.0039	**683**	**683ZZ**	**2RS**	—	—	311	112	74 000	88 000
		8	0.3150	2.5	0.0984	—	—	0.15	0.0059	**MR83**	—	—	—	—	395	140	67 000	79 000
		8	0.3150	—	—	3	0.1181	0.10	0.0039	—	**MR83ZZ**	—	—	—	395	140	67 000	79 000
		8	0.3150	3	0.1181	4	0.1575	0.15	0.0059	**693**	**693ZZ**	**2RS**	—	—	559	179	70 000	82 000
		9	0.3543	2.5	0.0984	—	—	0.20	0.0079	**MR93**	—	—	—	—	572	188	66 000	78 000
		9	0.3543	—	—	4	0.1575	0.15	0.0059	—	**MR93ZZ**	—	—	—	572	188	66 000	78 000
		9	0.3543	3	0.1181	5	0.1969	0.15	0.0059	**603**	**603ZZ**	—	—	—	572	188	66 000	78 000
		10	0.3937	4	0.1575	4	0.1575	0.15	0.0059	**623**(1)	**623ZZ**	**2RS**	**2RU**	—	633	218	66 000	78 000
		13	0.5118	5	0.1969	5	0.1969	0.20	0.0079	**633**(1)	**633ZZ**	**2RS**	—	—	1 300	485	51 000	60 000
4	0.1575	7	0.2756	2	0.0787	—	—	0.10	0.0039	**MR74**	—	—	—	—	312	115	70 000	82 000
		7	0.2756	—	—	2.5	0.0984	0.10	0.0039	—	**MR74ZZ**	—	—	—	255	107	71 000	83 000
		8	0.3150	2	0.0787	—	—	0.15	0.0059	**MR84**	—	—	—	—	395	140	67 000	79 000
		8	0.3150	—	—	3	0.1181	0.10	0.0039	—	**MR84ZZ**	—	—	—	395	140	67 000	79 000
		9	0.3543	2.5	0.0984	4	0.1575	0.10	0.0039	**684**	**684ZZ**	**2RS**	—	—	641	226	63 000	75 000
		10	0.3937	3	0.1181	4	0.1575	0.20	0.0079	**MR104**	**MR104ZZ**	**2RS**	**2RU**	—	711	270	59 000	70 000
		11	0.4331	4	0.1575	4	0.1575	0.15	0.0059	**694**(1)	**694ZZ**	**2RS**	—	—	959	347	57 000	67 000
		12	0.4724	4	0.1575	4	0.1575	0.20	0.0079	**604**(1)	**604ZZ**	**2RS**	—	—	959	347	57 000	67 000
		13	0.5118	5	0.1969	5	0.1969	0.20	0.0079	**624**(1)	**624ZZ**	**2RS**	**2RU**	—	1 300	485	51 000	60 000
		16	0.6299	5	0.1969	5	0.1969	0.30	0.0118	**634**(1)	**634ZZ**	**2RS**	—	—	1 340	517	46 000	54 000
5	0.1969	8	0.3150	2	0.0787	—	—	0.10	0.0039	**MR85**	—	—	—	—	309	121	62 000	74 000
		8	0.3150	—	—	2.5	0.0984	0.10	0.0039	—	**MR85ZZ**	—	—	—	218	91	63 000	75 000
		9	0.3543	2.5	0.0984	3	0.1181	0.15	0.0059	**MR95**	**MR95ZZ**	—	—	—	432	168	60 000	71 000
		9	0.3543	—	—	3	0.1181	0.15	0.0059	—	—	—	—	**TTS**	432	168	47 000	47 000
		10	0.3937	3	0.1181	4	0.1575	0.15	0.0059	**MR105**	**MR105ZZ**	**2RS**	—	—	432	168	60 000	71 000
		11	0.4331	4	0.1575	4	0.1575	0.15	0.0059	**MR115**(1)	**MR115ZZ**	**2RS**	—	—	716	283	54 000	64 000
		11	0.4331	3	0.1181	5	0.1969	0.15	0.0059	**685**	**685ZZ**	**2RS**	—	—	716	283	54 000	64 000
		13	0.5118	4	0.1575	4	0.1575	0.20	0.0079	**695**(1)	**695ZZ**	**2RS**	—	—	1 080	430	50 000	59 000
		14	0.5512	5	0.1969	5	0.1969	0.20	0.0079	**605**(1)	**605ZZ**	**2RS**	—	—	1 330	507	48 000	56 000

Cage type[4]	Ball: Size	Ball: Qty.	Open: $d_{a\ (min)}$	Open: $d_{a\ (max)}$	Open: $D_{a\ (min)}$	Open: $D_{a\ (max)}$	Shielded, Sealed: $d_{b\ (min)}$	Shielded, Sealed: $d_{b\ (max)}$	Shielded, Sealed: $D_{b\ (min)}$	Shielded, Sealed: $D_{b\ (max)}$	$r_{as\ (max)}$	Mass (Ref.): Open	Mass (Ref.): 2 Shields
	mm	pcs.	mm				mm				mm	g	
W	0.600	7	—	—	—	—	1.90	2.10	3.60	3.70	0.05	—	0.10
W	1.000	6	2.40	2.40	4.10	4.10	2.40	2.40	4.60	4.60	0.15	0.18	0.23
W	0.800	6	2.50	2.60	4.00	4.40	2.50	2.60	4.50	4.50	0.08	0.13	0.18
W	0.800	6	2.60	2.60	4.00	4.20	2.60	2.60	4.50	4.50	0.10	0.17	0.19
W	1.200	6	2.90	2.90	4.90	5.20	2.90	2.90	5.50	5.50	0.15	0.28	0.34
W	1.200	6	2.90	2.90	4.90	5.20	—	—	—	—	0.15	0.30	—
W	1.200	7	3.20	3.80	5.70	6.20	—	—	—	—	0.15	0.46	—
W	1.200	7	—	—	—	—	3.00	3.10	6.30	6.30	0.15	—	0.60
W	0.800	8	—	—	—	—	3.10	3.60	5.50	5.50	0.08	—	0.31
W	1.200	7	3.70	3.80	5.70	6.20	3.70	3.80	6.30	6.30	0.15	0.42	0.56
W	1.588	6	3.70	4.00	6.50	6.80	3.70	4.00	7.10	7.10	0.15	0.63	0.86
W	0.800	8	3.60	3.60	5.00	5.20	3.60	3.60	5.50	5.50	0.10	0.21	0.26
W	1.000	8	3.80	4.20	5.80	6.20	3.70	3.80	6.40	6.40	0.10	0.33	0.44
J	1.200	7	4.20	4.90	6.90	7.20	—	—	—	—	0.15	0.55	—
J	1.200	7	—	—	—	—	3.80	4.90	7.50	7.50	0.10	—	0.65
J	1.588	6	3.90	4.30	6.70	7.20	3.90	4.30	7.30	7.30	0.15	0.60	0.78
W	1.588	6	4.60	4.80	7.30	7.70	—	—	—	—	0.20	0.71	—
W	1.588	6	—	—	—	—	3.90	4.30	8.00	8.20	0.15	—	1.09
W	1.588	6	4.20	4.80	7.30	7.80	3.90	4.30	8.00	8.20	0.15	0.85	1.35
J	1.588	7	3.90	4.30	8.10	8.80	3.90	4.30	8.10	8.80	0.15	1.49	1.57
J	2.381	7	4.60	5.90	11.40	11.70	4.60	5.90	11.40	11.70	0.20	2.95	3.12
W	1.000	8	4.60	4.70	6.30	6.50	—	—	—	—	0.10	0.22	—
W	0.800	11	—	—	—	—	4.60	4.70	6.60	6.60	0.10	—	0.31
J	1.200	7	4.90	4.90	6.90	7.20	—	—	—	—	0.15	0.36	—
J	1.200	7	—	—	—	—	4.80	4.90	7.50	7.50	0.10	—	0.51
W	1.588	7	4.80	5.10	7.60	8.20	4.80	5.10	8.20	8.50	0.10	0.63	0.95
J	1.588	8	5.60	5.80	8.30	8.70	5.60	5.80	8.90	8.90	0.20	1.00	1.30
J	2.000	7	5.20	5.50	9.90	10.20	5.20	5.50	9.90	10.20	0.15	1.49	1.61
J	2.000	7	5.30	5.50	9.90	10.40	5.30	5.50	9.90	10.40	0.20	2.02	2.14
J	2.381	7	5.60	5.90	11.40	11.70	5.60	5.90	11.40	11.70	0.20	2.71	2.89
J	2.381	7	6.00	6.60	13.10	14.00	6.00	6.60	13.10	14.00	0.30	4.86	5.20
W	1.000	8	5.60	5.70	7.30	7.50	—	—	—	—	0.10	0.26	—
W	0.800	9	—	—	—	—	5.60	5.70	7.60	7.60	0.10	—	0.36
W	1.200	8	5.90	5.90	7.90	8.20	5.90	5.90	8.50	8.50	0.15	0.50	0.58
W	1.200	8	—	—	—	—	5.90	5.90	8.30	8.30	0.15	—	0.60
W	1.200	8	5.90	5.90	7.90	8.80	5.90	5.90	8.50	8.80	0.15	0.94	1.23
J	1.588	8	6.20	6.70	10.00	10.20	6.20	6.70	10.00	10.20	0.15	1.44	1.54
J	1.588	8	6.20	6.70	9.30	9.80	5.90	6.10	10.00	10.20	0.15	1.18	1.83
J	2.000	8	6.30	6.50	11.30	11.70	6.30	6.50	11.30	11.70	0.20	2.13	2.28
J	2.381	7	6.60	6.80	12.30	12.70	6.60	6.80	12.30	12.70	0.20	3.09	3.36

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Extra-miniature/miniature/small bearings【SUJ2】





Abutment and fillet

Dimension

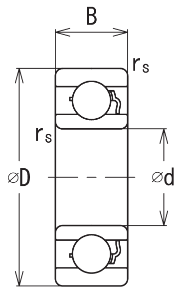
Extra-miniature/miniature/small bearings【SUJ2】

Bore diameter d		Outer diameter D		Width				Chamfer $r_{s\,(min)}$		Bearing number					Load rating		Limiting speed[3]	
				Open B		Shielded, Sealed B_1				Open	2 Shields[2]	2 Seals[2]			Cr	Cor	Grease	Oil
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch			2RS	2RU	TTS	N		min^{-1}	
5	0.1969	16	0.6299	5	0.1969	5	0.1969	0.30	0.0118	**625**[1]	**625ZZ**	**2RS**	**2RU**	—	1 730	670	44 000	52 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	**635**[1]	**635ZZ**	**2RS**	—	—	2 340	889	38 000	45 000
6	0.2362	10	0.3937	2.5	0.0984	—	—	0.15	0.0059	**MR106**	—	—	—	—	497	219	54 000	64 000
		10	0.3937	—	—	3	0.1181	0.10	0.0039	—	**MR106ZZ**	—	—	—	497	218	55 000	64 000
		10	0.3937	3	0.1181	3	0.1181	0.10	0.0039	**676**[1]	—	—	—	**TTS**	373	172	55 000	65 000
		12	0.4724	3	0.1181	4	0.1575	0.20	0.0079	**MR126**	**MR126ZZ**	**2RS**	—	—	716	293	50 000	59 000
		13	0.5118	3.5	0.1378	5	0.1969	0.15	0.0059	**686**	**686ZZ**	**2RS**	**2RU**	—	1 080	438	48 000	56 000
		15	0.5906	5	0.1969	5	0.1969	0.20	0.0079	**696**[1]	**696ZZ**	**2RS**	**2RU**	—	1 340	517	46 000	54 000
		15	0.5906	—	—	5	0.1969	0.20	0.0079	—	—	—	—	**TTS**	1 340	517	38 000	38 000
		16	0.6299	5	0.1969	5	0.1969	0.20	0.0079	**696A**[1]	**696AZZ**	**2RS**	**2RU**	—	1 340	517	46 000	54 000
		17	0.6693	6	0.2362	6	0.2362	0.30	0.0118	**606**[1]	**606ZZ**	**2RS**	**2RU**	—	2 260	838	42 000	49 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	**626**[1]	**626ZZ**	**2RS**	**2RU**	—	2 340	889	38 000	45 000
		22	0.8661	7	0.2756	7	0.2756	0.30	0.0118	**636**[1]	**636ZZ**	**2RS**	**2RU**	—	3 300	1 370	33 000	39 000
7	0.2756	11	0.4331	2.5	0.0984	3	0.1181	0.15	0.0059	**MR117**	**MR117ZZS**	—	—	—	456	201	50 000	59 000
		13	0.5118	3	0.1181	—	—	0.20	0.0079	**MR137**	—	—	—	—	541	276	45 000	53 000
		13	0.5118	—	—	4	0.1575	0.15	0.0059	—	**MR137ZZ**	—	—	—	541	276	45 000	53 000
		14	0.5512	3.5	0.1378	5	0.1969	0.15	0.0059	**687**	**687ZZ**	**2RS**	—	—	1 180	511	44 000	52 000
		17	0.6693	5	0.1969	5	0.1969	0.30	0.0118	**697**[1]	**697ZZ**	**2RS**	—	—	1 610	716	40 000	47 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	**607**[1]	**607ZZ**	**2RS**	**2RU**	—	2 340	889	38 000	45 000
		22	0.8661	7	0.2756	7	0.2756	0.30	0.0118	**627**[1]	**627ZZ**	**2RS**	**2RU**	—	3 300	1 370	33 000	39 000
		26	1.0236	9	0.3543	9	0.3543	0.30	0.0118	**637**[1]	**637ZZ**	**2RS**	—	—	4 580	1 970	28 000	33 000
8	0.3150	12	0.4724	2.5	0.0984	—	—	0.15	0.0059	**MR128**	—	—	—	—	544	275	46 000	54 000
		12	0.4724	—	—	3.5	0.1378	0.10	0.0039	—	**MR128ZZ**	**2RS**	—	—	545	274	46 000	54 000
		12	0.4724	—	—	3.5	0.1378	0.10	0.0039	—	—	—	—	**TTS**	544	275	31 000	31 000
		14	0.5512	3.5	0.1378	—	—	0.20	0.0079	**MR148**	—	—	—	—	818	386	42 000	50 000
		14	0.5512	—	—	4	0.1575	0.15	0.0059	—	**MR148ZZ**	**2RS**	—	—	818	386	42 000	50 000
		16	0.6299	4	0.1575	5	0.1969	0.20	0.0079	**688**	**688ZZ**	**2RS**	**2RU**	—	1 260	590	40 000	47 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	**698**[1]	**698ZZ**	**2RS**	**2RU**	—	2 240	912	37 000	44 000
		22	0.8661	7	0.2756	7	0.2756	0.30	0.0118	**608**[1]	**608ZZ**	**2RS**	**2RU**	—	3 300	1 370	33 000	39 000
		24	0.9449	8	0.315	8	0.315	0.30	0.0118	**628**[1]	**628ZZ**	**2RS**	**2RU**	—	3 330	1 410	31 000	37 000
		28	1.1024	9	0.3543	9	0.3543	0.30	0.0118	**638**[1]	**638ZZ**	**2RS**	**2RU**	—	4 580	1 970	28 000	33 000
9	0.3543	14	0.5512	3	0.1181	—	—	0.10	0.0039	**679**	—	—	—	—	919	467	41 000	48 000
		14	0.5512	—	—	4.5	0.1772	0.10	0.0039	—	**679ZZS**	—	—	—	919	467	41 000	48 000
		17	0.6693	4	0.1575	5	0.1969	0.20	0.0079	**689**	**689ZZ**	**2RS**	—	—	1 330	664	37 000	44 000
		20	0.7874	6	0.2362	6	0.2362	0.30	0.0118	**699**[1]	**699ZZ**	**2RS**	**2RU**	—	2 470	1 070	35 000	42 000
		24	0.9449	7	0.2756	7	0.2756	0.30	0.0118	**609**[1]	**609ZZ**	**2RS**	**2RU**	—	3 350	1 430	30 000	36 000
		26	1.0236	8	0.315	8	0.315	0.60	0.0236	**629**[1]	**629ZZ**	**2RS**	**2RU**	—	4 580	1 970	28 000	33 000
		30	1.1811	10	0.3937	10	0.3937	0.60	0.0236	**639**[1]	**639ZZ**	**2RS**	—	—	5 110	2 390	25 000	30 000

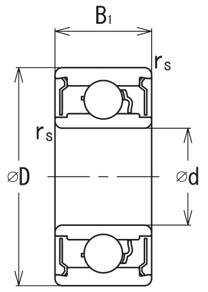
Cage type[4]	Ball		Abutment and fillet dimensions									Mass (Ref.)	
			Open				Shielded, Sealed				$r_{as\,(max)}$	Open	2 Shields
	Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$d_{b\,(min)}$	$d_{b\,(max)}$	$D_{b\,(min)}$	$D_{b\,(max)}$			
	mm	pcs.	mm				mm				mm	g	
J	2.778	7	7.00	7.40	13.90	14.40	7.00	7.40	13.90	14.40	0.30	4.30	4.53
J	3.500	6	7.00	8.40	16.60	17.00	7.00	8.40	16.60	17.00	0.30	7.57	8.11
W	1.200	10	6.90	6.90	9.00	9.20	—	—	—	—	0.15	0.58	—
W	1.200	10	—	—	—	—	6.80	6.90	9.40	9.40	0.10	—	0.71
W	1.000	11	6.80	7.00	8.90	9.20	6.80	7.00	8.90	9.20	0.10	0.73	0.76
J	1.588	8	7.30	7.60	10.30	10.70	7.10	7.10	11.00	11.00	0.20	1.23	1.57
J	2.000	8	7.20	7.90	11.10	11.80	7.20	7.30	11.80	12.20	0.15	1.85	2.50
J	2.381	7	7.30	7.40	13.10	13.40	7.30	7.40	13.10	13.40	0.20	3.52	3.82
J	2.381	7	—	—	—	—	7.30	7.40	12.90	13.40	0.20	—	3.76
J	2.381	7	7.30	7.40	13.10	14.40	7.30	7.40	13.10	14.40	0.20	4.46	4.76
J	3.500	6	7.70	8.10	14.90	15.40	7.70	8.10	14.90	15.40	0.30	5.43	5.94
J	3.500	6	8.00	8.40	16.60	17.00	8.00	8.40	16.60	17.00	0.30	7.18	7.70
J	3.969	7	8.00	10.40	19.10	20.00	8.00	10.40	19.10	20.00	0.30	12.2	12.8
W	1.200	9	7.90	7.90	10.10	10.10	7.90	7.90	10.40	10.40	0.15	0.61	0.75
W	1.200	12	8.60	9.30	11.20	11.40	—	—	—	—	0.20	1.55	—
W	1.200	12	—	—	—	—	8.20	8.90	11.80	12.20	0.15	—	2.00
J	2.000	9	8.20	8.90	12.10	12.80	8.20	8.40	12.80	13.20	0.15	2.04	2.77
J	2.381	9	8.70	9.10	14.40	15.00	8.70	9.10	14.40	15.00	0.30	4.81	5.03
J	3.500	6	8.70	8.90	16.60	17.00	8.70	8.90	16.60	17.00	0.30	6.76	7.26
J	3.969	7	9.00	10.40	19.10	20.00	9.00	10.40	19.10	20.00	0.30	11.6	12.2
J	4.762	7	9.00	13.80	22.50	24.00	9.00	13.80	22.50	24.00	0.30	22.1	23.2
W	1.200	12	9.00	9.00	11.00	11.20	—	—	—	—	0.15	0.71	—
W	1.200	12	—	—	—	—	8.60	8.90	11.40	11.40	0.10	—	1.01
W	1.200	12	—	—	—	—	8.80	9.00	11.40	11.40	0.10	—	0.95
J	1.588	10	9.60	9.80	12.30	12.70	—	—	—	—	0.20	1.80	—
J	1.588	10	—	—	—	—	8.90	9.20	12.90	13.20	0.15	—	2.00
J	2.000	10	9.60	10.40	13.60	14.40	9.50	9.60	14.30	14.70	0.20	3.16	3.79
J	3.175	7	9.70	9.70	16.80	17.00	9.70	9.70	16.80	17.00	0.30	6.21	6.72
J	3.969	7	10.00	10.40	19.10	20.00	10.00	10.40	19.10	20.00	0.30	11.0	11.6
J	3.969	7	10.00	11.80	20.00	22.00	10.00	11.80	20.00	22.00	0.30	16.5	17.2
J	4.762	7	10.00	13.80	22.50	26.00	10.00	13.80	22.50	26.00	0.30	27.2	28.3
J	1.588	12	9.80	10.30	12.70	13.20	—	—	—	—	0.10	1.29	—
W	1.588	12	—	—	—	—	9.80	10.20	13.30	13.50	0.10	—	1.84
J	2.000	11	10.60	11.40	14.60	15.40	10.30	10.60	15.30	15.70	0.20	3.43	4.12
J	3.175	8	11.00	11.50	17.50	18.00	11.00	11.50	17.50	18.00	0.30	7.09	7.59
J	3.969	7	11.00	12.00	20.60	22.00	11.00	12.00	20.60	22.00	0.30	13.3	14.0
J	4.762	7	13.00	13.80	22.50	22.60	13.00	13.80	22.50	22.60	0.60	17.8	18.9
RJ	4.762	8	13.00	15.20	25.40	26.00	13.00	15.20	25.40	26.00	0.60	33.3	34.8

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

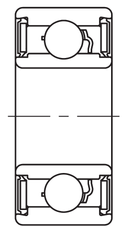
Extra-miniature/miniature/small bearings【Stainless-steel】

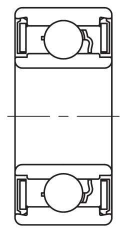


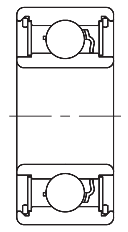
Open

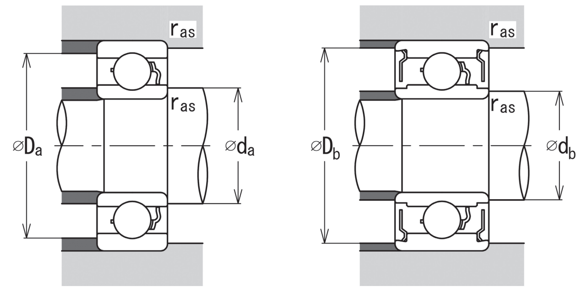


Shielded: ZZ


Sealed: 2RS


Sealed: 2RU


Sealed: TTS



Abutment and fillet

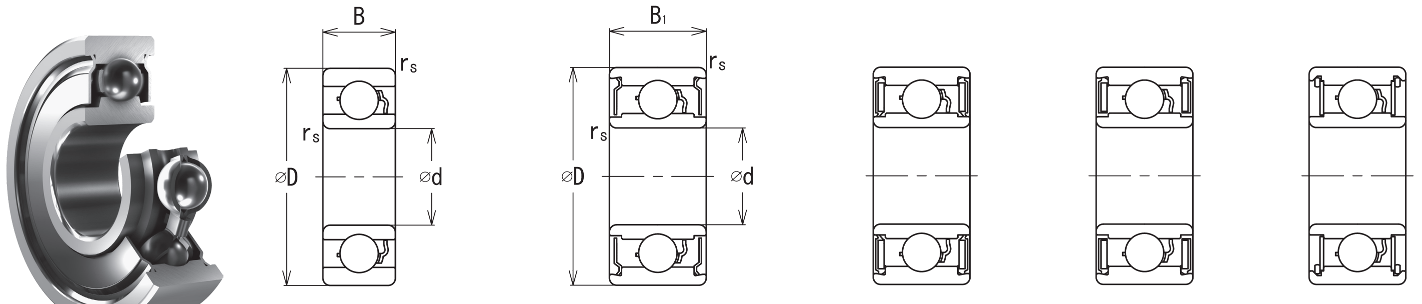
Dimension

Extra-miniature/miniature/small bearings【Stainless-steel】

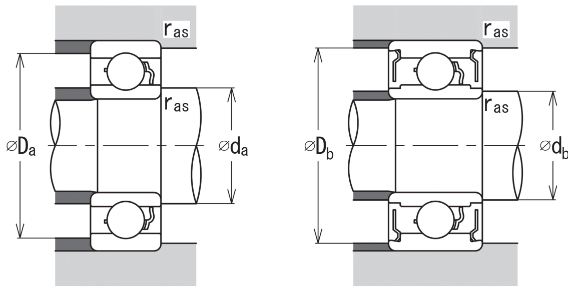
Bore diameter d		Outer diameter D		Width: Open B		Width: Shielded, Sealed B1		Chamfer $r_{s\,(min)}$		Bearing number: Open	Bearing number: 2 Shields[2]	2 Seals[2]: 2RS	2 Seals[2]: 2RU	2 Seals[2]: TTS	Load rating: Cr	Load rating: Cor	Limiting speed[3]: Grease	Limiting speed[3]: Oil
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch						N		min^{-1}	
0.6	0.0236	2.5	0.0984	1	0.0394	—	—	0.05	0.0020	**68/0.6H**	—	—	—	—	50	11	128 000	152 000
1	0.0394	3	0.1181	1	0.0394	—	—	0.05	0.0020	**681H**	—	—	—	—	81	20	117 000	139 000
		3	0.1181	1.5	0.0591	—	—	0.05	0.0020	**SMR31**	—	—	—	—	81	20	117 000	139 000
		4	0.1575	1.6	0.0630	—	—	0.10	0.0039	**691H**	—	—	—	—	120	29	105 000	124 000
1.2	0.0472	4	0.1575	1.8	0.0709	2.5	0.0984	0.10	0.0039	**SMR41X**	**SMR41XZZ**	—	—	—	96	27	105 000	124 000
1.5	0.0591	4	0.1575	1.2	0.0472	2	0.0787	0.05	0.0020	**681XH**	**681XHZZ**	—	—	—	96	27	105 000	124 000
		5	0.1969	2	0.0787	2.6	0.1024	0.15	0.0059	**691XH**	**691XHZZ**	—	—	—	202	55	94 000	111 000
		6	0.2362	2.5	0.0984	3	0.1181	0.15	0.0059	**601XH**	**601XHZZ**	—	—	—	281	79	86 000	101 000
2	0.0787	4	0.1575	1.2	0.0472	2	0.0787	0.05	0.0020	**672H**	**672HZZ**	—	—	—	106	32	98 000	116 000
		5	0.1969	1.5	0.0591	2.3	0.0906	0.08	0.0031	**682H**	**682HZZ**	—	—	—	144	40	94 000	111 000
		5	0.1969	2	0.0787	2.5	0.0984	0.10	0.0039	**SMR52**	**SMR52ZZ**	—	—	—	144	40	94 000	111 000
		6	0.2362	2.3	0.0906	3	0.1181	0.15	0.0059	**692H**	**692HZZ**	—	—	—	281	79	86 000	101 000
		6	0.2362	2.5	0.0984	2.5	0.0984	0.15	0.0059	**SMR62**	**SMR62ZZ**	—	—	—	281	79	86 000	101 000
		7	0.2756	2.5	0.0984	3	0.1181	0.15	0.0059	**SMR72**	**SMR72ZZS**	—	—	—	328	102	76 000	90 000
		7	0.2756	2.8	0.1102	3.5	0.1378	0.15	0.0059	**602H**	**602HZZS**	—	—	—	328	102	76 000	90 000
2.5	0.0984	6	0.2362	1.8	0.0709	2.6	0.1024	0.08	0.0031	**682XH**	**682XHZZ**	—	—	—	177	58	81 000	96 000
		7	0.2756	2.5	0.0984	3.5	0.1378	0.15	0.0059	**692XH**	**692XHZZS**	—	—	—	328	102	76 000	90 000
		8	0.3150	2.5	0.0984	—	—	0.20	0.0079	**SMR82X**	—	—	—	—	475	143	70 000	82 000
		8	0.3150	2.8	0.1102	4	0.1575	0.15	0.0059	**602XH**	**602XHZZ**	—	—	—	469	140	72 000	85 000
3	0.1181	6	0.2362	2	0.0787	2.5	0.0984	0.10	0.0039	**SMR63**	**SMR63ZZ**	—	—	—	177	58	81 000	96 000
		7	0.2756	2	0.0787	3	0.1181	0.10	0.0039	**683H**	**683HZZ**	**2RS**	—	—	265	90	74 000	88 000
		8	0.3150	2.5	0.0984	—	—	0.15	0.0059	**SMR83**	—	—	—	—	336	112	67 000	79 000
		8	0.3150	—	—	3	0.1181	0.10	0.0039	—	**SMR83ZZ**	—	—	—	336	112	67 000	79 000
		8	0.3150	3	0.1181	4	0.1575	0.15	0.0059	**693H**	**693HZZ**	**2RS**	—	—	475	143	70 000	82 000
		9	0.3543	2.5	0.0984	—	—	0.20	0.0079	**SMR93**	—	—	—	—	486	150	66 000	78 000
		9	0.3543	—	—	4	0.1575	0.15	0.0059	—	**SMR93ZZ**	—	—	—	486	150	66 000	78 000
		9	0.3543	3	0.1181	5	0.1969	0.15	0.0059	**603H**	**603HZZ**	—	—	—	486	150	66 000	78 000
		10	0.3937	4	0.1575	4	0.1575	0.15	0.0059	**623H**(1)	**623HZZ**	**2RS**	**2RU**	**TTS**	538	175	66 000	78 000
		13	0.5118	5	0.1969	5	0.1969	0.20	0.0079	**633H**(1)	**633HZZ**	**2RS**	—	—	1 110	388	51 000	60 000
4	0.1575	7	0.2756	2	0.0787	—	—	0.10	0.0039	**SMR74**	—	—	—	—	265	92	70 000	82 000
		7	0.2756	—	—	2.5	0.0984	0.10	0.0039	—	**SMR74ZZ**	—	—	—	217	86	71 000	83 000
		8	0.3150	2	0.0787	—	—	0.15	0.0059	**SMR84**	—	—	—	—	336	112	67 000	79 000
		8	0.3150	—	—	3	0.1181	0.10	0.0039	—	**SMR84ZZ**	—	—	—	336	112	67 000	79 000
		9	0.3543	2.5	0.0984	4	0.1575	0.10	0.0039	**684H**	**684HZZ**	**2RS**	—	**TTS**	545	181	63 000	75 000
		10	0.3937	3	0.1181	4	0.1575	0.20	0.0079	**SMR104**	**SMR104ZZ**	**2RS**	**2RU**	—	604	216	59 000	70 000
		11	0.4331	4	0.1575	4	0.1575	0.15	0.0059	**694H**(1)	**694HZZ**	**2RS**	—	—	815	277	57 000	67 000
		12	0.4724	4	0.1575	4	0.1575	0.20	0.0079	**604H**(1)	**604HZZ**	**2RS**	—	—	815	277	57 000	67 000
		13	0.5118	5	0.1969	5	0.1969	0.20	0.0079	**624H**(1)	**624HZZ**	**2RS**	**2RU**	—	1 110	388	51 000	60 000
		16	0.6299	5	0.1969	5	0.1969	0.30	0.0118	**634H**(1)	**634HZZ**	**2RS**	—	—	1 140	414	46 000	54 000

Cage type[4]	Ball: Size	Ball: Qty.	Open: $d_{a\,(min)}$	Open: $d_{a\,(max)}$	Open: $D_{a\,(min)}$	Open: $D_{a\,(max)}$	Shielded, Sealed: $d_{b\,(min)}$	Shielded, Sealed: $d_{b\,(max)}$	Shielded, Sealed: $D_{b\,(min)}$	Shielded, Sealed: $D_{b\,(max)}$	$r_{as\,(max)}$	Mass (Ref.): Open	Mass (Ref.): 2 Shields
	mm	pcs.	mm								mm	g	
W	0.500	5	1.00	1.10	2.00	2.10	—	—	—	—	0.05	0.02	—
W	0.600	6	1.40	1.50	2.60	2.70	—	—	—	—	0.05	0.03	—
W	0.600	6	1.40	1.50	2.60	2.70	—	—	—	—	0.05	0.04	—
W	0.800	5	1.80	1.90	3.30	3.50	—	—	—	—	0.10	0.09	—
W	0.600	7	2.00	2.10	3.10	3.20	2.00	2.10	3.60	3.60	0.10	0.11	0.14
W	0.600	7	1.90	2.10	3.10	3.60	1.90	2.10	3.60	3.70	0.05	0.07	0.10
W	1.000	6	2.40	2.40	4.10	4.10	2.40	2.40	4.60	4.60	0.15	0.17	0.22
W	1.200	6	2.70	2.90	4.90	5.20	2.70	2.90	5.50	5.50	0.15	0.32	0.37
W	0.600	8	2.40	2.50	3.50	3.60	2.40	2.50	3.70	3.70	0.05	0.05	0.08
W	0.800	6	2.50	2.60	4.00	4.40	2.50	2.60	4.50	4.50	0.08	0.13	0.18
W	0.800	6	2.60	2.60	4.00	4.20	2.60	2.60	4.50	4.50	0.10	0.16	0.19
W	1.200	6	2.90	2.90	4.90	5.20	2.90	2.90	5.50	5.50	0.15	0.28	0.33
W	1.200	6	2.90	2.90	4.90	5.20	2.90	2.90	5.50	5.50	0.15	0.29	0.29
W	1.200	7	3.20	3.80	5.70	6.20	3.00	3.10	6.30	6.30	0.15	0.45	0.51
W	1.200	7	3.20	3.80	5.70	6.20	3.00	3.10	6.30	6.30	0.15	0.50	0.59
W	0.800	8	3.10	3.60	5.00	5.40	3.10	3.60	5.50	5.50	0.08	0.22	0.30
W	1.200	7	3.70	3.80	5.70	6.20	3.70	3.80	6.30	6.30	0.15	0.42	0.56
W	1.588	6	4.10	4.30	6.70	6.70	—	—	—	—	0.20	0.52	—
W	1.588	6	3.70	4.00	6.50	6.80	3.70	4.00	7.10	7.10	0.15	0.62	0.85
W	0.800	8	3.60	3.60	5.00	5.20	3.60	3.60	5.50	5.50	0.10	0.21	0.25
W	1.000	8	3.80	4.20	5.80	6.20	3.70	3.80	6.40	6.40	0.10	0.33	0.44
J	1.200	7	4.20	4.90	6.90	7.20	—	—	—	—	0.15	0.55	—
J	1.200	7	—	—	—	—	3.80	4.90	7.50	7.50	0.10	—	0.64
J	1.588	6	3.90	4.30	6.70	7.20	3.90	4.30	7.30	7.30	0.15	0.60	0.77
W	1.588	6	4.60	4.80	7.30	7.70	—	—	—	—	0.20	0.70	—
W	1.588	6	—	—	—	—	3.90	4.30	8.00	8.20	0.15	—	1.07
W	1.588	6	4.20	4.80	7.30	7.80	3.90	4.30	8.00	8.20	0.15	0.84	1.33
J	1.588	7	3.90	4.30	8.10	8.80	3.90	4.30	8.10	8.80	0.15	1.47	1.56
J	2.381	7	4.60	5.90	11.40	11.70	4.60	5.90	11.40	11.70	0.20	2.91	3.08
W	1.000	8	4.60	4.70	6.30	6.50	—	—	—	—	0.10	0.22	—
W	0.800	11	—	—	—	—	4.60	4.70	6.60	6.60	0.10	—	0.30
J	1.200	7	4.90	4.90	6.90	7.20	—	—	—	—	0.15	0.36	—
J	1.200	7	—	—	—	—	4.80	4.90	7.50	7.50	0.10	—	0.51
W	1.588	7	4.80	5.10	7.60	8.20	4.80	5.10	8.20	8.50	0.10	0.62	0.93
J	1.588	8	5.60	5.80	8.30	8.70	5.60	5.80	8.90	8.90	0.20	0.99	1.29
J	2.000	7	5.20	5.50	9.90	10.20	5.20	5.50	9.90	10.20	0.15	1.47	1.59
J	2.000	7	5.30	5.50	9.90	10.40	5.30	5.50	9.90	10.40	0.20	1.99	2.11
J	2.381	7	5.60	5.90	11.40	11.70	5.60	5.90	11.40	11.70	0.20	2.78	2.95
J	2.381	7	6.00	6.60	13.10	14.00	6.00	6.60	13.10	14.00	0.30	4.80	5.14

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.



Open　Shielded: ZZ　Sealed: 2RS　Sealed: 2RU　Sealed: TTS



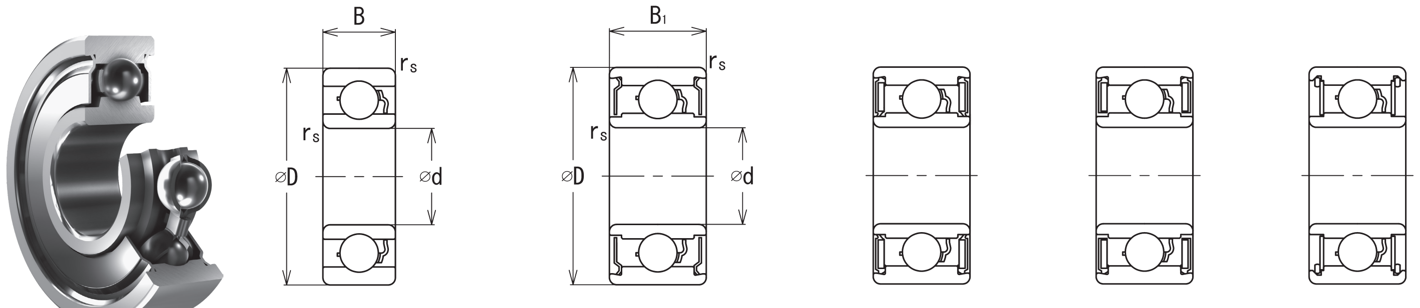
Abutment and fillet

Bore diameter d		Outer diameter D		Width: Open B		Width: Shielded, Sealed B1		Chamfer rs (min)		Bearing number: Open	Bearing number: 2 Shields(2)	2 Seals(2): 2RS	2 Seals(2): 2RU	2 Seals(2): TTS	Load rating: Cr	Load rating: Cor	Limiting speed(3): Grease	Limiting speed(3): Oil
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch						N		min⁻¹	
5	0.1969	8	0.3150	2	0.0787	—	—	0.10	0.0039	SMR85	—	—	—	—	263	97	62 000	74 000
		8	0.3150	—	—	2.5	0.0984	0.10	0.0039	—	SMR85ZZ	—	—	—	185	73	63 000	75 000
		9	0.3543	2.5	0.0984	3	0.1181	0.15	0.0059	SMR95	SMR95ZZ	—	—	TTS	367	134	60 000	71 000
		10	0.3937	3	0.1181	4	0.1575	0.15	0.0059	SMR105	SMR105ZZ	2RS	—	—	367	134	60 000	71 000
		11	0.4331	4	0.1575	4	0.1575	0.15	0.0059	SMR115(1)	SMR115ZZ	2RS	—	—	609	226	54 000	64 000
		11	0.4331	3	0.1181	5	0.1969	0.15	0.0059	685H	685HZZ	2RS	—	—	609	226	54 000	64 000
		13	0.5118	4	0.1575	4	0.1575	0.20	0.0079	695H(1)	695HZZ	2RS	—	—	916	344	50 000	59 000
		14	0.5512	5	0.1969	5	0.1969	0.20	0.0079	605H(1)	605HZZ	2RS	—	—	1 130	405	48 000	56 000
		16	0.6299	5	0.1969	5	0.1969	0.30	0.0118	625H(1)	625HZZ	2RS	—	—	1 470	536	44 000	52 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	635H(1)	635HZZ	2RS	—	—	1 990	711	38 000	45 000
6	0.2362	10	0.3937	2.5	0.0984	—	—	0.15	0.0059	SMR106	—	—	—	—	422	175	54 000	64 000
		10	0.3937	—	—	3	0.1181	0.10	0.0039	—	SMR106ZZ	—	—	—	423	174	55 000	64 000
		12	0.4724	3	0.1181	4	0.1575	0.20	0.0079	SMR126	SMR126ZZ	2RS	—	—	608	234	50 000	59 000
		13	0.5118	3.5	0.1378	5	0.1969	0.15	0.0059	686H	686HZZ	2RS	2RU	—	920	350	48 000	56 000
		13	0.5118	—	—	5	0.1969	0.15	0.0059	—	—	—	—	TTS	920	350	38 000	38 000
		15	0.5906	5	0.1969	5	0.1969	0.20	0.0079	696H(1)	696HZZ	2RS	2RU	—	1 140	414	46 000	54 000
		15	0.5906	—	—	5	0.1969	0.20	0.0079	—	—	—	—	TTS	1 140	414	38 000	38 000
		16	0.6299	5	0.1969	5	0.1969	0.20	0.0079	696AH(1)	696AHZZ	2RS	2RU	—	1 140	414	46 000	54 000
		17	0.6693	6	0.2362	6	0.2362	0.30	0.0118	606H(1)	606HZZ	2RS	2RU	—	1 920	670	42 000	49 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	626H(1)	626HZZ	2RS	2RU	—	1 990	711	38 000	45 000
		22	0.8661	7	0.2756	7	0.2756	0.30	0.0118	636H(1)	636HZZ	2RS	2RU	—	2 800	1 090	33 000	39 000
7	0.2756	11	0.4331	2.5	0.0984	3	0.1181	0.15	0.0059	SMR117	SMR117ZZS	—	—	—	388	161	50 000	59 000
		13	0.5118	3	0.1181	—	—	0.20	0.0079	SMR137	—	—	—	—	460	221	45 000	53 000
		13	0.5118	—	—	4	0.1575	0.15	0.0059	—	SMR137ZZ	—	—	—	460	221	45 000	53 000
		14	0.5512	3.5	0.1378	5	0.1969	0.15	0.0059	687H	687HZZ	2RS	—	—	999	409	44 000	52 000
		17	0.6693	5	0.1969	5	0.1969	0.30	0.0118	697H(1)	697HZZ	2RS	—	—	1 370	573	40 000	47 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	607H(1)	607HZZ	2RS	2RU	—	1 990	711	38 000	45 000
		19	0.7480	—	—	6	0.2362	0.30	0.0118	—	—	—	—	TTS	1 900	729	29 000	29 000
		22	0.8661	7	0.2756	7	0.2756	0.30	0.0118	627H(1)	627HZZ	2RS	2RU	—	2 800	1 090	33 000	39 000
		22	0.8661	—	—	7	0.2756	0.30	0.0118	—	—	—	—	TTS	2 800	1 090	27 000	27 000
8	0.3150	12	0.4724	2.5	0.0984	—	—	0.15	0.0059	SMR128	—	—	—	—	462	220	46 000	54 000
		12	0.4724	—	—	3.5	0.1378	0.10	0.0039	—	SMR128ZZ	2RS	—	—	463	219	46 000	54 000
		12	0.4724	—	—	3.5	0.1378	0.10	0.0039	—	—	—	—	TTS	462	220	31 000	31 000
		14	0.5512	3.5	0.1378	—	—	0.20	0.0079	SMR148	—	—	—	—	696	309	42 000	50 000
		14	0.5512	—	—	4	0.1575	0.15	0.0059	—	SMR148ZZ	2RS	—	—	696	309	42 000	50 000
		16	0.6299	4	0.1575	5	0.1969	0.20	0.0079	688H	688HZZ	2RS	2RU	—	1 070	472	40 000	47 000
		16	0.6299	—	—	5	0.1969	0.20	0.0079	—	—	—	—	TTS	1 070	472	29 000	29 000
		19	0.7480	6	0.2362	6	0.2362	0.30	0.0118	698H(1)	698HZZ	2RS	2RU	—	1 900	729	37 000	44 000
		22	0.8661	7	0.2756	7	0.2756	0.30	0.0118	608H(1)	608HZZ	2RS	2RU	—	2 800	1 090	33 000	39 000
8	0.3150	22	0.8661	—	—	7	0.2756	0.30	0.0118	—	—	—	—	TTS	2 800	1 090	27 000	27 000
		24	0.9449	8	0.3150	8	0.3150	0.30	0.0118	628H(1)	628HZZ	2RS	2RU	—	2 830	1 130	31 000	37 000
		28	1.1024	9	0.3543	9	0.3543	0.30	0.0118	638H(1)	638HZZ	2RS	2RU	—	3 890	1 570	28 000	33 000
9	0.3543	14	0.5512	3	0.1181	4.5	0.1772	0.10	0.0039	679H	679HZZS	—	—	—	781	374	41 000	48 000
		17	0.6693	4	0.1575	5	0.1969	0.20	0.0079	689H	689HZZ	2RS	—	—	1 130	531	37 000	44 000
		20	0.7874	6	0.2362	6	0.2362	0.30	0.0118	699H(1)	699HZZ	2RS	2RU	—	2 100	855	35 000	42 000
		24	0.9449	7	0.2756	7	0.2756	0.30	0.0118	609H(1)	609HZZ	2RS	2RU	—	2 850	1 150	30 000	36 000
		26	1.0236	8	0.3150	8	0.3150	0.60	0.0236	629H(1)	629HZZ	2RS	2RU	—	3 890	1 570	28 000	33 000
		30	1.1811	10	0.3937	10	0.3937	0.60	0.0236	639H(1)	639HZZ	2RS	—	—	4 350	1 910	25 000	30 000

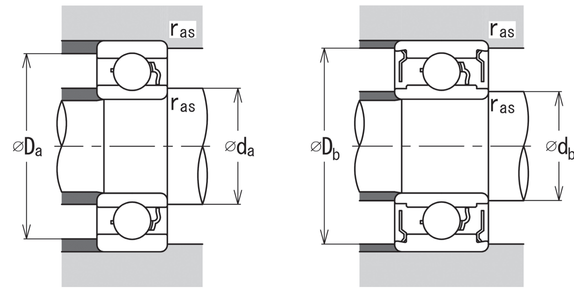
Cage type(4)	Ball: Size	Ball: Qty.	Open: $d_{a\,(min)}$	Open: $d_{a\,(max)}$	Open: $D_{a\,(min)}$	Open: $D_{a\,(max)}$	Shielded, Sealed: $d_{b\,(min)}$	Shielded, Sealed: $d_{b\,(max)}$	Shielded, Sealed: $D_{b\,(min)}$	Shielded, Sealed: $D_{b\,(max)}$	$r_{as\,(max)}$	Mass (Ref.): Open	Mass (Ref.): 2 Shields
	mm	pcs.	mm				mm				mm	g	
W	1.000	8	5.60	5.70	7.30	7.50	—	—	—	—	0.10	0.26	—
W	0.800	9	—	—	—	—	5.60	5.70	7.60	7.60	0.10	—	0.35
W	1.200	8	5.90	5.90	7.90	8.20	5.90	5.90	8.50	8.50	0.15	0.50	0.57
W	1.200	8	5.90	5.90	7.90	8.80	5.90	5.90	8.50	8.80	0.15	0.93	1.21
J	1.588	8	6.20	6.70	10.00	10.20	6.20	6.70	10.00	10.20	0.15	1.42	1.52
J	1.588	8	6.20	6.70	9.30	9.80	5.90	6.10	10.00	10.20	0.15	1.17	1.81
J	2.000	8	6.30	6.50	11.30	11.70	6.30	6.50	11.30	11.70	0.20	2.11	2.26
J	2.381	7	6.60	6.80	12.30	12.70	6.60	6.80	12.30	12.70	0.20	3.14	3.33
J	2.778	7	7.00	7.40	13.50	14.00	7.00	7.40	13.50	14.00	0.30	4.44	4.77
J	3.500	6	7.00	8.40	16.60	17.00	7.00	8.40	16.60	17.00	0.30	7.48	8.00
W	1.200	10	6.90	6.90	9.00	9.20	—	—	—	—	0.15	0.57	—
W	1.200	10	—	—	—	—	6.80	6.90	9.40	9.40	0.10	—	0.70
J	1.588	8	7.30	7.60	10.30	10.70	7.10	7.10	11.00	11.00	0.20	1.22	1.56
J	2.000	8	7.20	7.90	11.10	11.80	7.20	7.30	11.80	12.20	0.15	1.83	2.47
J	2.000	8	—	—	—	—	7.20	7.30	11.70	12.20	0.15	—	2.38
J	2.381	7	7.30	7.40	13.10	13.40	7.30	7.40	13.10	13.40	0.20	3.48	3.78
J	2.381	7	—	—	—	—	7.30	7.40	12.90	13.40	0.20	—	3.71
J	2.381	7	7.30	7.40	13.10	14.40	7.30	7.40	13.10	14.40	0.20	4.40	4.70
J	3.500	6	7.70	8.10	14.90	15.40	7.70	8.10	14.90	15.40	0.30	5.37	5.87
J	3.500	6	8.00	8.40	16.60	17.00	8.00	8.40	16.60	17.00	0.30	7.09	7.62
J	3.969	7	8.00	10.40	19.10	20.00	8.00	10.40	19.10	20.00	0.30	12.0	12.6
W	1.200	9	7.90	7.90	10.10	10.10	7.90	7.90	10.40	10.40	0.15	0.60	0.74
W	1.200	12	8.60	9.30	11.20	11.40	—	—	—	—	0.20	1.53	—
W	1.200	12	—	—	—	—	8.20	8.90	11.80	12.20	0.15	—	1.98
J	2.000	9	8.20	8.90	12.10	12.80	8.20	8.40	12.80	13.20	0.15	2.02	2.74
J	2.381	9	8.70	9.10	14.40	15.00	8.70	9.10	14.40	15.00	0.30	4.75	4.98
J	3.500	6	8.70	8.90	16.60	17.00	8.70	8.90	16.60	17.00	0.30	6.67	7.18
J	3.175	7	—	—	—	—	9.00	9.70	16.60	17.00	0.30	—	7.02
J	3.969	7	9.00	10.40	19.10	20.00	9.00	10.40	19.10	20.00	0.30	11.5	12.1
J	3.969	7	—	—	—	—	9.00	10.40	19.40	20.00	0.30	—	11.6
W	1.200	12	9.00	9.00	11.00	11.20	—	—	—	—	0.15	0.70	—
W	1.200	12	—	—	—	—	8.60	8.90	11.40	11.40	0.10	—	1.00
W	1.200	12	—	—	—	—	8.80	9.00	11.40	11.40	0.10	—	0.94
J	1.588	10	9.60	9.80	12.30	12.70	—	—	—	—	0.20	1.77	—
J	1.588	10	—	—	—	—	8.90	9.20	12.90	13.20	0.15	—	1.98
J	2.000	10	9.60	10.40	13.60	14.40	9.50	9.60	14.30	14.70	0.20	3.13	3.75
J	2.000	10	—	—	—	—	9.50	9.60	14.20	14.40	0.20	—	3.62
J	3.175	7	9.70	9.70	16.80	17.00	9.70	9.70	16.80	17.00	0.30	6.13	6.64
J	3.969	7	10.00	10.40	19.10	20.00	10.00	10.40	19.10	20.00	0.30	10.9	11.5
J	3.969	7	—	—	—	—	10.00	10.40	19.40	20.00	0.30	—	11.0
J	3.969	7	10.00	11.80	20.00	22.00	10.00	11.80	20.00	22.00	0.30	16.3	17.0
J	4.762	7	10.00	13.80	22.50	26.00	10.00	13.80	22.50	26.00	0.30	26.9	28.0
W	1.588	12	9.80	10.30	12.70	13.20	9.80	10.20	13.30	13.50	0.10	1.27	1.81
J	2.000	11	10.60	11.40	14.60	15.40	10.30	10.60	15.30	15.70	0.20	3.39	4.08
J	3.175	8	11.00	11.50	17.50	18.00	11.00	11.50	17.50	18.00	0.30	7.01	7.51
J	3.969	7	11.00	12.00	20.60	22.00	11.00	12.00	20.60	22.00	0.30	13.1	13.9
J	4.762	7	13.00	13.80	22.50	22.60	13.00	13.80	22.50	22.60	0.60	17.5	18.7
RJ	4.762	8	13.00	15.20	25.40	26.00	13.00	15.20	25.40	26.00	0.60	32.9	34.3

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Inch-series bearings【SUJ2】



Open | Shielded: ZZ | Sealed: 2RS | Sealed: 2RU | Sealed: TTS



Abutment and fillet

Dimension

Inch-series bearings【SUJ2】

Bore diameter d		Outer diameter D		Width				Chamfer $r_{s\,(min)}$		Bearing number					Load rating		Limiting speed[3]	
				Open B		Shielded, Sealed B_1				Open	2 Shields[2]	2 Seals[2]			Cr	Cor	Grease	Oil
												2RS	2RU	TTS				
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch						N		min^{-1}	
3.175	0.1250	6.350	0.2500	—	—	2.779	0.1094	0.10	0.0039	—	**R144ZZ**	—	—	—	284	95	77 000	91 000
		7.938	0.3125	—	—	3.571	0.1406	0.10	0.0039	—	**R2-5ZZ**	—	—	—	559	179	70 000	82 000
		9.525	0.3750	3.967	0.1562	3.967	0.1562	0.30	0.0118	**R2**[1]	**R2ZZ**	**2RS**	—	—	633	218	66 000	78 000
		9.525	0.3750	—	—	3.967	0.1562	0.30	0.0118	—	—	—	**2RU**	—	641	226	63 000	75 000
		12.700	0.5000	4.366	0.1719	4.366	0.1719	0.30	0.0118	**R2A**[1]	**R2AZZ**	—	—	—	641	226	63 000	75 000
3.967	0.1562	7.938	0.3125	—	—	3.175	0.1250	0.10	0.0039	—	**R155ZZS**	—	—	—	360	149	64 000	76 000
4.762	0.1875	7.938	0.3125	—	—	3.175	0.1250	0.10	0.0039	—	**R156ZZS**	—	—	**TTS**	360	149	64 000	76 000
		9.525	0.3750	3.175	0.1250	3.175	0.1250	0.10	0.0039	**R166**[1]	**R166ZZ**	—	—	—	711	270	59 000	70 000
		9.525	0.3750	—	—	3.175	0.1250	0.10	0.0039	—	—	—	—	**TTS**	711	270	48 000	48 000
		12.700	0.5000	3.967	0.1562	4.978	0.1960	0.30	0.0118	**R3**	**R3ZZ**	**2RS**	—	—	1 300	485	51 000	60 000
		15.875	0.6250	4.978	0.1960	4.978	0.1960	0.30	0.0118	**R3A**[1]	**R3AZZ**	—	—	—	1 480	617	42 000	50 000
6.350	0.2500	9.525	0.3750	3.175	0.1250	3.175	0.1250	0.10	0.0039	**R168**[1]	**R168ZZ**	—	—	—	373	172	55 000	65 000
		12.700	0.5000	3.175	0.1250	4.762	0.1875	0.15	0.0059	**R188**	**R188ZZ**	—	—	—	1 080	438	48 000	56 000
		15.875	0.6250	4.978	0.1960	4.978	0.1960	0.30	0.0118	**R4**[1]	**R4ZZ**	**2RS**	**2RU**	—	1 480	617	42 000	50 000
		19.050	0.7500	5.558	0.2188	7.142	0.2812	0.40	0.0157	**R4A**	**R4AZZ**	**2RS**	**2RU**	—	2 340	889	38 000	45 000
9.525	0.3750	22.225	0.8750	5.558	0.2188	7.142	0.2812	0.40	0.0157	**R6**	**R6ZZ**	**2RS**	**2RU**	—	3 330	1 410	31 000	37 000
		22.225	0.8750	—	—	7.142	0.2812	0.40	0.0157	—	—	—	—	**TTS**	3 330	1 410	24 000	24 000
12.700	0.5000	22.225	0.8750	5.558	0.2188	7.142	0.2812	0.40	0.0157	**R6-5**	**R6-5ZZS**	—	—	—	1 920	1 040	30 000	36 000
		28.575	1.1250	6.350	0.2500	7.938	0.3125	0.40	0.0157	**R8**	**R8ZZ**	**2RS**	**2RU**	—	5 110	2 390	25 000	30 000
15.875	0.6250	34.925	1.3750	7.142	0.2812	8.733	0.3438	0.80	0.0315	**R10**	**R10ZZ**	—	—	—	6 000	3 270	20 000	24 000
		34.925	1.3750	—	—	8.733	0.3438	0.80	0.0315	—	—	**2RS**	**2RU**	—	6 790	3 330	21 000	25 000
19.050	0.7500	41.275	1.6250	7.938	0.3125	—	—	0.80	0.0315	**R12**	—	—	—	—	7 920	4 450	17 000	21 000
		41.275	1.6250	—	—	11.113	0.4375	0.80	0.0315	—	**R12ZZ**	**2RS**	—	—	9 380	5 060	17 000	20 000
22.225	0.8750	47.625	1.8750	9.525	0.3750	—	—	0.80	0.0315	**R14**	—	—	—	—	10 100	5 850	15 000	18 000

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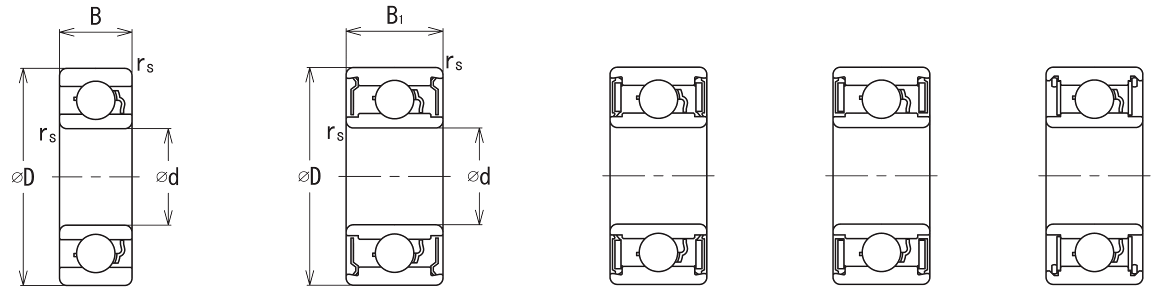
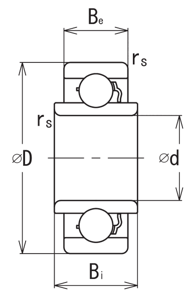
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Cage type[4]	Ball		Abutment and fillet dimensions									Mass (Ref.)	
	Size	Qty.	Open				Shielded, Sealed				$r_{as\,(max)}$	Open	2 Shields
			$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$d_{b\,(min)}$	$d_{b\,(max)}$	$D_{b\,(min)}$	$D_{b\,(max)}$			
	mm	pcs.	mm				mm				mm	g	
W	1.000	7	—	—	—	—	3.80	3.80	6.00	6.00	0.10	—	0.28
J	1.588	6	—	—	—	—	4.00	4.30	7.30	7.30	0.10	—	0.66
J	1.588	7	4.70	4.70	8.10	8.10	4.70	4.70	8.10	8.10	0.30	1.22	1.29
J	1.588	7	—	—	—	—	4.50	4.50	8.30	8.30	0.30	—	1.24
J	1.588	7	4.50	4.50	8.30	10.70	4.50	4.50	8.30	10.70	0.30	3.12	3.20
W	1.000	10	—	—	—	—	4.80	5.40	7.40	7.40	0.10	—	0.59
W	1.000	10	—	—	—	—	5.40	5.40	7.40	7.40	0.10	—	0.45
J	1.588	8	5.60	5.90	8.90	8.90	5.60	5.90	8.90	8.90	0.10	0.74	0.79
J	1.588	8	—	—	—	—	5.60	5.90	8.80	9.00	0.10	—	0.76
J	2.381	7	6.80	6.90	10.50	10.70	6.40	6.40	11.20	11.20	0.30	2.14	2.61
J	2.381	8	6.80	8.30	13.90	14.30	6.80	8.30	13.90	14.30	0.30	4.42	4.74
W	1.000	11	7.00	7.00	9.10	9.10	7.00	7.00	9.10	9.10	0.10	0.51	0.54
J	2.000	8	7.60	7.90	11.10	11.50	7.20	7.30	11.70	11.90	0.15	1.47	2.03
J	2.381	8	8.00	8.30	13.90	14.30	8.00	8.30	13.90	14.30	0.30	3.87	4.19
J	3.500	6	8.90	10.00	15.10	16.60	8.40	8.40	16.60	17.10	0.40	7.43	8.96
J	3.969	7	12.10	12.70	18.80	19.80	11.60	11.80	20.00	20.10	0.40	8.74	10.7
J	3.969	7	—	—	—	—	11.60	11.80	19.80	20.30	0.40	—	10.2
J	2.381	12	14.50	14.50	18.50	20.00	14.50	14.50	19.50	20.00	0.40	7.69	9.81
J	4.762	8	15.50	16.50	24.00	26.50	15.00	15.50	25.50	26.50	0.40	17.2	20.5
RJ	4.762	10	20.50	23.00	30.50	31.50	20.50	23.00	31.50	31.50	0.80	29.8	35.8
RJ	5.556	8	—	—	—	—	20.50	21.00	31.00	31.50	0.80	—	34.3
RJ	5.556	10	24.00	27.00	35.00	37.00	—	—	—	—	0.80	46.4	—
RJ	6.350	9	—	—	—	—	24.00	27.50	37.50	38.00	0.80	—	60.4
RJ	6.350	10	27.00	31.50	40.50	43.50	—	—	—	—	0.80	74.5	—

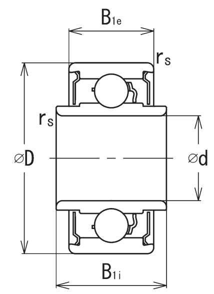
Inch-series bearings【Stainless-steel】



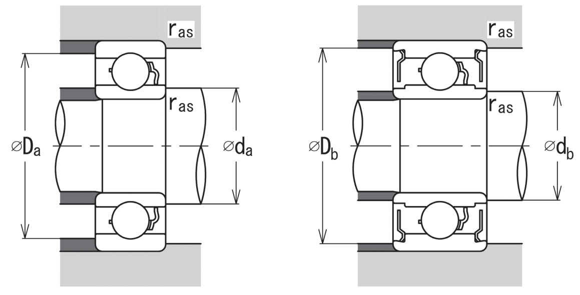
Open Shielded: ZZ Sealed: 2RS Sealed: 2RU Sealed: TTS



Extended inner ring open type



Extended inner ring shielded type



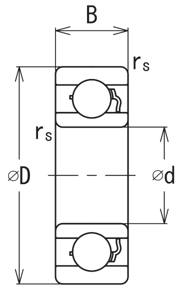
Abutment and fillet

Bore diameter d		Outer diameter D		Inner ring width				Outer ring width				Chamfer $r_{s\,(min)}$		Bearing number				
				Open B, B_i		Shielded, Sealed B_1, B_{1i}		Open B, B_e		Shielded, Sealed B_1, B_{1e}				Open	2 Shields[2]	2 Seals[2]		
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch			2RS	2RU	TTS
1.016	0.0400	3.175	0.1250	1.191	0.0469	—	—	1.191	0.0469	—	—	0.10	0.0039	**SR09**	—	—	—	—
1.191	0.0469	3.967	0.1562	1.588	0.0625	2.380	0.0937	1.588	0.0625	2.380	0.0937	0.10	0.0039	**SR0**	**SR0ZZ**	—	—	—
		3.967	0.1562	2.380	0.0937	3.175	0.1250	1.588	0.0625	2.380	0.0937	0.10	0.0039	**SRW0**	**SRW0ZZ**	—	—	—
1.397	0.0550	4.762	0.1875	1.984	0.0781	2.779	0.1094	1.984	0.0781	2.779	0.1094	0.10	0.0039	**SR1**	**SR1ZZ**	—	—	—
		4.762	0.1875	2.779	0.1094	3.571	0.1406	1.984	0.0781	2.779	0.1094	0.10	0.0039	**SRW1**	**SRW1ZZ**	—	—	—
1.984	0.0781	6.350	0.2500	2.380	0.0937	3.571	0.1406	2.380	0.0937	3.571	0.1406	0.10	0.0039	**SR1-4**	**SR1-4ZZ**	—	—	—
		6.350	0.2500	3.175	0.1250	4.366	0.1719	2.380	0.0937	3.571	0.1406	0.10	0.0039	**SRW1-4**	**SRW1-4ZZ**	—	—	—
2.380	0.0937	4.762	0.1875	1.588	0.0625	—	—	1.588	0.0625	—	—	0.10	0.0039	**SR133**	—	—	—	—
		4.762	0.1875	—	—	2.380	0.0937	—	—	2.380	0.0937	0.10	0.0039	—	**SR133ZZS**	—	—	—
		4.762	0.1875	—	—	3.175	0.1250	—	—	2.380	0.0937	0.10	0.0039	—	**SRW133ZZS**	—	—	—
		7.938	0.3125	2.779	0.1094	3.571	0.1406	2.779	0.1094	3.571	0.1406	0.15	0.0059	**SR1-5**	**SR1-5ZZ**	—	—	—
		7.938	0.3125	3.571	0.1406	4.366	0.1719	2.779	0.1094	3.571	0.1406	0.15	0.0059	**SRW1-5**[1]	**SRW1-5ZZ**	—	—	—
3.175	0.1250	6.350	0.2500	2.380	0.0937	—	—	2.380	0.0937	—	—	0.10	0.0039	**SR144J**	—	—	—	—
		6.350	0.2500	2.380	0.0937	2.779	0.1094	2.380	0.0937	2.779	0.1094	0.10	0.0039	**SR144**	**SR144ZZ**	—	—	—
		6.350	0.2500	—	—	2.779	0.1094	—	—	2.779	0.1094	0.10	0.0039	—	—	—	—	**TTS**
		6.350	0.2500	3.175	0.1250	3.571	0.1406	2.380	0.0937	2.779	0.1094	0.10	0.0039	**SRW144**	**SRW144ZZ**	—	—	—
		7.938	0.3125	2.779	0.1094	3.571	0.1406	2.779	0.1094	3.571	0.1406	0.10	0.0039	**SR2-5**	**SR2-5ZZ**	—	—	—
		7.938	0.3125	—	—	4.366	0.1719	—	—	3.571	0.1406	0.10	0.0039	—	**SRW2-5ZZ**	—	—	—
		9.525	0.3750	2.779	0.1094	3.571	0.1406	2.779	0.1094	3.571	0.1406	0.15	0.0059	**SR2-6**	**SR2-6ZZ**	—	—	—
		9.525	0.3750	—	—	4.366	0.1719	—	—	3.571	0.1406	0.15	0.0059	—	**SRW2-6ZZ**	—	—	—
		9.525	0.3750	3.967	0.1562	3.967	0.1562	3.967	0.1562	3.967	0.1562	0.30	0.0118	**SR2**[1]	**SR2ZZ**	**2RS**	—	**TTS**
		9.525	0.3750	—	—	3.967	0.1562	—	—	3.967	0.1562	0.30	0.0118	—	—	—	**2RU**	—
		9.525	0.3750	4.762	0.1875	4.762	0.1875	3.967	0.1562	3.967	0.1562	0.30	0.0118	**SRW2**[1]	**SRW2ZZ**	—	—	—
		12.700	0.5000	4.366	0.1719	4.366	0.1719	4.366	0.1719	4.366	0.1719	0.30	0.0118	**SR2A**[1]	**SR2AZZ**	—	—	—
3.967	0.1562	7.938	0.3125	2.779	0.1094	3.175	0.1250	2.779	0.1094	3.175	0.1250	0.10	0.0039	**SR155**	**SR155ZZS**	—	—	—
		7.938	0.3125	—	—	3.967	0.1562	—	—	3.175	0.1250	0.10	0.0039	—	**SRW155ZZS**	—	—	—
4.762	0.1875	7.938	0.3125	2.779	0.1094	3.175	0.1250	2.779	0.1094	3.175	0.1250	0.10	0.0039	**SR156**	**SR156ZZS**	—	—	**TTS**
		7.938	0.3125	—	—	3.967	0.1562	—	—	3.175	0.1250	0.10	0.0039	—	**SRW156ZZS**	—	—	—
		9.525	0.3750	3.175	0.1250	3.175	0.1250	3.175	0.1250	3.175	0.1250	0.10	0.0039	**SR166**[1]	**SR166ZZ**	—	—	—
		9.525	0.3750	—	—	3.175	0.1250	—	—	3.175	0.1250	0.10	0.0039	—	—	—	—	**TTS**
		9.525	0.3750	3.967	0.1562	3.967	0.1562	3.175	0.1250	3.175	0.1250	0.10	0.0039	**SRW166**[1]	**SRW166ZZ**	—	—	—
		12.700	0.5000	3.967	0.1562	4.978	0.1960	3.967	0.1562	4.978	0.1960	0.30	0.0118	**SR3**	**SR3ZZ**	**2RS**	—	—
		12.700	0.5000	—	—	4.978	0.1960	—	—	4.978	0.1960	0.30	0.0118	—	—	—	—	**TTS**
		12.700	0.5000	4.762	0.1875	5.771	0.2272	3.967	0.1562	4.978	0.1960	0.30	0.0118	**SRW3**	**SRW3ZZ**	**2RS**	—	—
		15.875	0.6250	4.978	0.1960	4.978	0.1960	4.978	0.1960	4.978	0.1960	0.30	0.0118	**SR3A**[1]	**SR3AZZ**	—	—	—
6.350	0.2500	9.525	0.3750	3.175	0.1250	3.175	0.1250	3.175	0.1250	3.175	0.1250	0.10	0.0039	**SR168**[1]	**SR168ZZ**	—	—	—
		9.525	0.3750	—	—	3.175	0.1250	—	—	3.175	0.1250	0.10	0.0039	—	—	—	—	**TTS**
		9.525	0.3750	3.967	0.1562	3.967	0.1562	3.175	0.1250	3.175	0.1250	0.10	0.0039	**SRW168**[1]	**SRW168ZZ**	—	—	—
		12.700	0.5000	3.175	0.1250	4.762	0.1875	3.175	0.1250	4.762	0.1875	0.15	0.0059	**SR188**	**SR188ZZ**	—	—	**TTS**
		12.700	0.5000	3.967	0.1562	5.558	0.2188	3.175	0.1250	4.762	0.1875	0.15	0.0059	**SRW188**	**SRW188ZZ**	—	—	**TTS**

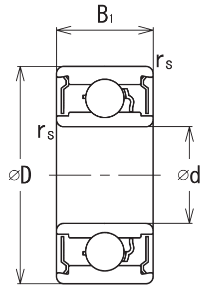
Load rating		Limiting speed[3]		Cage type[4]	Ball		Abutment and fillet dimensions									Mass (Ref.)	
							Open				Shielded, Sealed				$r_{as\,(max)}$	Open	2 Shields
Cr	Cor	Grease	Oil		Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$d_{b\,(min)}$	$d_{b\,(max)}$	$D_{b\,(min)}$	$D_{b\,(max)}$			
N		min^{-1}			mm	pcs.	mm				mm				mm	g	
90	22	115 000	136 000	W	0.635	6	1.50	1.50	2.70	2.70	—	—	—	—	0.10	0.04	—
96	27	105 000	124 000	W	0.600	7	2.00	2.10	3.10	3.20	2.00	2.10	3.60	3.60	0.10	0.09	0.13
96	27	105 000	124 000	W	0.600	7	2.00	2.10	3.10	3.20	2.00	2.10	3.60	3.60	0.10	0.11	0.14
197	53	97 000	115 000	W	1.000	6	2.00	2.20	3.90	4.30	2.00	2.20	4.30	4.30	0.10	0.15	0.2
197	53	97 000	115 000	W	1.000	6	2.00	2.20	3.90	4.30	2.00	2.20	4.30	4.30	0.10	0.17	0.22
241	76	77 000	91 000	W	1.000	7	2.80	3.80	5.50	5.80	2.80	3.80	6.00	6.00	0.10	0.34	0.50
241	76	77 000	91 000	W	1.000	7	2.80	3.80	5.50	5.80	2.80	3.80	6.00	6.00	0.10	0.40	0.55
161	48	90 000	106 000	W	0.800	7	2.90	2.90	4.20	4.20	—	—	—	—	0.10	0.09	—
122	42	92 000	109 000	W	0.600	10	—	—	—	—	2.90	2.90	4.30	4.30	0.10	—	0.16
122	42	92 000	109 000	W	0.600	10	—	—	—	—	2.90	2.90	4.30	4.30	0.10	—	0.17
469	140	72 000	85 000	W	1.588	6	3.60	4.00	6.50	6.80	3.60	4.00	7.10	7.10	0.15	0.60	0.75
469	140	72 000	85 000	W	1.588	6	3.60	4.00	6.50	6.80	3.60	4.00	7.10	7.10	0.15	0.76	0.80
264	87	77 000	91 000	J	1.000	8	3.80	3.80	5.50	5.80	—	—	—	—	0.10	0.26	—
241	76	77 000	91 000	W	1.000	7	3.80	3.80	5.50	5.80	3.80	3.80	6.00	6.00	0.10	0.26	0.28
241	76	72 000	72 000	W	1.000	7	—	—	—	—	3.80	3.80	5.80	5.80	0.10	—	0.29
241	76	77 000	91 000	W	1.000	7	3.80	3.80	5.50	5.80	3.80	3.80	6.00	6.00	0.10	0.28	0.31
475	143	70 000	82 000	J	1.588	6	4.00	4.30	6.70	7.20	4.00	4.30	7.30	7.30	0.10	0.53	0.66
475	143	70 000	82 000	W	1.588	6	—	—	—	—	4.00	4.30	7.30	7.30	0.10	—	0.69
545	181	63 000	75 000	J	1.588	7	4.40	5.10	7.60	8.40	4.00	4.50	8.30	8.70	0.15	0.94	1.13
545	181	63 000	75 000	J	1.588	7	—	—	—	—	4.00	4.50	8.30	8.70	0.15	—	1.19
538	175	66 000	78 000	J	1.588	7	4.70	4.70	8.10	8.10	4.70	4.70	8.10	8.10	0.30	1.20	1.28
545	181	63 000	75 000	J	1.588	7	—	—	—	—	4.50	4.50	8.30	8.30	0.30	—	1.23
538	175	66 000	78 000	J	1.588	7	4.70	4.70	8.10	8.10	4.70	4.70	8.10	8.10	0.30	1.26	1.34
545	181	63 000	75 000	J	1.588	7	4.50	4.50	8.30	10.70	4.50	4.50	8.30	10.70	0.30	3.08	3.16
306	119	64 000	76 000	W	1.000	10	4.80	5.40	7.10	7.40	4.80	5.40	7.40	7.40	0.10	0.51	0.58
306	119	64 000	76 000	W	1.000	10	—	—	—	—	4.80	5.40	7.40	7.40	0.10	—	0.65
306	119	64 000	76 000	W	1.000	10	5.40	5.40	7.10	7.40	5.40	5.40	7.40	7.40	0.10	0.40	0.45
306	119	64 000	76 000	W	1.000	10	—	—	—	—	5.40	5.40	7.40	7.40	0.10	—	0.48
604	216	59 000	70 000	J	1.588	8	5.60	5.90	8.90	8.90	5.60	5.90	8.90	8.90	0.10	0.73	0.78
604	216	48 000	48 000	J	1.588	8	—	—	—	—	5.60	5.90	8.80	9.00	0.10	—	0.75
604	216	59 000	70 000	J	1.588	8	5.60	5.90	8.90	8.90	5.60	5.90	8.90	8.90	0.10	0.78	0.84
1 110	388	51 000	60 000	J	2.381	7	6.80	6.90	10.50	10.70	6.40	6.40	11.20	11.20	0.30	2.12	2.58
1 110	388	44 000	44 000	J	2.381	7	—	—	—	—	6.40	6.40	11.10	11.10	0.30	—	2.51
1 110	388	51 000	60 000	J	2.381	7	6.80	6.90	10.50	10.70	6.40	6.40	11.20	11.20	0.30	2.24	2.68
1 260	493	42 000	50 000	J	2.381	8	6.80	8.30	13.90	14.30	6.80	8.30	13.90	14.30	0.30	4.36	4.69
317	138	55 000	65 000	W	1.000	11	7.00	7.00	9.10	9.10	7.00	7.00	9.10	9.10	0.10	0.51	0.54
317	138	55 000	65 000	W	1.000	11	—	—	—	—	7.00	7.00	8.90	8.90	0.10	—	0.54
317	138	55 000	65 000	W	1.000	11	7.00	7.00	9.10	9.10	7.00	7.00	9.10	9.10	0.10	0.55	0.58
920	350	48 000	56 000	J	2.000	8	7.60	7.90	11.10	11.50	7.20	7.30	11.70	11.90	0.15	1.46	2.00
920	350	48 000	56 000	J	2.000	8	7.60	7.90	11.10	11.50	7.20	7.30	11.70	11.90	0.15	1.57	2.08

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

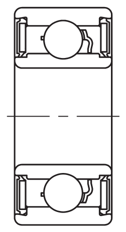
Inch-series bearings【Stainless-steel】



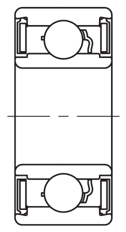
Open



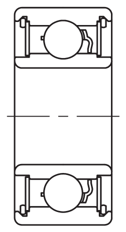
Shielded: ZZ



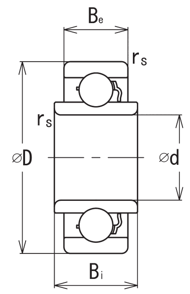
Sealed: 2RS



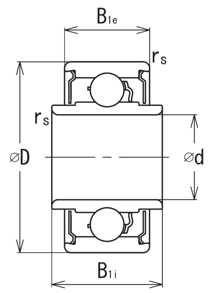
Sealed: 2RU



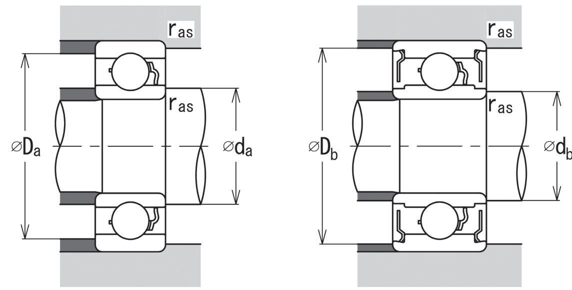
Sealed: TTS



Extended inner ring open type



Extended inner ring shielded type



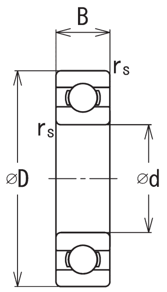
Abutment and fillet

Bore diameter d		Outer diameter D		Inner ring width				Outer ring width				Chamfer $r_{s\,(min)}$		Bearing number				
				Open B, B_i		Shielded, Sealed B_1, B_{1i}		Open B, B_e		Shielded, Sealed B_1, B_{1e}				Open	2 Shields(2)	2 Seals(2)		
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch			2RS	2RU	TTS
6.350	0.2500	15.875	0.6250	4.978	0.1960	4.978	0.1960	4.978	0.1960	4.978	0.1960	0.30	0.0118	**SR4** (1)	**SR4ZZ**	**2RS**	**2RU**	—
		15.875	0.6250	—	—	4.978	0.1960	—	—	4.978	0.1960	0.30	0.0118	—	—	—	—	**TTS**
		15.875	0.6250	5.771	0.2272	5.771	0.2272	4.978	0.1960	4.978	0.1960	0.30	0.0118	**SRW4** (1)	**SRW4ZZ**	**2RS**	—	—
		19.050	0.7500	5.558	0.2188	7.142	0.2812	5.558	0.2188	7.142	0.2812	0.40	0.0157	**SR4A**	**SR4AZZ**	**2RS**	**2RU**	**TTS**
7.938	0.3125	12.700	0.5000	3.967	0.1562	3.967	0.1562	3.967	0.1562	3.967	0.1562	0.15	0.0059	**SR1810** (1)	**SR1810ZZS**	—	—	**TTS**
		12.700	0.5000	4.762	0.1875	4.762	0.1875	3.967	0.1562	3.967	0.1562	0.15	0.0059	**SRW1810** (1)	**SRW1810ZZS**	—	—	**TTS**
9.525	0.3750	22.225	0.8750	5.558	0.2188	7.142	0.2812	5.558	0.2188	7.142	0.2812	0.40	0.0157	**SR6**	**SR6ZZ**	**2RS**	**2RU**	—
		22.225	0.8750	—	—	7.142	0.2812	—	—	7.142	0.2812	0.40	0.0157	—	—	—	—	**TTS**
12.700	0.5000	28.575	1.1250	6.350	0.2500	7.938	0.3125	6.350	0.2500	7.938	0.3125	0.40	0.0157	**SR8**	**SR8ZZ**	**2RS**	**2RU**	—
15.875	0.6250	34.925	1.3750	7.142	0.2812	8.733	0.3438	7.142	0.2812	8.733	0.3438	0.80	0.0315	**SR10**	**SR10ZZ**	—	—	—
		34.925	1.3750	—	—	8.733	0.3438	—	—	8.733	0.3438	0.80	0.0315	—	—	**2RS**	**2RU**	—
19.050	0.7500	41.275	1.6250	7.938	0.3125	—	—	7.938	0.3125	—	—	0.80	0.0315	**SR12**	—	—	—	—
		41.275	1.6250	—	—	11.113	0.4375	—	—	11.113	0.4375	0.80	0.0315	—	**SR12ZZ**	**2RS**	—	—
12.700	0.5000	22.225	0.8750	5.558	0.2188	7.142	0.2812	5.558	0.2188	7.142	0.2812	0.40	0.0157	**SR6-5**	**SR6-5ZZS**	—	—	—

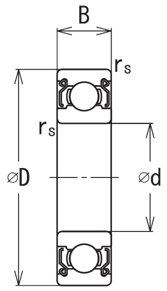
Load rating		Limiting speed(3)		Cage type(4)	Ball		Abutment and fillet dimensions									Mass (Ref.)	
							Open				Shielded, Sealed				$r_{as\,(max)}$	Open	2 Shields
Cr	Cor	Grease	Oil		Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$d_{b\,(min)}$	$d_{b\,(max)}$	$D_{b\,(min)}$	$D_{b\,(max)}$			
N		min^{-1}			mm	pcs.	mm				mm				mm	g	
1 260	493	42 000	50 000	J	2.381	8	8.00	8.30	13.90	14.30	8.00	8.30	13.90	14.30	0.30	3.82	4.15
1 260	493	34 000	34 000	J	2.381	8	—	—	—	—	8.00	8.30	13.50	13.90	0.30	—	4.15
1 260	493	42 000	50 000	J	2.381	8	8.00	8.30	13.90	14.30	8.00	8.30	13.90	14.30	0.30	3.97	4.29
1 990	711	38 000	45 000	J	3.500	6	8.90	10.00	15.10	16.60	8.40	8.40	16.60	17.10	0.40	7.34	8.85
460	221	45 000	53 000	W	1.200	12	8.90	8.90	11.60	11.90	8.90	8.90	11.60	11.90	0.15	1.40	1.48
460	221	45 000	53 000	W	1.200	12	8.90	8.90	11.60	11.90	8.90	8.90	11.60	11.90	0.15	1.47	1.56
2 830	1 130	31 000	37 000	J	3.969	7	12.10	12.70	18.80	19.80	11.60	11.80	20.00	20.10	0.40	8.64	10.6
2 830	1 130	24 000	24 000	J	3.969	7	—	—	—	—	11.60	11.80	19.80	20.30	0.40	—	10.1
4 350	1 910	25 000	30 000	J	4.762	8	15.50	16.50	24.00	26.50	15.00	15.50	25.50	26.50	0.40	17.0	20.2
5 100	2 610	20 000	24 000	RJ	4.762	10	20.50	23.00	30.50	31.50	20.50	23.00	31.50	31.50	0.80	29.4	35.4
5 100	2 610	20 000	24 000	RJ	4.762	10	—	—	—	—	20.50	21.00	31.00	31.50	0.80	—	35.3
6 730	3 560	17 000	21 000	RJ	5.556	10	24.00	27.00	35.00	37.00	—	—	—	—	0.80	45.9	—
7 980	4 050	17 000	20 000	RJ	6.350	9	—	—	—	—	24.00	27.50	37.50	38.00	0.80	—	59.7
1 630	834	30 000	36 000	J	2.381	12	14.50	14.50	18.50	20.00	14.50	14.50	19.50	20.00	0.40	7.60	9.69

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

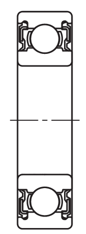
Extra-thin-section bearings【SUJ2】

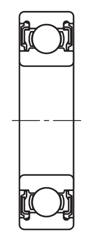


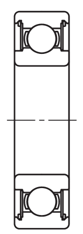
Open

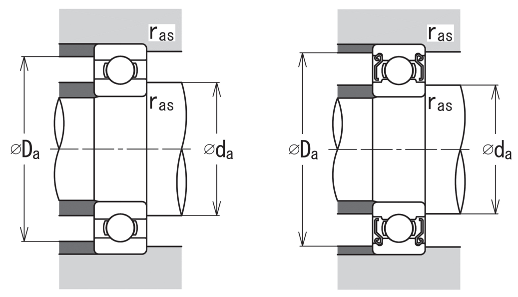


Shielded: ZZ


Sealed: 2RS


Sealed: 2RU


Sealed: TTS



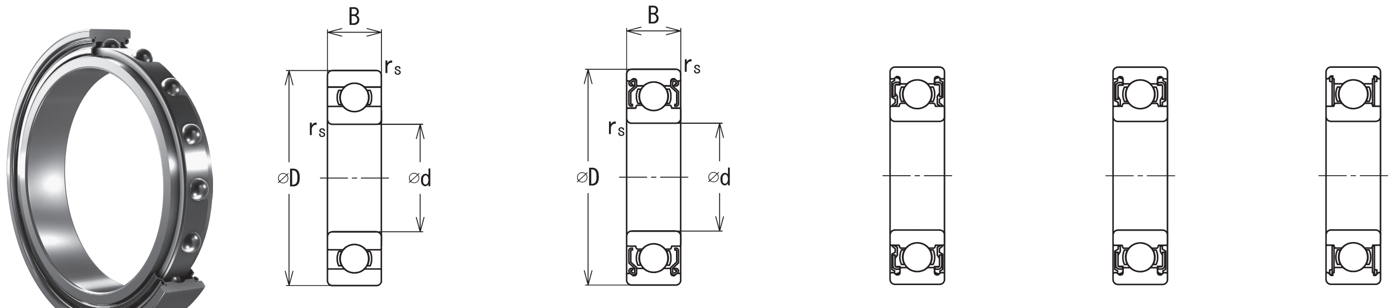
Abutment and fillet

Bore diameter d		Outer diameter D		Width B		Chamfer $r_{s\,(min)}$		Bearing number					Load rating		Limiting speed[3]		Cage type[4]
								Open	2 Shields[2]	2 Seals[2] 2RS	2RU	TTS	Cr	Cor	Grease	Oil	
mm	inch	mm	inch	mm	inch	mm	inch						N		min⁻¹		
10	0.3937	15	0.5906	3	0.1181	0.15	0.0059	**6700**	—	—	—	—	857	435	15 000	17 000	W
		15	0.5906	4	0.1575	0.15	0.0059	—	**6700ZZ**	**2RS**	—	—	857	435	15 000	17 000	W
		19	0.7480	5	0.1969	0.30	0.0118	**6800**[1]	**6800ZZ**	**2RS**	**2RU**	—	1 720	840	34 000	40 000	J
		19	0.7480	7	0.2756	0.30	0.0118	**63800**[1]	**63800ZZ**	**2RS**	**2RU**	—	1 720	840	34 000	40 000	J
		22	0.8661	6	0.2362	0.30	0.0118	**6900**[1]	**6900ZZ**	**2RS**	**2RU**	—	2 700	1 270	31 000	37 000	J
12	0.4724	18	0.7087	4	0.1575	0.20	0.0079	**6701**[1]	**6701ZZ**	**2RS**	—	—	928	532	13 000	15 000	W
		21	0.8268	5	0.1969	0.30	0.0118	**6801**[1]	**6801ZZ**	**2RS**	**2RU**	—	1 920	1 040	30 000	36 000	J
		21	0.8268	7	0.2756	0.30	0.0118	**63801**[1]	**63801ZZ**	**2RS**	**2RU**	—	1 920	1 040	30 000	36 000	J
		24	0.9449	6	0.2362	0.30	0.0118	**6901**[1]	**6901ZZ**	**2RS**	**2RU**	—	2 890	1 460	28 000	33 000	J
15	0.5906	21	0.8268	4	0.1575	0.20	0.0079	**6702**[1]	**6702ZZ**	**2RS**	—	—	937	581	11 000	13 000	W
		24	0.9449	5	0.1969	0.30	0.0118	**6802**[1]	**6802ZZ**	**2RS**	**2RU**	—	2 070	1 260	26 000	31 000	J
		24	0.9449	7	0.2756	0.30	0.0118	**63802**[1]	**63802ZZ**	**2RS**	**2RU**	—	2 070	1 260	26 000	31 000	J
		28	1.1024	7	0.2756	0.30	0.0118	**6902**[1]	**6902ZZ**	**2RS**	**2RU**	—	4 330	2 250	24 000	29 000	J
17	0.6693	23	0.9055	4	0.1575	0.20	0.0079	**6703**[1]	**6703ZZ**	**2RS**	—	—	999	657	9 500	11 000	W
		26	1.0236	5	0.1969	0.30	0.0118	**6803**[1]	**6803ZZ**	**2RS**	**2RU**	—	2 230	1 460	24 000	29 000	J
		26	1.0236	7	0.2756	0.30	0.0118	**63803**[1]	**63803ZZ**	**2RS**	**2RU**	—	2 230	1 460	24 000	29 000	J
		30	1.1811	7	0.2756	0.30	0.0118	**6903**[1]	**6903ZZ**	**2RS**	**2RU**	—	4 590	2 560	22 000	26 000	J
20	0.7874	27	1.0630	4	0.1575	0.20	0.0079	**6704**[1]	**6704ZZ**	**2RS**	—	—	1 040	729	8 500	10 000	W
		32	1.2598	7	0.2756	0.30	0.0118	**6804**[1]	**6804ZZ**	**2RS**	**2RU**	—	4 020	2 460	21 000	25 000	RJ
		32	1.2598	10	0.3937	0.30	0.0118	**63804**[1]	**63804ZZ**	**2RS**	**2RU**	—	4 020	2 460	21 000	25 000	RJ
		37	1.4567	9	0.3543	0.30	0.0118	**6904**[1]	**6904ZZ**	**2RS**	**2RU**	—	6 380	3 680	19 000	22 000	RJ
25	0.9843	32	1.2598	4	0.1575	0.20	0.0079	**6705**[1]	**6705ZZ**	**2RS**	**2RU**	—	1 100	838	7 000	8 000	W
		37	1.4567	7	0.2756	0.30	0.0118	**6805**[1]	**6805ZZ**	**2RS**	**2RU**	—	4 300	2 940	18 000	21 000	RJ
		37	1.4567	10	0.3937	0.30	0.0118	**63805**[1]	**63805ZZ**	**2RS**	**2RU**	—	4 300	2 940	18 000	21 000	RJ
		42	1.6535	9	0.3543	0.30	0.0118	**6905**[1]	**6905ZZ**	**2RS**	**2RU**	—	7 010	4 550	16 000	19 000	RJ
30	1.1811	37	1.4567	4	0.1575	0.20	0.0079	**6706**[1]	**6706ZZ**	**2RS**	**2RU**	—	1 140	947	5 500	7 000	W
		42	1.6535	7	0.2756	0.30	0.0118	**6806**[1]	**6806ZZ**	**2RS**	**2RU**	—	4 540	3 420	15 000	18 000	RJ
		47	1.8504	9	0.3543	0.30	0.0118	**6906**[1]	**6906ZZ**	**2RS**	**2RU**	—	7 240	5 010	14 000	17 000	RJ
35	1.3780	44	1.7323	5	0.1969	0.30	0.0118	**6707**[1]	—	**2RS**	—	—	1 860	1 630	4 900	6 000	W
		47	1.8504	7	0.2756	0.30	0.0118	**6807**[1]	**6807ZZ**	**2RS**	**2RU**	—	4 740	3 820	13 000	16 000	RJ
		55	2.1654	10	0.3937	0.60	0.0236	**6907**[1]	**6907ZZ**	**2RS**	**2RU**	—	10 900	7 750	12 000	14 000	RJ
40	1.5748	50	1.9685	6	0.2362	0.30	0.0118	**6708**[1]	—	**2RS**	—	—	2 510	2 230	4 300	5 000	W
		52	2.0472	7	0.2756	0.30	0.0118	**6808**[1]	**6808ZZ**	**2RS**	**2RU**	—	4 930	4 180	12 000	14 000	RJ
		62	2.4409	12	0.4724	0.60	0.0236	**6908**[1]	**6908ZZ**	**2RS**	**2RU**	—	13 700	9 920	11 000	13 000	RJ
45	1.7717	55	2.1654	6	0.2362	0.30	0.0118	**6709**[1]	—	**2RS**	**2RU**	—	2 570	2 400	3 900	4 600	W
		58	2.2835	7	0.2756	0.30	0.0118	**6809**[1]	**6809ZZ**	**2RS**	**2RU**	—	6 210	5 380	11 000	13 000	RJ
		68	2.6772	12	0.4724	0.60	0.0236	**6909**[1]	**6909ZZ**	**2RS**	**2RU**	—	14 100	10 900	9 700	11 000	RJ
50	1.9685	62	2.4409	6	0.2362	0.30	0.0118	**6710**[1]	—	**2RS**	—	—	2 670	2 650	3 500	4 100	W
		65	2.5591	7	0.2756	0.30	0.0118	**6810**[1]	**6810ZZ**	**2RS**	**2RU**	—	6 400	5 830	9 500	11 000	RJ

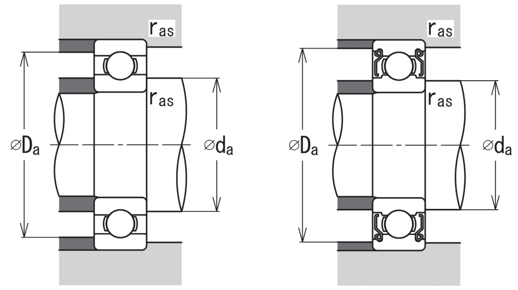
Ball		Abutment and fillet dimensions					Mass (Ref.)	
Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$r_{as\,(max)}$	Open	2 Shields
mm	pcs.	mm					g	
1.588	11	11.00	11.00	14.00	14.50	0.15	1.34	—
1.588	11	11.00	11.00	14.50	14.50	0.15	—	1.76
2.381	10	11.50	11.50	17.50	17.50	0.30	4.81	5.10
2.381	10	11.50	11.50	17.50	17.50	0.30	6.75	7.04
3.175	9	12.00	13.00	19.50	20.00	0.30	8.80	9.39
1.588	13	13.50	13.50	17.00	17.00	0.20	2.65	2.83
2.381	12	13.50	13.50	19.50	19.50	0.30	5.36	5.70
2.381	12	13.50	13.50	19.50	19.50	0.30	7.59	7.93
3.175	10	14.00	15.00	21.50	22.00	0.30	9.96	10.8
1.588	14	16.50	16.50	20.00	20.00	0.20	3.17	3.37
2.381	14	16.50	16.50	22.50	22.50	0.30	6.28	6.69
2.381	14	16.50	16.50	22.50	22.50	0.30	8.92	9.33
3.969	10	17.00	18.50	25.50	26.00	0.30	14.9	16.0
1.588	16	18.50	18.50	22.00	22.00	0.20	3.53	3.75
2.381	16	18.50	18.50	24.50	24.50	0.30	7.10	7.54
2.381	16	18.50	18.50	24.50	24.50	0.30	9.98	10.4
3.969	11	19.00	20.50	28.00	28.50	0.30	15.6	16.7
1.588	18	21.50	22.00	26.00	26.00	0.20	5.10	5.40
3.500	13	22.00	22.50	30.00	30.50	0.30	15.7	17.1
3.500	13	22.00	22.50	30.00	30.50	0.30	22.4	23.8
4.762	11	22.00	23.50	34.00	35.00	0.30	33.0	35.1
1.588	21	26.50	27.00	31.00	31.00	0.20	6.16	6.53
3.500	15	27.00	28.00	34.50	35.00	0.30	19.6	20.8
3.500	15	27.00	28.00	34.50	35.00	0.30	27.6	28.8
4.762	13	27.00	30.50	39.50	40.00	0.30	39.2	42.0
1.588	24	31.50	32.00	36.00	36.00	0.20	7.34	7.78
3.500	17	32.00	33.00	39.50	40.00	0.30	22.6	23.8
4.762	14	32.00	35.00	44.50	45.00	0.30	43.9	47.9
2.000	26	37.00	37.50	42.50	42.50	0.30	13.7	15.1
3.500	19	37.00	38.00	44.00	45.00	0.30	26.9	28.2
5.953	14	39.00	42.00	52.50	52.50	0.60	69.2	73.3
2.381	25	42.00	43.00	48.00	48.50	0.30	20.9	23.1
3.500	21	42.00	43.00	49.00	50.00	0.30	28.9	30.3
6.747	14	44.00	46.50	58.00	59.50	0.60	101	108
2.381	27	47.00	48.00	53.50	53.50	0.30	22.7	25.3
3.969	21	47.00	48.00	55.00	56.00	0.30	34.3	36.1
6.747	15	49.00	52.00	63.50	64.00	0.60	123	130
2.381	30	52.00	54.00	59.50	60.00	0.30	33.8	36.7
3.969	23	52.00	54.50	62.00	63.00	0.30	47.4	49.5

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Extra-thin-section bearings【SUJ2】



Open Shielded: ZZ Sealed: 2RS Sealed: 2RU Sealed: TTS



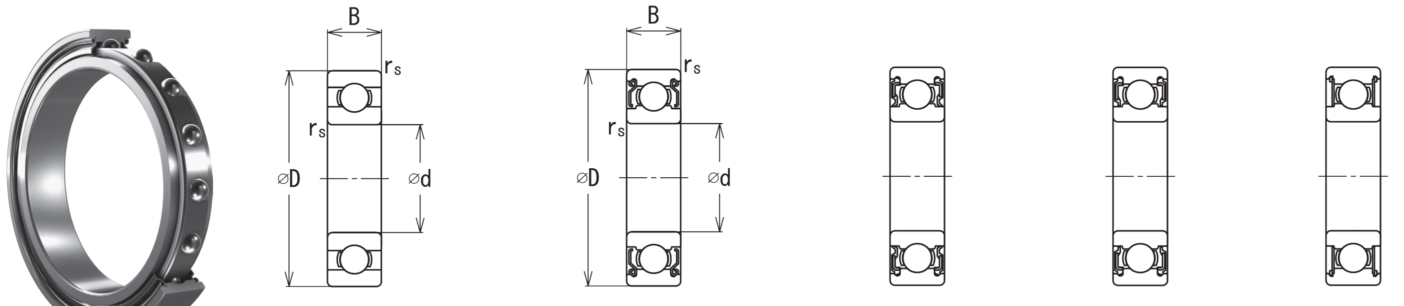
Abutment and fillet

Bore diameter d		Outer diameter D		Width B		Chamfer $r_{s\,(min)}$		Bearing number					Load rating		Limiting speed(3)		Cage type(4)
								Open	2 Shields(2)	2 Seals(2)			Cr	Cor	Grease	Oil	
mm	inch	mm	inch	mm	inch	mm	inch			2RS	2RU	TTS	N		min^{-1}		
50	1.9685	72	2.8346	12	0.4724	0.60	0.0236	**6910**(1)	**6910ZZ**	**2RS**	**2RU**	—	14 500	11 700	9 000	11 000	RJ
55	2.1654	72	2.8346	9	0.3543	0.30	0.0118	**6811**(1)	**6811ZZ**	**2RS**	**2RU**	—	8 800	8 080	8 600	10 000	RJ
		80	3.1496	13	0.5118	1.00	0.0394	**6911**(1)	**6911ZZ**	**2RS**	**2RU**	—	16 600	14 100	8 100	9 600	RJ
60	2.3622	78	3.0709	10	0.3937	0.30	0.0118	**6812**(1)	**6812ZZ**	**2RS**	**2RU**	—	11 500	10 600	7 900	9 400	RJ
		85	3.3465	13	0.5118	1.00	0.0394	**6912**(1)	**6912ZZ**	**2RS**	**2RU**	—	20 200	17 300	7 500	8 900	RJ
65	2.5591	85	3.3465	10	0.3937	0.60	0.0236	**6813**(1)	**6813ZZ**	**2RS**	—	—	11 900	11 500	7 300	8 600	RJ
		90	3.5433	13	0.5118	1.00	0.0394	**6913**(1)	**6913ZZ**	**2RS**	—	—	17 300	16 000	7 000	8 300	RJ
70	2.7559	90	3.5433	10	0.3937	0.60	0.0236	**6814**(1)	**6814ZZ**	**2RS**	**2RU**	—	11 600	11 800	6 800	8 100	RJ
		100	3.9370	16	0.6299	1.00	0.0394	**6914**(1)	**6914ZZ**	**2RS**	—	—	23 700	21 100	6 400	7 600	RJ
75	2.9528	95	3.7402	10	0.3937	0.60	0.0236	**6815**(1)	**6815ZZ**	**2RS**	—	—	12 300	12 800	6 400	7 600	RJ
		105	4.1339	16	0.6299	1.00	0.0394	**6915**(1)	**6915ZZ**	**2RS**	—	—	24 000	22 600	6 000	7 100	RJ
80	3.1496	100	3.9370	10	0.3937	0.60	0.0236	**6816**(1)	**6816ZZ**	**2RS**	**2RU**	—	12 600	13 300	6 000	7 100	RJ
		110	4.3307	16	0.6299	1.00	0.0394	**6916**(1)	**6916ZZ**	**2RS**	—	—	24 800	23 900	5 700	6 700	RJ
85	3.3465	110	4.3307	13	0.5118	1.00	0.0394	**6817**(1)	**6817ZZ**	**2RS**	—	—	18 700	19 000	5 600	6 600	RJ
		120	4.7244	18	0.7087	1.10	0.0433	**6917**(1)	**6917ZZ**	**2RS**	—	—	31 900	29 600	5 300	6 200	RJ
90	3.5433	115	4.5276	13	0.5118	1.00	0.0394	**6818**(1)	**6818ZZ**	**2RS**	—	—	18 300	19 500	5 300	6 200	RJ
		125	4.9213	18	0.7087	1.10	0.0433	**6918**(1)	—	**2RS**	—	—	32 400	31 600	5 000	5 900	RJ
95	3.7402	120	4.7244	13	0.5118	1.00	0.0394	**6819**(1)	—	—	**2RU**	—	18 800	20 300	5 000	5 900	RJ

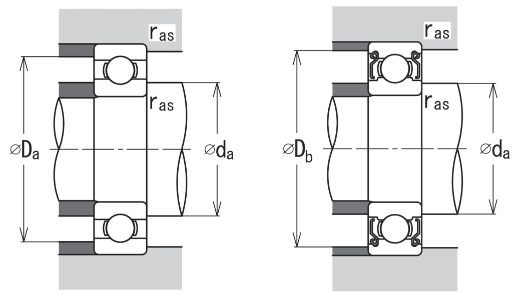
Ball		Abutment and fillet dimensions					Mass (Ref.)	
Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$r_{as\,(max)}$	Open	2 Shields
mm	pcs.	mm					g	
6.747	16	54.00	56.50	68.00	68.50	0.60	123	131
4.762	22	57.00	60.00	69.00	70.00	0.30	74.7	78.3
7.144	17	60.00	62.50	75.50	75.50	1.00	168	177
5.556	21	62.00	65.00	75.00	76.00	0.30	93.9	99.4
7.938	17	65.00	67.50	80.50	80.50	1.00	180	186
5.556	23	69.00	71.00	81.00	81.50	0.60	118	125
7.144	19	70.00	72.50	85.00	85.00	1.00	198	208
5.556	24	74.00	76.00	86.00	86.50	0.60	127	135
8.731	17	75.00	79.00	94.00	95.00	1.00	320	335
5.556	26	79.00	81.00	91.00	91.50	0.60	135	143
8.731	18	80.00	84.00	99.00	100.00	1.00	342	357
5.556	27	84.00	86.00	96.00	96.50	0.60	144	152
8.731	19	85.00	89.00	103.50	105.00	1.00	364	379
7.144	23	90.00	92.50	105.50	105.50	1.00	244	258
10.319	17	91.50	96.00	113.00	113.50	1.00	508	526
7.144	24	95.00	97.50	110.00	110.00	1.00	251	267
10.319	18	96.50	101.00	118.50	119.50	1.00	537	561
7.144	25	100.00	102.50	115.50	115.50	1.00	267	284

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Extra-thin-section bearings【Stainless-steel】



Open Shielded: ZZ Sealed: 2RS Sealed: 2RU Sealed: TTS



Abutment and fillet

Bore diameter d		Outer diameter D		Width				Chamfer $r_{s\,(min)}$		Bearing number					Load rating		Limiting speed(3)	
				Open B		Shielded, Sealed B_1				Open	2 Shields(2)	2 Seals(2)			Cr	Cor	Grease	Oil
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch			2RS	2RU	TTS	N		min^{-1}	
10	0.3937	15	0.5906	3	0.1181	4	0.1575	0.15	0.0059	**6700H**	**6700HZZ**	**2RS**	—	—	729	348	15 000	17 000
		19	0.7480	5	0.1969	5	0.1969	0.30	0.0118	**6800H**(1)	**6800HZZ**	**2RS**	**2RU**	—	1 460	672	34 000	40 000
		19	0.7480	7	0.2756	7	0.2756	0.30	0.0118	**63800H**(1)	**63800HZZ**	**2RS**	**2RU**	—	1 460	672	34 000	40 000
		22	0.8661	6	0.2362	6	0.2362	0.30	0.0118	**6900H**(1)	**6900HZZ**	**2RS**	**2RU**	—	2 290	1 020	31 000	37 000
12	0.4724	18	0.7087	4	0.1575	4	0.1575	0.20	0.0079	**6701H**(1)	**6701HZZ**	**2RS**	—	—	789	425	13 000	15 000
		21	0.8268	5	0.1969	5	0.1969	0.30	0.0118	**6801H**(1)	**6801HZZ**	**2RS**	**2RU**	—	1 630	834	30 000	36 000
		21	0.8268	7	0.2756	7	0.2756	0.30	0.0118	**63801H**(1)	**63801HZZ**	**2RS**	**2RU**	—	1 630	834	30 000	36 000
		24	0.9449	6	0.2362	6	0.2362	0.30	0.0118	**6901H**(1)	**6901HZZ**	**2RS**	**2RU**	—	2 460	1 170	28 000	33 000
15	0.5906	21	0.8268	4	0.1575	4	0.1575	0.20	0.0079	**6702H**(1)	**6702HZZ**	**2RS**	—	—	797	465	11 000	13 000
		24	0.9449	5	0.1969	5	0.1969	0.30	0.0118	**6802H**(1)	**6802HZZ**	**2RS**	**2RU**	—	1 760	1 010	26 000	31 000
		24	0.9449	7	0.2756	7	0.2756	0.30	0.0118	**63802H**(1)	**63802HZZ**	**2RS**	**2RU**	—	1 760	1 010	26 000	31 000
		28	1.1024	7	0.2756	7	0.2756	0.30	0.0118	**6902H**(1)	**6902HZZ**	**2RS**	**2RU**	—	3 680	1 800	24 000	29 000
17	0.6693	23	0.9055	4	0.1575	4	0.1575	0.20	0.0079	**6703H**(1)	**6703HZZ**	**2RS**	—	—	849	525	9 500	11 000
		26	1.0236	5	0.1969	5	0.1969	0.30	0.0118	**6803H**(1)	**6803HZZ**	**2RS**	**2RU**	—	1 900	1 170	24 000	29 000
		30	1.1811	7	0.2756	7	0.2756	0.30	0.0118	**6903H**(1)	**6903HZZ**	**2RS**	**2RU**	—	3 900	2 050	22 000	26 000
20	0.7874	27	1.0630	4	0.1575	4	0.1575	0.20	0.0079	**6704H**(1)	**6704HZZ**	**2RS**	—	—	885	583	8 500	10 000
		32	1.2598	7	0.2756	7	0.2756	0.30	0.0118	**6804H**(1)	**6804HZZ**	**2RS**	**2RU**	—	3 410	1 970	21 000	25 000
		37	1.4567	9	0.3543	9	0.3543	0.30	0.0118	**6904H**(1)	**6904HZZ**	**2RS**	**2RU**	—	5 420	2 950	19 000	22 000
25	0.9843	32	1.2598	4	0.1575	4	0.1575	0.20	0.0079	**6705H**(1)	**6705HZZ**	**2RS**	**2RU**	—	931	670	7 000	8 000
		37	1.4567	7	0.2756	7	0.2756	0.30	0.0118	**6805H**(1)	**6805HZZ**	**2RS**	**2RU**	—	3 660	2 350	18 000	21 000
		42	1.6535	9	0.3543	9	0.3543	0.30	0.0118	**6905H**(1)	**6905HZZ**	**2RS**	**2RU**	—	5 960	3 640	16 000	19 000
30	1.1811	37	1.4567	4	0.1575	4	0.1575	0.20	0.0079	**6706H**(1)	**6706HZZ**	**2RS**	**2RU**	—	969	757	5 500	7 000
		42	1.6535	7	0.2756	7	0.2756	0.30	0.0118	**6806H**(1)	**6806HZZ**	**2RS**	**2RU**	—	3 860	2 730	15 000	18 000
		47	1.8504	9	0.3543	9	0.3543	0.30	0.0118	**6906H**(1)	**6906HZZ**	**2RS**	**2RU**	—	6 160	4 010	14 000	17 000
35	1.3780	44	1.7323	5	0.1969	5	0.1969	0.30	0.0118	**6707H**(1)	—	**2RS**	—	—	1 590	1 310	4 900	6 000
		47	1.8504	7	0.2756	7	0.2756	0.30	0.0118	**6807H**(1)	**6807HZZ**	**2RS**	**2RU**	—	4 030	3 060	13 000	16 000
		55	2.1654	10	0.3937	10	0.3937	0.60	0.0236	**6907H**(1)	**6907HZZ**	**2RS**	**2RU**	—	9 250	6 200	12 000	14 000
40	1.5748	50	1.9685	6	0.2362	6	0.2362	0.30	0.0118	**6708H**(1)	—	**2RS**	—	—	2 140	1 790	4 300	5 000
		52	2.0472	7	0.2756	7	0.2756	0.30	0.0118	**6808H**(1)	**6808HZZ**	**2RS**	**2RU**	—	4 190	3 340	12 000	14 000
		62	2.4409	12	0.4724	12	0.4724	0.60	0.0236	**6908H**(1)	**6908HZZ**	**2RS**	**2RU**	—	11 600	7 930	11 000	13 000
45	1.7717	58	2.2835	7	0.2756	7	0.2756	0.30	0.0118	**6809H**(1)	**6809HZZ**	**2RS**	**2RU**	—	5 280	4 300	11 000	13 000
		68	2.6772	12	0.4724	12	0.4724	0.60	0.0236	**6909H**(1)	**6909HZZ**	**2RS**	**2RU**	—	12 000	8 700	9 700	11 000
50	1.9685	65	2.5591	7	0.2756	7	0.2756	0.30	0.0118	**6810H**(1)	**6810HZZ**	**2RS**	**2RU**	—	5 440	4 660	9 500	11 000
		72	2.8346	12	0.4724	12	0.4724	0.60	0.0236	**6910H**(1)	**6910HZZ**	**2RS**	**2RU**	—	12 400	9 370	9 000	11 000
55	2.1654	72	2.8346	9	0.3543	9	0.3543	0.30	0.0118	**6811H**(1)	**6811HZZ**	**2RS**	**2RU**	—	7 480	6 470	8 600	10 000
		80	3.1496	13	0.5118	13	0.5118	1.00	0.0394	**6911H**(1)	**6911HZZ**	**2RS**	**2RU**	—	14 100	11 300	8 100	9 600

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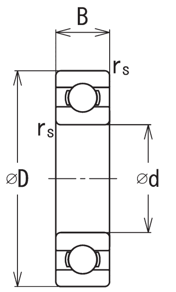
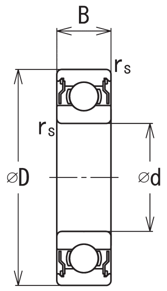
(4) Some items are also available with the TW cage. Please contact us for details.

Cage type(4)	Ball		Abutment and fillet dimensions							Mass (Ref.)	
	Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	Open $D_{a\,(min)}$	Open $D_{a\,(max)}$	Shielded, Sealed $D_{b\,(min)}$	Shielded, Sealed $D_{b\,(max)}$	$r_{as\,(max)}$	Open	2 Shields
	mm	pcs.	mm		mm		mm		mm	g	
W	1.588	11	11.00	11.00	14.00	14.50	14.50	14.50	0.15	1.33	1.74
J	2.381	10	11.50	11.50	17.50	17.50	17.50	17.50	0.30	4.76	5.04
J	2.381	10	11.50	11.50	17.50	17.50	17.50	17.50	0.30	6.67	6.95
J	3.175	9	12.00	13.00	19.50	20.00	19.50	20.00	0.30	8.69	9.28
W	1.588	13	13.50	13.50	17.00	17.00	17.00	17.00	0.20	2.62	2.80
J	2.381	12	13.50	13.50	19.50	19.50	19.50	19.50	0.30	5.29	5.64
J	2.381	12	13.50	13.50	19.50	19.50	19.50	19.50	0.30	7.49	7.84
J	3.175	10	14.00	15.00	21.50	22.00	21.50	22.00	0.30	9.84	10.7
W	1.588	14	16.50	16.50	20.00	20.00	20.00	20.00	0.20	3.13	3.34
J	2.381	14	16.50	16.50	22.50	22.50	22.50	22.50	0.30	6.20	6.61
J	2.381	14	16.50	16.50	22.50	22.50	22.50	22.50	0.30	8.81	9.22
J	3.969	10	17.00	18.50	25.50	26.00	25.50	26.00	0.30	14.7	15.8
W	1.588	16	18.50	18.50	22.00	22.00	22.00	22.00	0.20	3.48	3.71
J	2.381	16	18.50	18.50	24.50	24.50	24.50	24.50	0.30	7.01	7.46
J	3.969	11	19.00	20.50	28.00	28.50	28.00	28.50	0.30	15.4	16.6
W	1.588	18	21.50	22.00	26.00	26.00	26.00	26.00	0.20	5.03	5.34
J	3.500	13	22.00	22.50	30.00	30.50	30.00	30.50	0.30	15.6	16.9
RJ	4.762	11	22.00	23.50	34.00	35.00	34.00	35.00	0.30	32.6	34.7
W	1.588	21	26.50	27.00	31.00	31.00	31.00	31.00	0.20	6.08	6.46
J	3.500	15	27.00	28.00	34.50	35.00	34.50	35.00	0.30	19.4	20.6
RJ	4.762	13	27.00	30.50	39.50	40.00	39.50	40.00	0.30	38.7	41.5
W	1.588	24	31.50	32.00	36.00	36.00	36.00	36.00	0.20	7.26	7.69
J	3.500	17	32.00	33.00	39.50	40.00	39.50	40.00	0.30	21.9	23.1
RJ	4.762	14	32.00	35.00	44.50	45.00	44.50	45.00	0.30	43.4	47.4
W	2.000	26	37.00	37.50	42.50	42.50	42.50	42.50	0.30	13.5	14.9
J	3.500	19	37.00	38.00	44.00	45.00	44.00	45.00	0.30	26.6	27.9
RJ	5.953	14	39.00	42.00	52.50	52.50	52.50	52.50	0.60	68.4	72.5
W	2.381	25	42.00	43.00	48.00	48.50	48.00	48.50	0.30	20.7	22.9
RJ	3.500	21	42.00	43.00	49.00	50.00	49.00	50.00	0.30	28.6	30.0
RJ	6.747	14	44.00	46.50	58.00	59.50	58.00	59.50	0.60	99.8	106
RJ	3.969	21	47.00	48.00	55.00	56.00	55.00	56.00	0.30	33.8	35.7
RJ	6.747	15	49.00	52.00	63.50	64.00	63.50	64.00	0.60	121	128
RJ	3.969	23	52.00	54.50	62.00	63.00	62.00	63.00	0.30	46.9	48.9
RJ	6.747	16	54.00	56.50	68.00	68.50	68.00	68.50	0.60	122	130
RJ	4.762	22	57.00	60.00	69.00	70.00	69.00	70.00	0.30	73.8	77.4
RJ	7.144	17	60.00	62.50	75.50	75.50	75.50	75.50	1.00	166	175

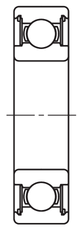
Extra-thin-section ET, ER bearings

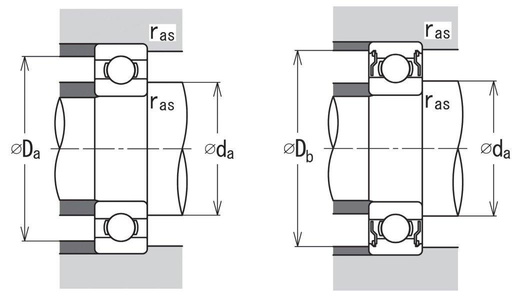


Open



Shielded: ZZ


Sealed: TTS



Abutment and fillet

ET series (Metric series) SUJ2

Bore diameter d (mm)	d (inch)	Outer diameter D (mm)	D (inch)	Width B (mm)	B (inch)	Chamfer $r_{s\,(min)}$ (mm)	$r_{s\,(min)}$ (inch)	Bearing number Open	2 Shields(2)	2 Seals(2) TTS	Load rating Cr (N)	Cor (N)	Limiting speed(3) Grease (min⁻¹)	Oil (min⁻¹)	Cage type
15	0.5906	20	0.7874	3.5	0.1378	0.15	0.0059	**ET2015**	—	—	943	583	11 000	13 000	W
		21	0.8268	3.5	0.1378	0.15	0.0059	**ET2115**	—	—	937	581	11 000	13 000	W
16	0.6299	22	0.8661	4	0.1575	0.15	0.0059	**ET2216**	**ET2216ZZS**	—	971	620	10 000	12 000	W
20	0.7874	25	0.9843	4	0.1575	0.15	0.0059	**ET2520**(1)	**ET2520ZZS**	—	1 010	691	8 500	10 000	W

Ball Size (mm)	Ball Qty. (pcs.)	$d_{a\,(min)}$ (mm)	$d_{a\,(max)}$ (mm)	Open $D_{a\,(min)}$ (mm)	Open $D_{a\,(max)}$ (mm)	Shielded, Sealed $D_{b\,(min)}$ (mm)	Shielded, Sealed $D_{b\,(max)}$ (mm)	$r_{as\,(max)}$ (mm)	Mass (Ref.) Open (g)	Mass (Ref.) 2 Shields (g)
1.588	14	16.00	16.00	19.00	19.50	—	—	0.15	2.14	—
1.588	14	16.00	16.50	19.50	20.00	—	—	0.15	3.04	—
1.588	15	17.00	17.50	20.50	21.00	21.00	21.50	0.15	3.66	3.69
1.588	17	21.00	21.00	24.50	24.50	24.50	24.50	0.15	2.96	3.30

ER series (Inch series) SUJ2

Bore diameter d (mm)	d (inch)	Outer diameter D (mm)	D (inch)	Width B (mm)	B (inch)	Chamfer $r_{s\,(min)}$ (mm)	$r_{s\,(min)}$ (inch)	Bearing number Open	2 Shields(2)	2 Seals(2) TTS	Load rating Cr (N)	Cor (N)	Limiting speed(3) Grease (min⁻¹)	Oil (min⁻¹)	Cage type
9.525	0.3750	15.875	0.6250	3.967	0.1562	0.25	0.0098	**ER1038**(1)	**ER1038ZZS**	—	857	435	15 000	17 500	W
12.700	0.5000	19.050	0.7500	3.967	0.1562	0.25	0.0098	**ER1212**(1)	**ER1212ZZS**	**TTS**	919	537	12 000	14 000	W
19.05	0.7500	25.400	1.0000	3.967	0.1562	0.25	0.0098	**ER1634**(1)	**ER1634ZZS**	—	1 010	691	8 500	10 000	W

Ball Size (mm)	Ball Qty. (pcs.)	$d_{a\,(min)}$ (mm)	$d_{a\,(max)}$ (mm)	Open $D_{a\,(min)}$ (mm)	Open $D_{a\,(max)}$ (mm)	Shielded, Sealed $D_{b\,(min)}$ (mm)	Shielded, Sealed $D_{b\,(max)}$ (mm)	$r_{as\,(max)}$ (mm)	Mass (Ref.) Open (g)	Mass (Ref.) 2 Shields (g)
1.588	11	11.10	11.20	14.30	14.30	14.30	14.30	0.25	2.40	2.60
1.588	13	14.00	14.00	17.50	18.00	17.50	18.00	0.25	3.01	3.26
1.588	17	21.00	21.00	24.50	24.50	24.50	24.50	0.25	4.22	4.56

SET series (Metric series) Stainless-steel

Bore diameter d (mm)	d (inch)	Outer diameter D (mm)	D (inch)	Width B (mm)	B (inch)	Chamfer $r_{s\,(min)}$ (mm)	$r_{s\,(min)}$ (inch)	Bearing number Open	2 Shields(2)	2 Seals(2) TTS	Load rating Cr (N)	Cor (N)	Limiting speed(3) Grease (min⁻¹)	Oil (min⁻¹)	Cage type
20	0.7874	25	0.9843	4	0.1575	0.15	0.0059	**SET2520**(1)	**SET2520ZZS**	—	861	553	8 500	10 000	W

Ball Size (mm)	Ball Qty. (pcs.)	$d_{a\,(min)}$ (mm)	$d_{a\,(max)}$ (mm)	Open $D_{a\,(min)}$ (mm)	Open $D_{a\,(max)}$ (mm)	Shielded, Sealed $D_{b\,(min)}$ (mm)	Shielded, Sealed $D_{b\,(max)}$ (mm)	$r_{as\,(max)}$ (mm)	Mass (Ref.) Open (g)	Mass (Ref.) 2 Shields (g)
1.588	17	21.00	21.00	24.50	24.50	24.50	24.50	0.15	2.92	3.26

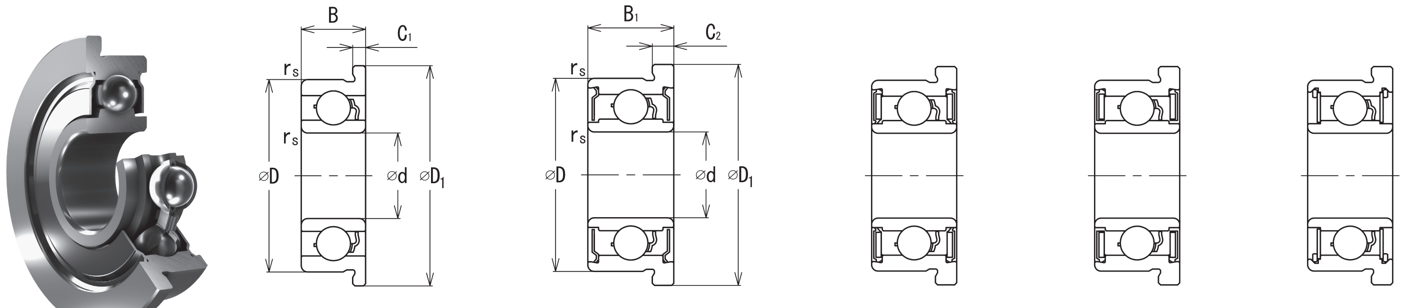
SER (Inch series) Stainless-steel

Bore diameter d (mm)	d (inch)	Outer diameter D (mm)	D (inch)	Width B (mm)	B (inch)	Chamfer $r_{s\,(min)}$ (mm)	$r_{s\,(min)}$ (inch)	Bearing number Open	2 Shields(2)	2 Seals(2) TTS	Load rating Cr (N)	Cor (N)	Limiting speed(3) Grease (min⁻¹)	Oil (min⁻¹)	Cage type
9.525	0.3750	15.875	0.6250	3.967	0.1562	0.25	0.0098	**SER1038**(1)	**SER1038ZZS**	**TTS**	729	348	15 000	17 500	W
12.700	0.5000	19.050	0.7500	3.967	0.1562	0.25	0.0098	**SER1212**(1)	**SER1212ZZS**	**TTS**	781	429	12 000	14 000	W
15.875	0.6250	22.225	0.8750	3.967	0.1562	0.25	0.0098	**SER1458**(1)	**SER1458ZZS**	—	825	496	10 000	12 000	W
19.050	0.7500	25.400	1.0000	3.967	0.1562	0.25	0.0098	**SER1634**(1)	**SER1634ZZS**	—	861	553	8 500	10 000	W

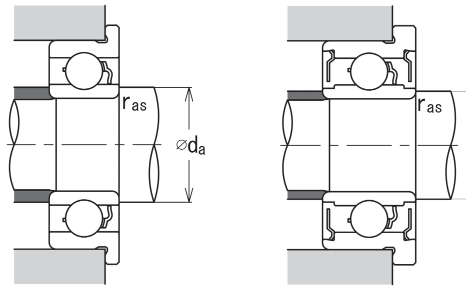
Ball Size (mm)	Ball Qty. (pcs.)	$d_{a\,(min)}$ (mm)	$d_{a\,(max)}$ (mm)	Open $D_{a\,(min)}$ (mm)	Open $D_{a\,(max)}$ (mm)	Shielded, Sealed $D_{b\,(min)}$ (mm)	Shielded, Sealed $D_{b\,(max)}$ (mm)	$r_{as\,(max)}$ (mm)	Mass (Ref.) Open (g)	Mass (Ref.) 2 Shields (g)
1.588	11	11.10	11.20	14.30	14.30	14.30	14.30	0.25	2.37	2.57
1.588	13	14.00	14.00	17.50	18.00	17.50	18.00	0.25	2.98	3.22
1.588	15	17.50	17.50	21.00	21.00	21.00	21.00	0.25	3.60	3.89
1.588	17	21.00	21.00	24.50	24.50	24.50	24.50	0.25	4.17	4.51

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix ZS or TS.
(3) Applicable only for open, single ZS and ZZS bearings in inner ring rotating conditions.

Flanged extra-miniature/miniature/small bearings【SUJ2】



Open Shielded: ZZ Sealed: 2RS Sealed: 2RU Sealed: TTS



Abutment and fillet

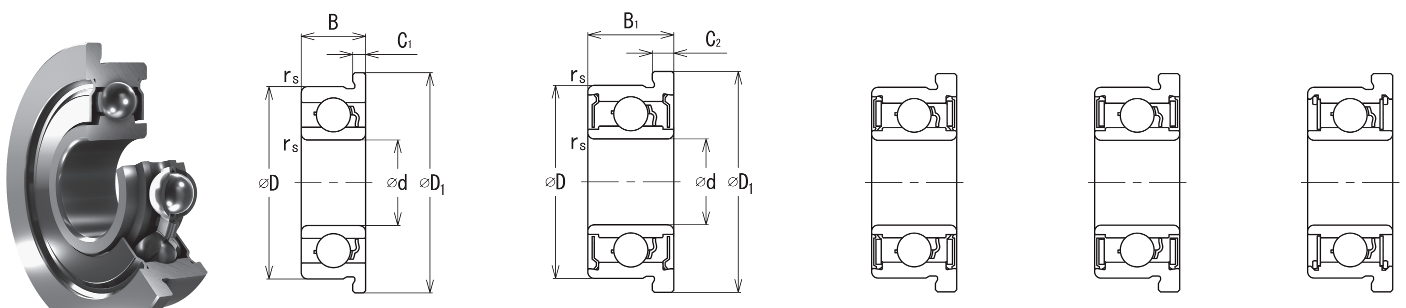
Dimension

Bore diameter d (mm)	Bore diameter d (inch)	Outer diameter D (mm)	Outer diameter D (inch)	Width, Open B (mm)	Width, Open B (inch)	Width, Shielded, Sealed B_1 (mm)	Width, Shielded, Sealed B_1 (inch)	Flange outer diameter, Open D_1 (mm)	Flange outer diameter, Open D_1 (inch)	Flange outer diameter, Shielded, Sealed D_2 (mm)	Flange outer diameter, Shielded, Sealed D_2 (inch)	Flange width, Open C_1 (mm)	Flange width, Open C_1 (inch)	Flange width, Shielded, Sealed C_2 (mm)	Flange width, Shielded, Sealed C_2 (inch)	Chamfer $r_{s\,(min)}$ (mm)	Chamfer $r_{s\,(min)}$ (inch)
1.5	0.0591	5	0.1969	—	—	2.6	0.1024	—	—	6.5	0.2559	—	—	0.8	0.0315	0.15	0.0059
2	0.0787	5	0.1969	1.5	0.0591	2.3	0.0906	6.1	0.2402	6.1	0.2402	0.5	0.0197	0.6	0.0236	0.08	0.0031
		5	0.1969	—	—	2.5	0.0984	—	—	6.2	0.2441	—	—	0.6	0.0236	0.10	0.0039
		6	0.2362	2.3	0.0906	3	0.1181	7.5	0.2953	7.5	0.2953	0.6	0.0236	0.8	0.0315	0.15	0.0059
		6	0.2362	—	—	2.5	0.0984	—	—	7.2	0.2835	—	—	0.6	0.0236	0.10	0.0039
2.5	0.0984	6	0.2362	—	—	2.6	0.1024	—	—	7.1	0.2795	—	—	0.8	0.0315	0.08	0.0031
3	0.1181	6	0.2362	2	0.0787	2.5	0.0984	7.2	0.2835	7.2	0.2835	0.6	0.0236	0.6	0.0236	0.10	0.0039
		7	0.2756	2	0.0787	3	0.1181	8.1	0.3189	8.1	0.3189	0.5	0.0197	0.8	0.0315	0.10	0.0039
		8	0.3150	—	—	3	0.1181	—	—	9.2	0.3622	—	—	0.6	0.0236	0.10	0.0039
		8	0.3150	3	0.1181	4	0.1575	9.5	0.3740	9.5	0.374	0.7	0.0276	0.9	0.0354	0.15	0.0059
		9	0.3543	—	—	4	0.1575	—	—	10.6	0.4173	—	—	0.8	0.0315	0.15	0.0059
		9	0.3543	3	0.1181	5	0.1969	10.5	0.4134	10.5	0.4134	0.7	0.0276	1.0	0.0394	0.15	0.0059
		10	0.3937	4	0.1575	4	0.1575	11.5	0.4528	11.5	0.4528	1.0	0.0394	1.0	0.0394	0.15	0.0059
4	0.1575	7	0.2756	2	0.0787	—	—	8.2	0.3228	—	—	0.6	0.0236	—	—	0.10	0.0039
		7	0.2756	—	—	2.5	0.0984	—	—	8.2	0.3228	—	—	0.6	0.0236	0.10	0.0039
		8	0.3150	2	0.0787	—	—	9.2	0.3622	—	—	0.6	0.0236	—	—	0.15	0.0059
		8	0.3150	—	—	3	0.1181	—	—	9.2	0.3622	—	—	0.6	0.0236	0.10	0.0039
		9	0.3543	2.5	0.0984	4	0.1575	10.3	0.4055	10.3	0.4055	0.6	0.0236	1.0	0.0394	0.10	0.0039
		10	0.3937	3	0.1181	4	0.1575	11.2	0.4409	11.6	0.4567	0.6	0.0236	0.8	0.0315	0.20	0.0079
		11	0.4331	4	0.1575	4	0.1575	12.5	0.4921	12.5	0.4921	1.0	0.0394	1.0	0.0394	0.15	0.0059
		12	0.4724	4	0.1575	4	0.1575	13.5	0.5315	13.5	0.5315	1.0	0.0394	1.0	0.0394	0.20	0.0079
		13	0.5118	5	0.1969	5	0.1969	15	0.5906	15	0.5906	1.0	0.0394	1.0	0.0394	0.20	0.0079
		16	0.6299	5	0.1969	5	0.1969	18	0.7087	18	0.7087	1.0	0.0394	1.0	0.0394	0.30	0.0118
5	0.1969	8	0.3150	2	0.0787	—	—	9.2	0.3622	—	—	0.6	0.0236	—	—	0.10	0.0039
		8	0.3150	—	—	2.5	0.0984	—	—	9.2	0.3622	—	—	0.6	0.0236	0.10	0.0039
		9	0.3543	2.5	0.0984	3	0.1181	10.2	0.4016	10.2	0.4016	0.6	0.0236	0.6	0.0236	0.15	0.0059
		10	0.3937	3	0.1181	4	0.1575	11.2	0.4409	11.6	0.4567	0.6	0.0236	0.8	0.0315	0.15	0.0059
		11	0.4331	4	0.1575	4	0.1575	12.6	0.4961	12.6	0.4961	0.8	0.0315	0.8	0.0315	0.15	0.0059
		11	0.4331	3	0.1181	5	0.1969	12.5	0.4921	12.5	0.4921	0.8	0.0315	1.0	0.0394	0.15	0.0059
		13	0.5118	4	0.1575	4	0.1575	15	0.5906	15	0.5906	1.0	0.0394	1.0	0.0394	0.20	0.0079
		14	0.5512	5	0.1969	5	0.1969	16	0.6299	16	0.6299	1.0	0.0394	1.0	0.0394	0.20	0.0079
		16	0.6299	5	0.1969	5	0.1969	18	0.7087	18	0.7087	1.0	0.0394	1.0	0.0394	0.30	0.0118
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
6	0.2362	10	0.3937	2.5	0.0984	—	—	11.2	0.4409	—	—	0.6	0.0236	—	—	0.15	0.0059
		10	0.3937	—	—	3	0.1181	—	—	11.2	0.4409	—	—	0.6	0.0236	0.10	0.0039
6	0.2362	12	0.4724	3	0.1181	4	0.1575	13.2	0.5197	13.6	0.5354	0.6	0.0236	0.8	0.0315	0.20	0.0079
		13	0.5118	3.5	0.1378	5	0.1969	15	0.5906	15	0.5906	1.0	0.0394	1.1	0.0433	0.15	0.0059
		15	0.5906	5	0.1969	5	0.1969	17	0.6693	17	0.6693	1.2	0.0472	1.2	0.0472	0.20	0.0079
		17	0.6693	6	0.2362	6	0.2362	19	0.7480	19	0.748	1.2	0.0472	1.2	0.0472	0.30	0.0118

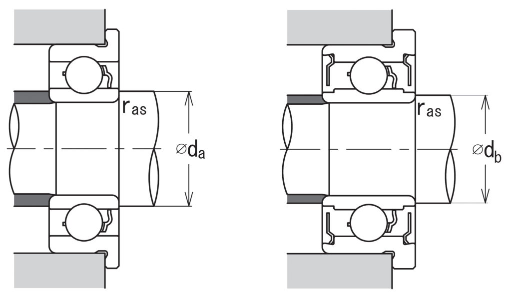
Bearing number: Open	Bearing number: 2 Shields(2)	2 Seals(2): 2RS	2 Seals(2): 2RU	2 Seals(2): TTS	Load rating Cr (N)	Load rating Cor (N)	Limiting speed(3) Grease (min^{-1})	Limiting speed(3) Oil (min^{-1})	Cage type(4)	Ball Size (mm)	Ball Qty. (pcs.)	Abutment and fillet dimensions, Open $d_{a\,(min)}$ (mm)	Open $d_{a\,(max)}$ (mm)	Shielded, Sealed $d_{b\,(min)}$ (mm)	Shielded, Sealed $d_{b\,(max)}$ (mm)	$r_{as\,(max)}$ (mm)	Mass (Ref.) Open (g)	Mass (Ref.) 2 Shields (g)
—	**F691XZZ**	—	—	—	238	69	94 000	111 000	W	1.000	6	—	—	2.40	2.40	0.15	—	0.30
F682	**F682ZZ**	—	—	—	169	50	94 000	111 000	W	0.800	6	2.50	2.60	2.50	2.60	0.08	0.16	0.22
—	**MF52ZZ**	—	—	—	169	50	94 000	111 000	W	0.800	6	—	—	2.60	2.60	0.10	—	0.24
F692	**F692ZZ**	—	—	—	330	99	86 000	101 000	W	1.200	6	2.90	2.90	2.90	2.90	0.15	0.35	0.43
—	**MF62ZZ**	—	—	—	209	73	81 000	96 000	W	0.800	8	—	—	2.80	3.60	0.10	—	0.42
—	**F682XZZ**	—	—	—	209	73	81 000	96 000	W	0.800	8	—	—	3.10	3.60	0.08	—	0.37
MF63	**MF63ZZ**	—	—	—	209	73	81 000	96 000	W	0.800	8	3.60	3.60	3.60	3.60	0.10	0.27	0.31
F683	**F683ZZ**	**2RS**	—	—	311	112	74 000	88 000	W	1.000	8	3.80	4.20	3.70	3.80	0.10	0.37	0.52
—	**MF83ZZ**	—	—	—	395	140	67 000	79 000	J	1.200	7	—	—	4.20	4.90	0.10	—	0.71
F693	**F693ZZ**	**2RS**	—	—	559	179	70 000	82 000	J	1.588	6	3.90	4.30	3.90	4.30	0.15	0.71	0.91
—	**MF93ZZ**	—	—	—	572	188	66 000	78 000	W	1.588	6	—	—	3.90	4.30	0.15	—	1.23
F603	**F603ZZ**	—	—	—	572	188	66 000	78 000	W	1.588	6	4.20	4.80	3.90	4.30	0.15	0.97	1.52
F623(1)	**F623ZZ**	**2RS**	**2RU**	—	633	218	66 000	78 000	J	1.588	7	3.90	4.30	3.90	4.30	0.15	1.68	1.76
MF74	—	—	—	—	312	115	70 000	82 000	W	1.000	8	4.60	4.70	—	—	0.10	0.28	—
—	**MF74ZZ**	—	—	—	255	107	71 000	83 000	W	0.800	11	—	—	4.60	4.70	0.10	—	0.37
MF84	—	—	—	—	395	140	67 000	79 000	J	1.200	7	4.90	4.90	—	—	0.15	0.43	—
—	**MF84ZZ**	—	—	—	395	140	67 000	79 000	J	1.200	7	—	—	4.80	4.90	0.10	—	0.58
F684	**F684ZZ**	**2RS**	—	—	641	226	63 000	75 000	W	1.588	7	4.80	5.10	4.80	5.10	0.10	0.71	1.09
MF104	**MF104ZZ**	**2RS**	**2RU**	—	711	270	59 000	70 000	J	1.588	8	5.60	5.80	5.60	5.80	0.20	1.09	1.47
F694(1)	**F694ZZ**	**2RS**	—	—	959	347	57 000	67 000	J	2.000	7	5.20	5.50	5.20	5.50	0.15	1.69	1.81
F604(1)	**F604ZZ**	**2RS**	—	—	959	347	57 000	67 000	J	2.000	7	5.30	5.50	5.30	5.50	0.20	2.25	2.37
F624(1)	**F624ZZ**	**2RS**	**2RU**	—	1 300	485	51 000	60 000	J	2.381	7	5.60	5.90	5.60	5.90	0.20	3.05	3.22
F634(1)	**F634ZZ**	**2RS**	—	—	1 340	517	46 000	54 000	J	2.381	7	6.00	6.60	6.00	6.60	0.30	5.29	5.63
MF85	—	—	—	—	309	121	62 000	74 000	W	1.000	8	5.60	5.70	—	—	0.10	0.33	—
—	**MF85ZZ**	—	—	—	218	91	63 000	75 000	W	0.800	9	—	—	5.60	5.70	0.10	—	0.42
MF95	**MF95ZZ**	—	—	**TTS**	432	168	60 000	71 000	W	1.200	8	5.90	5.90	5.90	5.90	0.15	0.58	0.65
MF105	**MF105ZZ**	**2RS**	—	—	432	168	60 000	71 000	W	1.200	8	5.90	5.90	5.90	5.90	0.15	1.03	1.38
MF115(1)	**MF115ZZ**	**2RS**	—	—	716	283	54 000	64 000	J	1.588	8	6.20	6.70	6.20	6.70	0.15	1.61	1.71
F685	**F685ZZ**	**2RS**	—	—	716	283	54 000	64 000	J	1.588	8	6.20	6.70	5.90	6.10	0.15	1.34	2.03
F695(1)	**F695ZZ**	**2RS**	—	—	1 080	430	50 000	59 000	J	2.000	8	6.30	6.50	6.30	6.50	0.20	2.47	2.62
F605(1)	**F605ZZ**	**2RS**	—	—	1 330	507	48 000	56 000	J	2.381	7	6.60	6.80	6.60	6.80	0.20	3.52	3.79
F625(1)	**F625ZZ**	**2RS**	**2RU**	—	1 730	670	44 000	52 000	J	2.778	7	7.00	7.40	7.00	7.40	0.30	4.71	4.94
F635(1)	**F635ZZ**	**2RS**	—	—	2 340	889	38 000	45 000	J	3.500	6	7.00	8.40	7.00	8.40	0.30	8.68	9.20
MF106	—	—	—	—	497	219	54 000	64 000	W	1.200	10	6.90	6.90	—	—	0.15	0.66	—
—	**MF106ZZ**	—	—	—	497	218	55 000	64 000	W	1.200	10	—	—	6.80	6.90	0.10	—	0.78
MF126	**MF126ZZ**	**2RS**	—	—	716	293	50 000	59 000	J	1.588	8	7.30	7.60	7.10	7.10	0.20	1.35	1.77
F686	**F686ZZ**	**2RS**	**2RU**	—	1 080	438	48 000	56 000	J	2.000	8	7.20	7.90	7.20	7.30	0.15	2.17	2.86
F696(1)	**F696ZZ**	**2RS**	**2RU**	—	1 340	517	46 000	54 000	J	2.381	7	7.30	7.40	7.30	7.40	0.20	3.98	4.28
F606(1)	**F606ZZ**	**2RS**	**2RU**	—	2 260	838	42 000	49 000	J	3.500	6	7.70	8.10	7.70	8.10	0.30	5.97	6.47

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Flanged extra-miniature/miniature/small bearings【SUJ2】



Open | Shielded: ZZ | Sealed: 2RS | Sealed: 2RU | Sealed: TTS



Abutment and fillet

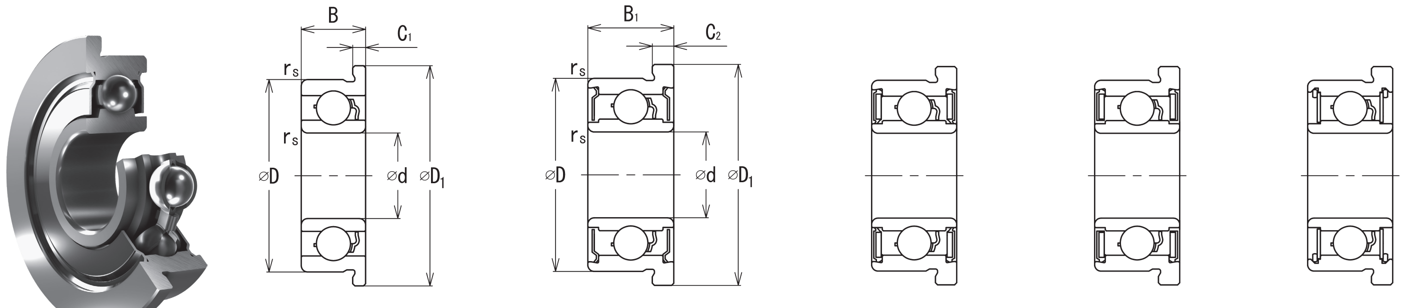
Dimension

Bore diameter d		Outer diameter D		Width Open B		Width Shielded, Sealed B1		Flange outer diameter Open D1		Flange outer diameter Shielded, Sealed D2		Flange width Open C1		Flange width Shielded, Sealed C2		Chamfer rs (min)	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
6	0.2362	19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
7	0.2756	11	0.4331	2.5	0.0984	3	0.1181	12.2	0.4803	12.2	0.4803	0.6	0.0236	0.6	0.0236	0.15	0.0059
		13	0.5118	—	—	4	0.1575	—	—	14.6	0.5748	—	—	0.8	0.0315	0.15	0.0059
		14	0.5512	3.5	0.1378	5	0.1969	16	0.6299	16	0.6299	1.0	0.0394	1.1	0.0433	0.15	0.0059
		17	0.6693	5	0.1969	5	0.1969	19	0.7480	19	0.748	1.2	0.0472	1.2	0.0472	0.30	0.0118
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
		22	0.8661	7	0.2756	7	0.2756	25	0.9843	25	0.9843	1.5	0.0591	1.5	0.0591	0.30	0.0118
8	0.3150	12	0.4724	2.5	0.0984	—	—	13.2	0.5197	—	—	0.6	0.0236	—	—	0.15	0.0059
		12	0.4724	—	—	3.5	0.1378	—	—	13.6	0.5354	—	—	0.8	0.0315	0.10	0.0039
		12	0.4724	—	—	3.5	0.1378	—	—	13.6	0.5354	—	—	0.8	0.0315	0.10	0.0039
		14	0.5512	3.5	0.1378	—	—	15.6	0.6142	—	—	0.8	0.0315	—	—	0.20	0.0079
		14	0.5512	—	—	4	0.1575	—	—	15.6	0.6142	—	—	0.8	0.0315	0.15	0.0059
		16	0.6299	4	0.1575	5	0.1969	18	0.7087	18	0.7087	1.0	0.0394	1.1	0.0433	0.20	0.0079
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
		22	0.8661	7	0.2756	7	0.2756	25	0.9843	25	0.9843	1.5	0.0591	1.5	0.0591	0.30	0.0118
9	0.3543	17	0.6693	—	—	5	0.1969	—	—	19	0.748	—	—	1.1	0.0433	0.20	0.0079
		20	0.7874	6	0.2362	6	0.2362	23	0.9055	23	0.9055	1.5	0.0591	1.5	0.0591	0.30	0.0118
		24	0.9449	7	0.2756	7	0.2756	27	1.0630	27	1.063	1.5	0.0591	1.5	0.0591	0.30	0.0118

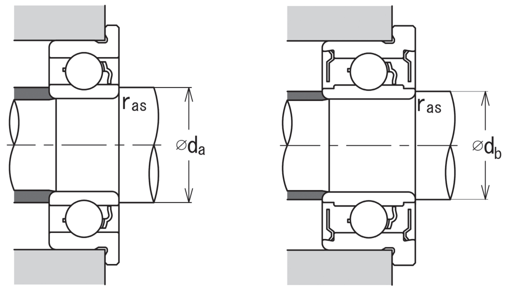
Bearing number Open	Bearing number 2 Shields(2)	2 Seals(2) 2RS	2RU	TTS	Load rating Cr	Cor	Limiting speed(3) Grease	Oil	Cage type(4)	Ball Size	Ball Qty.	Open da (min)	Open da (max)	Shielded, Sealed db (min)	Shielded, Sealed db (max)	ras (max)	Mass (Ref.) Open	Mass (Ref.) 2 Shields
					N		min⁻¹			mm	pcs.	mm		mm		mm	g	
F626(1)	F626ZZ	2RS	2RU	—	2 340	889	38 000	45 000	J	3.500	6	8.00	8.40	8.00	8.40	0.30	8.31	8.84
MF117	MF117ZZS	—	—	—	456	201	50 000	59 000	W	1.200	9	7.90	7.90	7.90	7.90	0.15	0.70	0.84
—	MF137ZZ	—	—	—	541	276	45 000	53 000	W	1.200	12	—	—	8.20	8.90	0.15	—	2.2
F687	F687ZZ	2RS	—	—	1 180	511	44 000	52 000	J	2.000	9	8.20	8.90	8.20	8.40	0.15	2.39	3.15
F697(1)	F697ZZ	2RS	—	—	1 610	716	40 000	47 000	J	2.381	9	8.70	9.10	8.70	9.10	0.30	5.35	5.57
F607(1)	F607ZZ	2RS	2RU	—	2 340	889	38 000	45 000	J	3.500	6	8.70	8.90	8.70	8.90	0.30	7.90	8.40
F627(1)	F627ZZ	2RS	2RU	—	3 300	1 370	33 000	39 000	J	3.969	7	9.00	10.40	9.00	10.40	0.30	13.0	13.6
MF128	—	—	—	—	544	275	46 000	54 000	W	1.200	12	9.00	9.00	—	—	0.15	0.80	—
—	MF128ZZ	2RS	—	—	545	274	46 000	54 000	W	1.200	12	—	—	8.60	8.90	0.10	—	1.20
—	—	—	—	TTS	544	275	31 000	31 000	W	1.200	12	—	—	8.80	9.00	0.10	—	1.13
MF148	—	—	—	—	818	386	42 000	50 000	J	1.588	10	9.60	9.80	—	—	0.20	2.01	—
—	MF148ZZ	2RS	—	—	818	386	42 000	50 000	J	1.588	10	—	—	8.90	9.20	0.15	—	2.22
F688	F688ZZ	2RS	2RU	—	1 260	590	40 000	47 000	J	2.000	10	9.60	10.40	9.50	9.60	0.20	3.57	4.25
F698(1)	F698ZZ	2RS	2RU	—	2 240	912	37 000	44 000	J	3.175	7	9.70	9.70	9.70	9.70	0.30	7.34	7.85
F608(1)	F608ZZ	2RS	2RU	—	3 300	1 370	33 000	39 000	J	3.969	7	10.00	10.40	10.00	10.40	0.30	12.3	12.9
—	F689ZZ	2RS	—	—	1 330	664	37 000	44 000	J	2.000	11	—	—	10.30	10.60	0.20	—	4.58
F699(1)	F699ZZ	2RS	2RU	—	2 470	1 070	35 000	42 000	J	3.175	8	10.60	11.50	10.60	11.50	0.20	8.27	8.77
F609(1)	F609ZZ	2RS	2RU	—	3 350	1 430	30 000	36 000	J	3.969	7	11.00	12.00	11.00	12.00	0.30	14.7	15.5

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Flanged extra-miniature/miniature/small bearings【Stainless-steel】



Open　Shielded: ZZ　Sealed: 2RS　Sealed: 2RU　Sealed: TTS



Abutment and fillet

Bore diameter d		Outer diameter D		Width Open B		Width Shielded, Sealed B_1		Flange outer diameter Open D_1		Flange outer diameter Shielded, Sealed D_2		Flange width Open C_1		Flange width Shielded, Sealed C_2		Chamfer $r_{s\,(min)}$	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
1	0.0394	3	0.1181	1	0.0394	—	—	3.8	0.1496	—	—	0.3	0.0118	—	—	0.05	0.002
		4	0.1575	1.6	0.063	—	—	5	0.1969	—	—	0.5	0.0197	—	—	0.10	0.0039
1.5	0.0591	4	0.1575	1.2	0.0472	2	0.0787	5	0.1969	5	0.1969	0.4	0.0157	0.6	0.0236	0.05	0.002
		5	0.1969	2	0.0787	2.6	0.1024	6.5	0.2559	6.5	0.2559	0.6	0.0236	0.8	0.0315	0.15	0.0059
		6	0.2362	—	—	3	0.1181	—	—	7.5	0.2953	—	—	0.8	0.0315	0.15	0.0059
2	0.0787	5	0.1969	1.5	0.0591	2.3	0.0906	6.1	0.2402	6.1	0.2402	0.5	0.0197	0.6	0.0236	0.08	0.0031
		5	0.1969	2	0.0787	2.5	0.0984	6.2	0.2441	6.2	0.2441	0.6	0.0236	0.6	0.0236	0.10	0.0039
		6	0.2362	2.3	0.0906	3	0.1181	7.5	0.2953	7.5	0.2953	0.6	0.0236	0.8	0.0315	0.15	0.0059
		6	0.2362	—	—	3	0.1181	—	—	7.5	0.2953	—	—	0.8	0.0315	0.15	0.0059
		6	0.2362	2.5	0.0984	—	—	7.2	0.2835	—	—	0.6	0.0236	—	—	0.15	0.0059
		7	0.2756	—	—	3	0.1181	—	—	8.2	0.3228	—	—	0.6	0.0236	0.15	0.0059
		7	0.2756	—	—	3.5	0.1378	—	—	8.5	0.3346	—	—	0.9	0.0354	0.15	0.0059
2.5	0.0984	6	0.2362	1.8	0.0709	2.6	0.1024	7.1	0.2795	7.1	0.2795	0.5	0.0197	0.8	0.0315	0.08	0.0031
		7	0.2756	—	—	3.5	0.1378	—	—	8.5	0.3346	—	—	0.9	0.0354	0.15	0.0059
		8	0.3150	2.8	0.1102	4	0.1575	9.5	0.3740	9.5	0.374	0.7	0.0276	0.9	0.0354	0.15	0.0059
3	0.1181	6	0.2362	2	0.0787	2.5	0.0984	7.2	0.2835	7.2	0.2835	0.6	0.0236	0.6	0.0236	0.10	0.0039
		7	0.2756	2	0.0787	3	0.1181	8.1	0.3189	8.1	0.3189	0.5	0.0197	0.8	0.0315	0.10	0.0039
		8	0.3150	2.5	0.0984	—	—	9.2	0.3622	—	—	0.6	0.0236	—	—	0.15	0.0059
		8	0.3150	—	—	3	0.1181	—	—	9.2	0.3622	—	—	0.6	0.0236	0.10	0.0039
		8	0.3150	3	0.1181	4	0.1575	9.5	0.3740	9.5	0.374	0.7	0.0276	0.9	0.0354	0.15	0.0059
		9	0.3543	2.5	0.0984	—	—	10.2	0.4016	—	—	0.6	0.0236	—	—	0.20	0.0079
		9	0.3543	—	—	4	0.1575	—	—	10.6	0.4173	—	—	0.8	0.0315	0.15	0.0059
		9	0.3543	3	0.1181	5	0.1969	10.5	0.4134	10.5	0.4134	0.7	0.0276	1.0	0.0394	0.15	0.0059
		10	0.3937	4	0.1575	4	0.1575	11.5	0.4528	11.5	0.4528	1.0	0.0394	1.0	0.0394	0.15	0.0059
4	0.1575	7	0.2756	2	0.0787	—	—	8.2	0.3228	—	—	0.6	0.0236	—	—	0.10	0.0039
		7	0.2756	—	—	2.5	0.0984	—	—	8.2	0.3228	—	—	0.6	0.0236	0.10	0.0039
		8	0.3150	2	0.0787	—	—	9.2	0.3622	—	—	0.6	0.0236	—	—	0.15	0.0059
		8	0.3150	—	—	3	0.1181	—	—	9.2	0.3622	—	—	0.6	0.0236	0.10	0.0039
		9	0.3543	2.5	0.0984	4	0.1575	10.3	0.4055	10.3	0.4055	0.6	0.0236	1.0	0.0394	0.10	0.0039
		10	0.3937	3	0.1181	4	0.1575	11.2	0.4409	11.6	0.4567	0.6	0.0236	0.8	0.0315	0.20	0.0079
		11	0.4331	4	0.1575	4	0.1575	12.5	0.4921	12.5	0.4921	1.0	0.0394	1.0	0.0394	0.15	0.0059
		12	0.4724	4	0.1575	4	0.1575	13.5	0.5315	13.5	0.5315	1.0	0.0394	1.0	0.0394	0.20	0.0079
		13	0.5118	5	0.1969	5	0.1969	15	0.5906	15	0.5906	1.0	0.0394	1.0	0.0394	0.20	0.0079
		16	0.6299	5	0.1969	5	0.1969	18	0.7087	18	0.7087	1.0	0.0394	1.0	0.0394	0.30	0.0118
5	0.1969	8	0.3150	2	0.0787	—	—	9.2	0.3622	—	—	0.6	0.0236	—	—	0.10	0.0039
		8	0.3150	—	—	2.5	0.0984	—	—	9.2	0.3622	—	—	0.6	0.0236	0.10	0.0039
		9	0.3543	2.5	0.0984	3	0.1181	10.2	0.4016	10.2	0.4016	0.6	0.0236	0.6	0.0236	0.15	0.0059
		10	0.3937	3	0.1181	4	0.1575	11.2	0.4409	11.6	0.4567	0.6	0.0236	0.8	0.0315	0.15	0.0059
		11	0.4331	4	0.1575	4	0.1575	12.6	0.4961	12.6	0.4961	0.8	0.0315	0.8	0.0315	0.15	0.0059

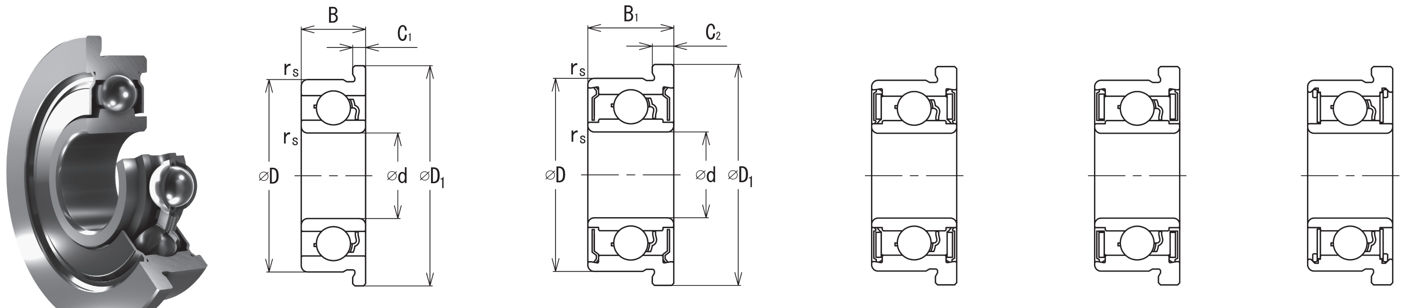
Bearing number Open	Bearing number 2 Shields(2)	2 Seals(2) 2RS	2 Seals(2) 2RU	2 Seals(2) TTS	Load rating Cr	Load rating Cor	Limiting speed(3) Grease	Limiting speed(3) Oil	Cage type(4)	Ball Size	Ball Qty.	Abutment and fillet dimensions Open $d_{a\,(min)}$	Open $d_{a\,(max)}$	Shielded, Sealed $d_{b\,(min)}$	Shielded, Sealed $d_{b\,(max)}$	$r_{as\,(max)}$	Mass (Ref.) Open	Mass (Ref.) 2 Shields
					N		min^{-1}			mm	pcs.	mm				mm	g	
F681H	—	—	—	—	81	20	117 000	139 000	W	0.600	6	1.40	1.50	—	—	0.05	0.04	—
F691H	—	—	—	—	120	29	105 000	124 000	W	0.800	5	1.80	1.90	—	—	0.10	0.12	—
F681XH	F681XHZZ	—	—	—	96	27	105 000	124 000	W	0.600	7	1.90	2.10	1.90	2.10	0.05	0.09	0.13
F691XH	F691XHZZ	—	—	—	202	55	94 000	111 000	W	1.000	6	2.40	2.40	2.40	2.40	0.15	0.23	0.29
—	F601XHZZ	—	—	—	281	79	86 000	101 000	W	1.200	6	—	—	2.70	2.90	0.15	—	0.46
F682H	F682HZZ	—	—	—	144	40	94 000	111 000	W	0.800	6	2.50	2.60	2.50	2.60	0.08	0.16	0.22
SMF52	SMF52ZZ	—	—	—	144	40	94 000	111 000	W	0.800	6	2.60	2.60	2.60	2.60	0.10	0.21	0.23
F692H	F692HZZ	—	—	—	281	79	86 000	101 000	W	1.200	6	2.90	2.90	2.90	2.90	0.15	0.35	0.43
—	—	—	—	TTS	281	79	86 000	95 000	J	1.200	6	—	—	2.90	2.90	0.15	—	0.43
SMF62	—	—	—	—	281	79	86 000	101 000	W	1.200	6	2.90	2.90	—	—	0.15	0.35	—
—	SMF72ZZS	—	—	—	328	102	76 000	90 000	W	1.200	7	—	—	3.00	3.10	0.15	—	0.57
—	F602HZZS	—	—	—	328	102	76 000	90 000	W	1.200	7	—	—	3.00	3.10	0.15	—	0.69
F682XH	F682XHZZ	—	—	—	177	58	81 000	96 000	W	0.800	8	3.10	3.60	3.10	3.60	0.08	0.26	0.37
—	F692XHZZS	—	—	—	328	102	76 000	90 000	W	1.200	7	—	—	3.70	3.80	0.15	—	0.68
F602XH	F602XHZZ	—	—	—	469	140	72 000	85 000	W	1.588	6	3.70	4.00	3.70	4.00	0.15	0.74	0.98
SMF63	SMF63ZZ	—	—	—	177	58	81 000	96 000	W	0.800	8	3.60	3.60	3.60	3.60	0.10	0.26	0.30
F683H	F683HZZ	2RS	—	—	265	90	74 000	88 000	W	1.000	8	3.80	4.20	3.70	3.80	0.10	0.37	0.51
SMF83	—	—	—	—	336	112	67 000	79 000	J	1.200	7	4.20	4.90	—	—	0.15	0.62	—
—	SMF83ZZ	—	—	—	336	112	67 000	79 000	J	1.200	7	—	—	4.20	4.90	0.10	—	0.70
F693H	F693HZZ	2RS	—	—	475	143	70 000	82 000	J	1.588	6	3.90	4.30	3.90	4.30	0.15	0.70	0.90
SMF93	—	—	—	—	486	150	66 000	78 000	W	1.588	6	4.60	4.80	—	—	0.20	0.78	—
—	SMF93ZZ	—	—	—	486	150	66 000	78 000	W	1.588	6	—	—	3.90	4.30	0.15	—	1.22
F603H	F603HZZ	—	—	—	486	150	66 000	78 000	W	1.588	6	4.20	4.80	3.90	4.30	0.15	0.96	1.50
F623H(1)	F623HZZ	2RS	2RU	—	538	175	66 000	78 000	J	1.588	7	3.90	4.30	3.90	4.30	0.15	1.66	1.74
SMF74	—	—	—	—	265	92	70 000	82 000	W	1.000	8	4.60	4.70	—	—	0.10	0.28	—
—	SMF74ZZ	—	—	—	217	86	71 000	83 000	W	0.800	11	—	—	4.60	4.70	0.10	—	0.36
SMF84	—	—	—	—	336	112	67 000	79 000	J	1.200	7	4.90	4.90	—	—	0.15	0.43	—
—	SMF84ZZ	—	—	TTS	336	112	67 000	79 000	J	1.200	7	—	—	4.80	4.90	0.10	—	0.57
F684H	F684HZZ	2RS	—	—	545	181	63 000	75 000	W	1.588	7	4.80	5.10	4.80	5.10	0.10	0.70	1.07
SMF104	SMF104ZZ	2RS	2RU	—	604	216	59 000	70 000	J	1.588	8	5.60	5.80	5.60	5.80	0.20	1.08	1.45
F694H(1)	F694HZZ	2RS	—	—	815	277	57 000	67 000	J	2.000	7	5.20	5.50	5.20	5.50	0.15	1.67	1.79
F604H(1)	F604HZZ	2RS	—	—	815	277	57 000	67 000	J	2.000	7	5.30	5.50	5.30	5.50	0.20	2.22	2.34
F624H(1)	F624HZZ	2RS	2RU	—	1 110	388	51 000	60 000	J	2.381	7	5.60	5.90	5.60	5.90	0.20	3.11	3.28
F634H(1)	F634HZZ	2RS	—	—	1 140	414	46 000	54 000	J	2.381	7	6.00	6.60	6.00	6.60	0.30	5.22	5.56
SMF85	—	—	—	—	263	97	62 000	74 000	W	1.000	8	5.60	5.70	—	—	0.10	0.32	—
—	SMF85ZZ	—	—	—	185	73	63 000	75 000	W	0.800	9	—	—	5.60	5.70	0.10	—	0.42
SMF95	SMF95ZZ	—	—	TTS	367	134	60 000	71 000	W	1.200	8	5.90	5.90	5.90	5.90	0.15	0.57	0.64
SMF105	SMF105ZZ	2RS	—	—	367	134	60 000	71 000	W	1.200	8	5.90	5.90	5.90	5.90	0.15	1.01	1.37
SMF115(1)	SMF115ZZ	2RS	—	—	609	226	54 000	64 000	J	1.588	8	6.20	6.70	6.20	6.70	0.15	1.59	1.69

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

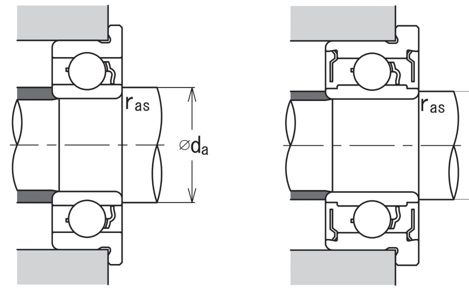
Flanged extra-miniature/miniature/small bearings【Stainless-steel】

Dimension

Flanged extra-miniature/miniature/small bearings【Stainless-steel】



Open Shielded: ZZ Sealed: 2RS Sealed: 2RU Sealed: TTS



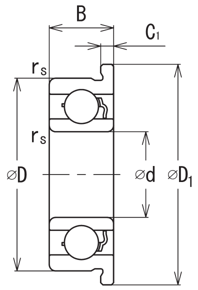
Abutment and fillet

Bore diameter d		Outer diameter D		Width: Open B		Width: Shielded, Sealed B_1		Flange outer diameter: Open D_1		Flange outer diameter: Shielded, Sealed D_2		Flange width: Open C_1		Flange width: Shielded, Sealed C_2		Chamfer $r_{s\,(min)}$	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
5	0.1969	11	0.4331	3	0.1181	5	0.1969	12.5	0.4921	12.5	0.4921	0.8	0.0315	1.0	0.0394	0.15	0.0059
		13	0.5118	4	0.1575	4	0.1575	15	0.5906	15	0.5906	1.0	0.0394	1.0	0.0394	0.20	0.0079
		14	0.5512	5	0.1969	5	0.1969	16	0.6299	16	0.6299	1.0	0.0394	1.0	0.0394	0.20	0.0079
		16	0.6299	5	0.1969	5	0.1969	18	0.7087	18	0.7087	1.0	0.0394	1.0	0.0394	0.30	0.0118
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
6	0.2362	10	0.3937	2.5	0.0984	—	—	11.2	0.4409	—	—	0.6	0.0236	—	—	0.15	0.0059
		10	0.3937	—	—	3	0.1181	—	—	11.2	0.4409	—	—	0.6	0.0236	0.10	0.0039
		10	0.3937	3	0.1181	3	0.1181	11.2	0.4409	11.2	0.4409	0.6	0.0236	0.6	0.0236	0.10	0.0039
		12	0.4724	3	0.1181	4	0.1575	13.2	0.5197	13.6	0.5354	0.6	0.0236	0.8	0.0315	0.20	0.0079
		13	0.5118	3.5	0.1378	5	0.1969	15	0.5906	15	0.5906	1.0	0.0394	1.1	0.0433	0.15	0.0059
		15	0.5906	5	0.1969	5	0.1969	17	0.6693	17	0.6693	1.2	0.0472	1.2	0.0472	0.20	0.0079
		17	0.6693	6	0.2362	6	0.2362	19	0.7480	19	0.748	1.2	0.0472	1.2	0.0472	0.30	0.0118
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
7	0.2756	11	0.4331	2.5	0.0984	3	0.1181	12.2	0.4803	12.2	0.4803	0.6	0.0236	0.6	0.0236	0.15	0.0059
		13	0.5118	3	0.1181	—	—	14.2	0.5591	—	—	0.6	0.0236	—	—	0.20	0.0079
		13	0.5118	—	—	4	0.1575	—	—	14.6	0.5748	—	—	0.8	0.0315	0.15	0.0059
		14	0.5512	3.5	0.1378	5	0.1969	16	0.6299	16	0.6299	1.0	0.0394	1.1	0.0433	0.15	0.0059
		17	0.6693	5	0.1969	5	0.1969	19	0.7480	19	0.748	1.2	0.0472	1.2	0.0472	0.30	0.0118
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
		22	0.8661	7	0.2756	7	0.2756	25	0.9843	25	0.9843	1.5	0.0591	1.5	0.0591	0.30	0.0118
8	0.3150	12	0.4724	2.5	0.0984	—	—	13.2	0.5197	—	—	0.6	0.0236	—	—	0.15	0.0059
		12	0.4724	—	—	3.5	0.1378	—	—	13.6	0.5354	—	—	0.8	0.0315	0.10	0.0039
		12	0.4724	—	—	3.5	0.1378	—	—	13.6	0.5354	—	—	0.8	0.0315	0.10	0.0039
		14	0.5512	3.5	0.1378	—	—	15.6	0.6142	—	—	0.8	0.0315	—	—	0.20	0.0079
		14	0.5512	—	—	4	0.1575	—	—	15.6	0.6142	—	—	0.8	0.0315	0.15	0.0059
		16	0.6299	4	0.1575	5	0.1969	18	0.7087	18	0.7087	1.0	0.0394	1.1	0.0433	0.20	0.0079
		19	0.7480	6	0.2362	6	0.2362	22	0.8661	22	0.8661	1.5	0.0591	1.5	0.0591	0.30	0.0118
		22	0.8661	7	0.2756	7	0.2756	25	0.9843	25	0.9843	1.5	0.0591	1.5	0.0591	0.30	0.0118
9	0.3543	17	0.6693	4	0.1575	5	0.1969	19	0.7480	19	0.748	1.0	0.0394	1.1	0.0433	0.20	0.0079
		20	0.7874	6	0.2362	6	0.2362	23	0.9055	23	0.9055	1.5	0.0591	1.5	0.0591	0.30	0.0118
		24	0.9449	7	0.2756	7	0.2756	27	1.0630	27	1.063	1.5	0.0591	1.5	0.0591	0.30	0.0118

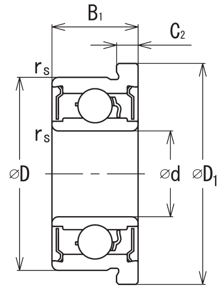
Bearing number: Open	2 Shields(2)	2 Seals(2): 2RS	2RU	TTS	Load rating: Cr	Cor	Limiting speed(3): Grease	Oil	Cage type(4)	Ball: Size	Qty.	Abutment and fillet dimensions, Open: $d_{a\,(min)}$	$d_{a\,(max)}$	Shielded, Sealed: $d_{b\,(min)}$	$d_{b\,(max)}$	$r_{as\,(max)}$	Mass (Ref.): Open	2 Shields
					N		min⁻¹			mm	pcs.	mm		mm		mm	g	
F685H	F685HZZ	2RS	—	—	609	226	54 000	64 000	J	1.588	8	6.20	6.70	5.90	6.10	0.15	1.33	2.01
F695H(1)	F695HZZ	2RS	—	—	916	344	50 000	59 000	J	2.000	8	6.30	6.50	6.30	6.50	0.20	2.44	2.59
F605H(1)	F605HZZ	2RS	—	—	1 130	405	48 000	56 000	J	2.381	7	6.60	6.80	6.60	6.80	0.20	3.47	3.74
F625H(1)	F625HZZ	2RS	—	—	1 470	536	44 000	52 000	J	2.778	7	7.00	7.40	7.00	7.40	0.30	4.88	5.21
F635H(1)	F635HZZ	2RS	—	—	1 990	711	38 000	45 000	J	3.500	6	7.00	8.40	7.00	8.40	0.30	8.57	9.10
SMF106	—	—	—	—	422	175	54 000	64 000	W	1.200	10	6.90	6.90	—	—	0.15	0.66	—
—	SMF106ZZ	—	—	—	423	174	55 000	64 000	W	1.200	10	—	—	6.80	6.90	0.10	—	0.77
F676H(1)	—	—	—	TTS	317	138	55 000	65 000	W	1.000	11	6.80	7.00	6.80	7.00	0.10	0.80	0.83
SMF126	SMF126ZZ	2RS	—	—	608	234	50 000	59 000	J	1.588	8	7.30	7.60	7.10	7.10	0.20	1.33	1.75
F686H	F686HZZ	2RS	2RU	TTS	920	350	48 000	56 000	J	2.000	8	7.20	7.90	7.20	7.30	0.15	2.15	2.83
F696H(1)	F696HZZ	2RS	2RU	—	1 140	414	46 000	54 000	J	2.381	7	7.30	7.40	7.30	7.40	0.20	3.93	4.23
F606H(1)	F606HZZ	2RS	2RU	—	1 920	670	42 000	49 000	J	3.500	6	7.70	8.10	7.70	8.10	0.30	5.90	6.40
F626H(1)	F626HZZ	2RS	2RU	—	1 990	711	38 000	45 000	J	3.500	6	8.00	8.40	8.00	8.40	0.30	8.22	8.74
SMF117	SMF117ZZS	—	—	—	388	161	50 000	59 000	W	1.200	9	7.90	7.90	7.90	7.90	0.15	0.69	0.83
SMF137	—	—	—	—	460	221	45 000	53 000	W	1.200	12	8.60	9.30	—	—	0.20	1.65	—
—	SMF137ZZ	—	—	—	460	221	45 000	53 000	W	1.200	12	—	—	8.20	8.90	0.15	—	2.18
F687H	F687HZZ	2RS	—	—	999	409	44 000	52 000	J	2.000	9	8.20	8.90	8.20	8.40	0.15	2.36	3.11
F697H(1)	F697HZZ	2RS	—	—	1 370	573	40 000	47 000	J	2.381	9	8.70	9.10	8.70	9.10	0.30	5.28	5.50
F607H(1)	F607HZZ	2RS	2RU	—	1 990	711	38 000	45 000	J	3.500	6	8.70	8.90	8.70	8.90	0.30	7.80	8.31
F627H(1)	F627HZZ	2RS	2RU	—	2 800	1 090	33 000	39 000	J	3.969	7	9.00	10.40	9.00	10.40	0.30	12.8	13.4
SMF128	—	—	—	—	462	220	46 000	54 000	W	1.200	12	9.00	9.00	—	—	0.15	0.79	—
—	SMF128ZZ	2RS	—	—	463	219	46 000	54 000	W	1.200	12	—	—	8.60	8.90	0.10	—	1.18
—	—	—	—	TTS	462	220	31 000	31 000	W	1.200	12	—	—	8.80	9.00	0.10	—	1.12
SMF148	—	—	—	—	696	309	42 000	50 000	J	1.588	10	9.60	9.80	—	—	0.20	1.99	—
—	SMF148ZZ	2RS	—	—	696	309	42 000	50 000	J	1.588	10	—	—	8.90	9.20	0.15	—	2.20
F688H	F688HZZ	2RS	2RU	TTS	1 070	472	40 000	47 000	J	2.000	10	9.60	10.40	9.50	9.60	0.20	3.52	4.20
F698H(1)	F698HZZ	2RS	2RU	—	1 900	729	37 000	44 000	J	3.175	7	9.70	9.70	9.70	9.70	0.30	7.25	7.76
F608H(1)	F608HZZ	2RS	2RU	—	2 800	1 090	33 000	39 000	J	3.969	7	10.00	10.40	10.00	10.40	0.30	12.1	12.8
F689H	F689HZZ	2RS	—	—	1 130	531	37 000	44 000	J	2.000	11	10.60	11.40	10.30	10.60	0.20	3.82	4.52
F699H(1)	F699HZZ	2RS	2RU	—	2 100	855	35 000	42 000	J	3.175	8	11.00	11.50	11.00	11.50	0.30	8.17	8.67
F609H(1)	F609HZZ	—	—	—	2 850	1 150	30 000	36 000	J	3.969	7	11.00	12.00	11.00	12.00	0.30	14.5	15.3

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

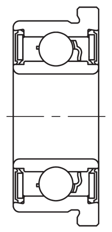
Flanged inch-series bearings【SUJ2】

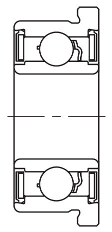


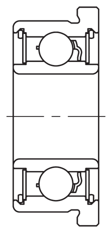
Open

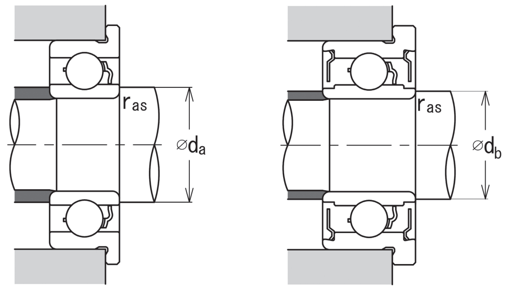


Shielded: ZZ


Sealed: 2RS


Sealed: 2RU


Sealed: TTS



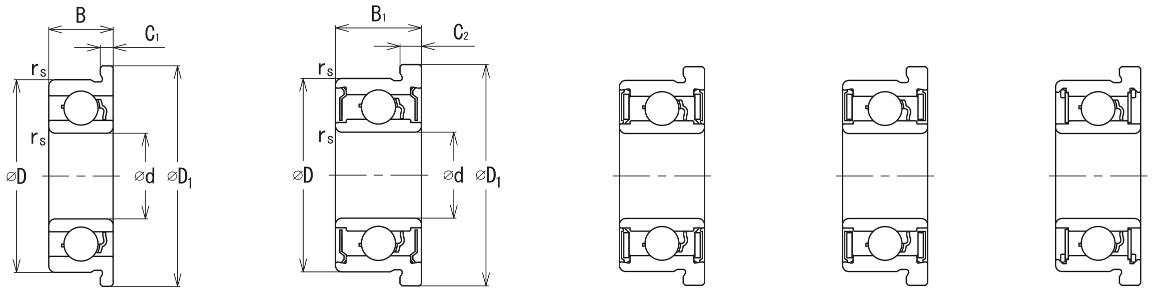
Abutment and fillet

Bore diameter d		Outer diameter D		Width: Open B		Width: Shielded, Sealed B_1		Flange outer diameter D_1		Flange width: Open C_1		Flange width: Shielded, Sealed C_2		Chamfer $r_{s\,(min)}$		Bearing number: Open	Bearing number: 2 Shields(2)
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch		
2.380	0.0937	4.762	0.1875	1.588	0.0625	—	—	5.944	0.2340	0.457	0.0180	—	—	0.10	0.0039	**FR133**	—
3.175	0.1250	6.350	0.2500	—	—	2.779	0.1094	7.518	0.2960	—	—	0.787	0.0310	0.10	0.0039	—	**FR144ZZ**
		7.938	0.3125	—	—	3.571	0.1406	9.119	0.3590	—	—	0.787	0.0310	0.10	0.0039	—	**FR2-5ZZ**
		9.525	0.3750	3.967	0.1562	3.967	0.1562	11.176	0.4400	0.762	0.0300	0.762	0.0300	0.30	0.0118	**FR2**(1)	**FR2ZZ**
3.967	0.1562	7.938	0.3125	—	—	3.175	0.1250	9.119	0.3590	—	—	0.914	0.0360	0.10	0.0039	—	**FR155ZZS**
4.762	0.1875	12.700	0.5000	4.978	0.1960	4.978	0.1960	14.351	0.5650	1.067	0.0420	1.067	0.0420	0.30	0.0118	**FR3**	**FR3ZZ**
6.350	0.2500	9.525	0.3750	—	—	3.175	0.1250	10.719	0.4220	—	—	0.914	0.0360	0.10	0.0039	—	**FR168ZZ**
		12.700	0.5000	—	—	4.762	0.1875	13.894	0.5470	—	—	1.143	0.0450	0.15	0.0059	—	**FR188ZZ**
		15.875	0.6250	4.978	0.1960	4.978	0.1960	17.526	0.6900	1.067	0.0420	1.067	0.0420	0.30	0.0118	**FR4**(1)	**FR4ZZ**
7.938	0.3125	12.700	0.5000	3.967	0.1562	3.967	0.1562	13.894	0.5470	0.787	0.0310	0.787	0.0310	0.15	0.0059	**FR1810**(1)	**FR1810ZZS**
9.525	0.3750	22.225	0.8750	5.558	0.2188	7.142	0.2812	24.613	0.9690	1.575	0.0620	1.575	0.0620	0.40	0.0157	**FR6**	**FR6ZZ**
12.700	0.5000	28.575	1.1250	6.350	0.2500	7.938	0.3125	31.120	1.2252	1.575	0.0620	1.575	0.0620	0.40	0.0157	**FR8**	**FR8ZZ**
15.875	0.6250	34.925	1.3750	—	—	8.733	0.3438	37.846	1.4900	—	—	1.745	0.0687	0.80	0.0315	—	**FR10ZZ**

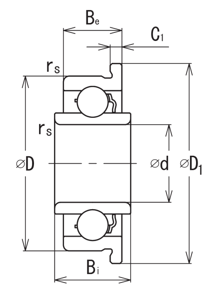
Bearing number: 2 Seals(2)			Load rating		Limiting speed(3)		Cage type(4)	Ball		Abutment and fillet dimensions: Open		Abutment and fillet dimensions: Shielded, Sealed		$r_{as\,(max)}$	Mass (Ref.)	
2RS	2RU	TTS	Cr	Cor	Grease	Oil		Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$d_{b\,(min)}$	$d_{b\,(max)}$		Open	2 Shields
			N		min^{-1}			mm	pcs.	mm		mm		mm	g	
—	—	—	189	60	90 000	106 000	W	0.800	7	2.90	2.90	—	—	0.10	0.13	—
—	—	—	284	95	77 000	91 000	W	1.000	7	—	—	3.80	3.80	0.10	—	0.36
—	—	—	559	179	70 000	82 000	W	1.588	6	—	—	4.00	4.30	0.10	—	0.75
—	—	—	633	218	66 000	78 000	J	1.588	7	4.70	4.70	4.70	4.70	0.30	1.39	1.46
—	—	—	360	149	64 000	76 000	W	1.000	10	—	—	4.80	5.40	0.10	—	0.69
2RS	—	—	1 300	485	51 000	60 000	J	2.381	7	6.80	6.90	6.40	6.40	0.30	2.93	2.91
—	—	—	373	172	55 000	65 000	W	1.000	11	—	—	7.00	7.00	0.10	—	0.67
—	—	—	1 080	438	48 000	56 000	J	2.000	8	—	—	7.20	7.30	0.15	—	2.24
2RS	**2RU**	—	1 480	617	42 000	50 000	J	2.381	8	8.00	8.30	8.00	8.30	0.30	4.26	4.58
—	—	**TTS**	541	276	45 000	53 000	W	1.200	12	8.90	8.90	8.90	8.90	0.15	1.56	1.65
2RS	**2RU**	—	3 330	1 410	31 000	37 000	J	3.969	7	12.10	12.70	11.60	11.80	0.40	9.85	11.8
2RS	**2RU**	—	5 110	2 390	25 000	30 000	J	4.762	8	15.50	16.50	15.00	15.50	0.40	18.7	21.8
—	—	—	6 000	3 270	20 000	24 000	RJ	4.762	10	—	—	20.50	23.00	0.80	—	38.5

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

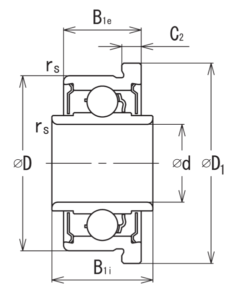
Flanged inch-series bearings【Stainless-steel】



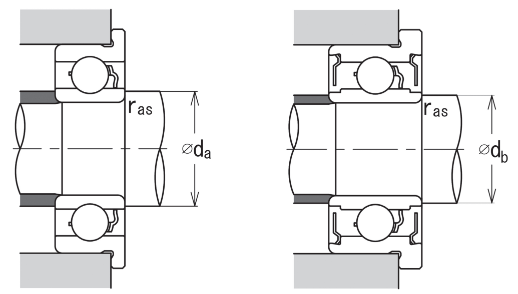
Open | Shielded: ZZ | Sealed: 2RS | Sealed: 2RU | Sealed: TTS



Extended inner ring open type



Extended inner ring shielded type



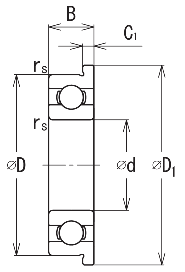
Abutment and fillet

Bore diameter d		Outer diameter D		Inner ring width: Open B, B_i		Inner ring width: Shielded, Sealed B_1, B_{1i}		Outer ring width: Open B, B_e		Outer ring width: Shielded, Sealed B_1, B_{1e}		Flange outer diameter D_1		Flange width: Open C_1		Flange width: Shielded, Sealed C_2		Chamfer $r_{s\,(min)}$	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
1.016	0.0400	3.175	0.1250	1.191	0.0469	—	—	1.191	0.0469	—	—	4.343	0.1710	0.330	0.0130	—	—	0.10	0.0039
1.191	0.0469	3.967	0.1562	1.588	0.0625	2.38	0.0937	1.588	0.0625	2.380	0.0937	5.156	0.203	0.330	0.0130	0.787	0.031	0.10	0.0039
		3.967	0.1562	—	—	3.175	0.1250	—	—	2.380	0.0937	5.156	0.2030	—	—	0.787	0.0310	0.10	0.0039
1.397	0.0550	4.762	0.1875	1.984	0.0781	2.779	0.1094	1.984	0.0781	2.779	0.1094	5.944	0.2340	0.584	0.0230	0.787	0.0310	0.10	0.0039
		4.762	0.1875	—	—	3.571	0.1406	—	—	2.779	0.1094	5.944	0.2340	—	—	0.787	0.0310	0.10	0.0039
1.984	0.0781	6.350	0.2500	2.380	0.0937	3.571	0.1406	2.380	0.0937	3.571	0.1406	7.518	0.2960	0.584	0.0230	0.787	0.0310	0.10	0.0039
		6.350	0.2500	3.175	0.1250	4.366	0.1719	2.380	0.0937	3.571	0.1406	7.518	0.2960	0.584	0.0230	0.787	0.0310	0.10	0.0039
2.380	0.0937	4.762	0.1875	1.588	0.0625	—	—	1.588	0.0625	—	—	5.944	0.2340	0.457	0.0180	—	—	0.10	0.0039
		4.762	0.1875	—	—	2.380	0.0937	—	—	2.380	0.0937	5.944	0.2340	—	—	0.787	0.0310	0.10	0.0039
		4.762	0.1875	2.380	0.0937	—	—	1.588	0.0625	—	—	5.944	0.2340	0.457	0.0180	—	—	0.10	0.0039
		4.762	0.1875	—	—	3.175	0.1250	—	—	2.380	0.0937	5.944	0.2340	—	—	0.787	0.0310	0.10	0.0039
		7.938	0.3125	2.779	0.1094	3.571	0.1406	2.779	0.1094	3.571	0.1406	9.119	0.3590	0.584	0.0230	0.787	0.0310	0.15	0.0059
3.175	0.1250	6.350	0.2500	2.380	0.0937	2.779	0.1094	2.380	0.0937	2.779	0.1094	7.518	0.2960	0.584	0.0230	0.787	0.0310	0.10	0.0039
		6.350	0.2500	3.175	0.1250	3.571	0.1406	2.380	0.0937	2.779	0.1094	7.518	0.2960	0.584	0.0230	0.787	0.0310	0.10	0.0039
		7.938	0.3125	2.779	0.1094	3.571	0.1406	2.779	0.1094	3.571	0.1406	9.119	0.3590	0.584	0.0230	0.787	0.0310	0.10	0.0039
		7.938	0.3125	—	—	4.366	0.1719	—	—	3.571	0.1406	9.119	0.3590	—	—	0.787	0.0310	0.10	0.0039
		9.525	0.3750	2.779	0.1094	3.571	0.1406	2.779	0.1094	3.571	0.1406	10.719	0.4220	0.584	0.0230	0.787	0.0310	0.15	0.0059
		9.525	0.3750	—	—	4.366	0.1719	—	—	3.571	0.1406	10.719	0.4220	—	—	0.787	0.0310	0.15	0.0059
		9.525	0.3750	3.967	0.1562	3.967	0.1562	3.967	0.1562	3.967	0.1562	11.176	0.4400	0.762	0.0300	0.762	0.0300	0.30	0.0118
		9.525	0.3750	—	—	3.967	0.1562	—	—	3.967	0.1562	11.176	0.4400	—	—	0.762	0.0300	0.30	0.0118
		9.525	0.3750	4.762	0.1875	4.762	0.1875	3.967	0.1562	3.967	0.1562	11.176	0.4400	0.762	0.0300	0.762	0.0300	0.30	0.0118
3.967	0.1562	7.938	0.3125	2.779	0.1094	3.175	0.1250	2.779	0.1094	3.175	0.1250	9.119	0.3590	0.584	0.0230	0.914	0.0360	0.10	0.0039
		7.938	0.3125	—	—	3.967	0.1562	—	—	3.175	0.1250	9.119	0.3590	—	—	0.914	0.0360	0.10	0.0039
4.762	0.1875	7.938	0.3125	2.779	0.1094	3.175	0.1250	2.779	0.1094	3.175	0.1250	9.119	0.3590	0.584	0.0230	0.914	0.0360	0.10	0.0039
		7.938	0.3125	—	—	3.967	0.1562	—	—	3.175	0.1250	9.119	0.3590	—	—	0.914	0.0360	0.10	0.0039
		9.525	0.3750	—	—	3.175	0.1250	—	—	3.175	0.1250	10.719	0.4220	—	—	0.787	0.0310	0.10	0.0039
		9.525	0.3750	—	—	3.967	0.1562	—	—	3.175	0.1250	10.719	0.4220	—	—	0.787	0.0310	0.10	0.0039
		12.700	0.5000	4.978	0.1960	4.978	0.1960	4.978	0.1960	4.978	0.1960	14.351	0.5650	1.067	0.0420	1.067	0.0420	0.30	0.0118
		12.700	0.5000	5.771	0.2272	5.771	0.2272	4.978	0.1960	4.978	0.1960	14.351	0.5650	1.067	0.0420	1.067	0.0420	0.30	0.0118
6.350	0.2500	9.525	0.3750	3.175	0.1250	3.175	0.1250	3.175	0.1250	3.175	0.1250	10.719	0.4220	0.584	0.0230	0.914	0.0360	0.10	0.0039
		9.525	0.3750	—	—	3.175	0.1250	—	—	3.175	0.1250	10.719	0.4220	—	—	0.914	0.0360	0.10	0.0039
		9.525	0.3750	—	—	3.967	0.1562	—	—	3.175	0.1250	10.719	0.4220	—	—	0.914	0.0360	0.10	0.0039
		12.700	0.5000	3.175	0.1250	4.762	0.1875	3.175	0.1250	4.762	0.1875	13.894	0.5470	0.584	0.0230	1.143	0.0450	0.15	0.0059
		12.700	0.5000	3.967	0.1562	5.558	0.2188	3.175	0.1250	4.762	0.1875	13.894	0.5470	0.584	0.0230	1.143	0.0450	0.15	0.0059
		15.875	0.6250	4.978	0.1960	4.978	0.1960	4.978	0.1960	4.978	0.1960	17.526	0.6900	1.067	0.0420	1.067	0.0420	0.30	0.0118
		15.875	0.6250	5.771	0.2272	5.771	0.2272	4.978	0.1960	4.978	0.1960	17.526	0.6900	1.067	0.0420	1.067	0.0420	0.30	0.0118
7.938	0.3125	12.700	0.5000	3.967	0.1562	3.967	0.1562	3.967	0.1562	3.967	0.1562	13.894	0.5470	0.787	0.0310	0.787	0.0310	0.15	0.0059
		12.700	0.5000	4.762	0.1875	4.762	0.1875	3.967	0.1562	3.967	0.1562	13.894	0.5470	0.787	0.0310	0.787	0.0310	0.15	0.0059
9.525	0.3750	22.225	0.8750	5.558	0.2188	7.142	0.2812	5.558	0.2188	7.142	0.2812	24.613	0.9690	1.575	0.0620	1.575	0.0620	0.40	0.0157
12.700	0.5000	28.575	1.1250	6.350	0.2500	7.938	0.3125	6.350	0.2500	7.938	0.3125	31.120	1.2252	1.575	0.0620	1.575	0.0620	0.40	0.0157

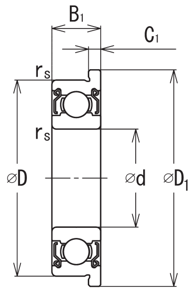
Bearing number: Open	Bearing number: 2 Shields[2]	2 Seals[2]: 2RS	2 Seals[2]: 2RU	2 Seals[2]: TTS	Load rating Cr	Load rating Cor	Limiting speed[3] Grease	Limiting speed[3] Oil	Cage type[4]	Ball Size	Ball Qty.	Abutment and fillet dimensions, Open: $d_{a\,(min)}$	Open: $d_{a\,(max)}$	Shielded, Sealed: $d_{b\,(min)}$	Shielded, Sealed: $d_{b\,(max)}$	$r_{as\,(max)}$	Mass (Ref.) Open	Mass (Ref.) 2 Shields
					N		min^{-1}			mm	pcs.	mm		mm		mm	g	
SFR09	—	—	—	—	90	22	115 000	136 000	W	0.635	6	1.50	1.50	—	—	0.10	0.05	—
SFR0	**SFR0ZZ**	—	—	—	96	27	105 000	124 000	W	0.600	7	2.00	2.10	2.00	2.10	0.10	0.11	0.18
—	**SFRW0ZZ**	—	—	—	96	27	105 000	124 000	W	0.600	7	—	—	2.00	2.10	0.10	—	0.19
SFR1	**SFR1ZZ**	—	—	—	197	53	97 000	115 000	W	1.000	6	2.00	2.20	2.00	2.20	0.10	0.19	0.26
—	**SFRW1ZZ**	—	—	—	197	53	97 000	115 000	W	1.000	6	—	—	2.00	2.20	0.10	—	0.27
SFR1-4	**SFR1-4ZZ**	—	—	—	241	76	77 000	91 000	W	1.000	7	2.80	3.80	2.80	3.80	0.10	0.40	0.57
SFRW1-4	**SFRW1-4ZZ**	—	—	—	241	76	77 000	91 000	W	1.000	7	2.80	3.80	2.80	3.80	0.10	0.45	0.62
SFR133	—	—	—	—	161	48	90 000	106 000	W	0.800	7	2.90	2.90	—	—	0.10	0.13	—
—	**SFR133ZZS**	—	—	—	122	42	92 000	109 000	W	0.600	10	—	—	2.90	2.90	0.10	—	0.21
SFRW133	—	—	—	—	161	48	90 000	106 000	W	0.800	7	2.90	2.90	—	—	0.10	0.14	—
—	**SFRW133ZZS**	—	—	—	122	42	92 000	109 000	W	0.600	10	—	—	2.90	2.90	0.10	—	0.23
SFR1-5	**SFR1-5ZZ**	—	—	—	469	140	72 000	85 000	W	1.588	6	3.60	4.00	3.60	4.00	0.15	0.67	0.84
SFR144	**SFR144ZZ**	—	—	**TTS**	241	76	77 000	91 000	W	1.000	7	3.80	3.80	3.80	3.80	0.10	0.31	0.35
SFRW144	**SFRW144ZZ**	—	—	—	241	76	77 000	91 000	W	1.000	7	3.80	3.80	3.80	3.80	0.10	0.33	0.38
SFR2-5	**SFR2-5ZZ**	—	—	—	475	143	70 000	82 000	J	1.588	6	4.00	4.30	4.00	4.30	0.10	0.59	0.74
—	**SFRW2-5ZZ**	—	—	—	475	143	70 000	82 000	J	1.588	6	—	—	4.00	4.30	0.10	—	0.78
SFR2-6	**SFR2-6ZZ**	—	—	—	545	181	63 000	75 000	J	1.588	7	4.40	5.10	4.00	4.50	0.15	1.02	1.24
—	**SFRW2-6ZZ**	—	—	—	545	181	63 000	75 000	J	1.588	7	—	—	4.00	4.50	0.15	—	1.30
SFR2[1]	**SFR2ZZ**	**2RS**	—	—	538	175	66 000	78 000	J	1.588	7	4.70	4.70	4.70	4.70	0.30	1.37	1.44
—	—	—	**2RU**	—	545	181	63 000	75 000	J	1.588	7	—	—	4.50	4.50	0.30	—	1.40
SFRW2[1]	**SFRW2ZZ**	—	—	—	538	175	66 000	78 000	J	1.588	7	4.70	4.70	4.70	4.70	0.30	1.43	1.51
SFR155	**SFR155ZZS**	—	—	—	306	119	64 000	76 000	W	1.000	10	4.80	5.40	4.80	5.40	0.10	0.58	0.69
—	**SFRW155ZZS**	—	—	—	306	119	64 000	76 000	W	1.000	10	—	—	4.80	5.40	0.10	—	0.75
SFR156	**SFR156ZZS**	—	—	**TTS**	306	119	64 000	76 000	W	1.000	10	5.40	5.40	5.40	5.40	0.10	0.46	0.55
—	**SFRW156ZZS**	—	—	—	306	119	64 000	76 000	W	1.000	10	—	—	5.40	5.40	0.10	—	0.59
—	**SFR166ZZ**	—	—	**TTS**	604	216	59 000	70 000	J	1.588	8	—	—	5.60	5.90	0.10	—	0.89
—	**SFRW166ZZ**	—	—	—	604	216	59 000	70 000	J	1.588	8	—	—	5.60	5.90	0.10	—	0.94
SFR3	**SFR3ZZ**	**2RS**	—	**TTS**	1 110	388	51 000	60 000	J	2.381	7	6.80	6.90	6.40	6.40	0.30	2.89	2.87
SFRW3[1]	**SFRW3ZZ**	**2RS**	—	—	1 110	388	51 000	60 000	J	2.381	7	6.40	6.40	6.40	6.40	0.30	3.02	2.97
SFR168	**SFR168ZZ**	—	—	—	317	138	55 000	65 000	W	1.000	11	7.00	7.00	7.00	7.00	0.10	0.63	0.66
—	—	—	—	**TTS**	317	138	55 000	65 000	W	1.000	11	—	—	7.00	7.00	0.10	—	0.66
—	**SFRW168ZZ**	—	—	—	317	138	55 000	65 000	W	1.000	11	—	—	7.00	7.00	0.10	—	0.71
SFR188	**SFR188ZZ**	—	—	**TTS**	920	350	48 000	56 000	J	2.000	8	7.60	7.90	7.20	7.30	0.15	1.57	2.21
SFRW188	**SFRW188ZZ**	—	—	**TTS**	920	350	48 000	56 000	J	2.000	8	7.60	7.90	7.20	7.30	0.15	1.68	2.29
SFR4[1]	**SFR4ZZ**	**2RS**	**2RU**	**TTS**	1 260	493	42 000	50 000	J	2.381	8	8.00	8.30	8.00	8.30	0.30	4.20	4.53
SFRW4[1]	**SFRW4ZZ**	**2RS**	—	—	1 260	493	42 000	50 000	J	2.381	8	8.00	8.30	8.00	8.30	0.30	4.35	4.68
SFR1810[1]	**SFR1810ZZS**	—	—	**TTS**	460	221	45 000	53 000	W	1.200	12	8.90	8.90	8.90	8.90	0.15	1.54	1.63
SFRW1810[1]	**SFRW1810ZZS**	—	—	**TTS**	460	221	45 000	53 000	W	1.200	12	8.90	8.90	8.90	8.90	0.15	1.62	1.70
SFR6	**SFR6ZZ**	**2RS**	**2RU**	**TTS**	2 830	1 130	31 000	37 000	J	3.969	7	12.10	12.70	11.60	11.80	0.40	9.73	11.7
SFR8	**SFR8ZZ**	**2RS**	**2RU**	**TTS**	4 350	1 910	25 000	30 000	J	4.762	8	15.50	16.50	15.00	15.50	0.40	18.5	21.6

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

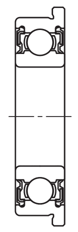
Flanged extra-thin-section bearings【SUJ2】

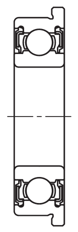


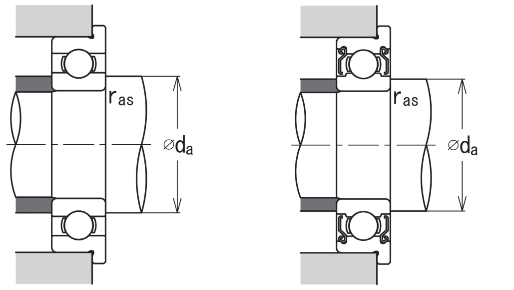
Open



Shielded: ZZ


Sealed: 2RS


Sealed: 2RU



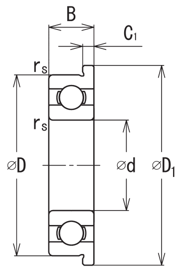
Abutment and fillet

Bore diameter d		Outer diameter D		Width Open B		Width Shielded, Sealed B_1		Flange outer diameter D_1		Flange width C_1		Chamfer $r_{s\,(min)}$		Bearing number Open	Bearing number 2 Shields(2)	2 Shields(2) 2RS	2 Shields(2) 2RU
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch				
10	0.3937	15	0.5906	3	0.1181	4	0.1575	16.5	0.6496	0.800	0.0315	0.15	0.0059	**F6700**	**F6700ZZ**	**2RS**	—
		19	0.7480	5	0.1969	5	0.1969	21	0.8268	1.000	0.0394	0.30	0.0118	**F6800**(1)	**F6800ZZ**	**2RS**	**2RU**
		19	0.7480	7	0.2756	7	0.2756	21	0.8268	1.500	0.0591	0.30	0.0118	**F63800**(1)	**F63800ZZ**	**2RS**	**2RU**
		22	0.8661	6	0.2362	6	0.2362	25	0.9843	1.500	0.0591	0.30	0.0118	**F6900**(1)	**F6900ZZ**	**2RS**	**2RU**
12	0.4724	18	0.7087	4	0.1575	4	0.1575	19.5	0.7677	0.800	0.0315	0.20	0.0079	**F6701**(1)	**F6701ZZ**	**2RS**	—
		21	0.8268	5	0.1969	5	0.1969	23	0.9055	1.100	0.0433	0.30	0.0118	**F6801**(1)	**F6801ZZ**	**2RS**	**2RU**
		21	0.8268	7	0.2756	7	0.2756	23	0.9055	1.500	0.0591	0.30	0.0118	**F63801**(1)	**F63801ZZ**	**2RS**	**2RU**
		24	0.9449	6	0.2362	6	0.2362	26.5	1.0433	1.500	0.0591	0.30	0.0118	**F6901**(1)	**F6901ZZ**	**2RS**	**2RU**
15	0.5906	21	0.8268	4	0.1575	4	0.1575	22.5	0.8858	0.800	0.0315	0.20	0.0079	**F6702**(1)	**F6702ZZ**	**2RS**	—
		24	0.9449	5	0.1969	5	0.1969	26	1.0236	1.100	0.0433	0.30	0.0118	**F6802**(1)	**F6802ZZ**	**2RS**	**2RU**
		24	0.9449	7	0.2756	7	0.2756	26	1.0236	1.500	0.0591	0.30	0.0118	**F63802**(1)	**F63802ZZ**	**2RS**	**2RU**
		28	1.1024	7	0.2756	7	0.2756	30.5	1.2008	1.500	0.0591	0.30	0.0118	**F6902**(1)	**F6902ZZ**	**2RS**	**2RU**
17	0.6693	23	0.9055	4	0.1575	4	0.1575	24.5	0.9646	0.800	0.0315	0.20	0.0079	**F6703**(1)	**F6703ZZ**	**2RS**	—
		26	1.0236	5	0.1969	5	0.1969	28	1.1024	1.100	0.0433	0.30	0.0118	**F6803**(1)	**F6803ZZ**	**2RS**	**2RU**
		26	1.0236	7	0.2756	7	0.2756	28	1.1024	1.500	0.0591	0.30	0.0118	**F63803**(1)	**F63803ZZ**	**2RS**	**2RU**
		30	1.1811	7	0.2756	7	0.2756	32.5	1.2795	1.500	0.0591	0.30	0.0118	**F6903**(1)	**F6903ZZ**	**2RS**	**2RU**
20	0.7874	27	1.0630	4	0.1575	4	0.1575	28.5	1.1220	0.800	0.0315	0.20	0.0079	**F6704**(1)	**F6704ZZ**	**2RS**	—
		32	1.2598	7	0.2756	7	0.2756	35	1.3780	1.500	0.0591	0.30	0.0118	**F6804**(1)	**F6804ZZ**	**2RS**	**2RU**
		37	1.4567	9	0.3543	9	0.3543	40	1.5748	2.000	0.0787	0.30	0.0118	**F6904**(1)	**F6904ZZ**	**2RS**	**2RU**
25	0.9843	32	1.2598	4	0.1575	4	0.1575	34	1.3386	1.000	0.0394	0.20	0.0079	**F6705**(1)	**F6705ZZ**	**2RS**	**2RU**
		37	1.4567	7	0.2756	7	0.2756	40	1.5748	1.500	0.0591	0.30	0.0118	**F6805**(1)	**F6805ZZ**	**2RS**	**2RU**
		42	1.6535	9	0.3543	9	0.3543	45	1.7717	2.000	0.0787	0.30	0.0118	**F6905**(1)	**F6905ZZ**	**2RS**	**2RU**
30	1.1811	37	1.4567	4	0.1575	4	0.1575	39	1.5354	1.000	0.0394	0.20	0.0079	**F6706**(1)	**F6706ZZ**	**2RU**	**2RU**
		42	1.6535	7	0.2756	7	0.2756	45	1.7717	1.500	0.0591	0.30	0.0118	**F6806**(1)	**F6806ZZ**	**2RS**	**2RU**
		47	1.8504	9	0.3543	9	0.3543	50	1.9685	2.000	0.0787	0.30	0.0118	**F6906**(1)	**F6906ZZ**	**2RS**	**2RU**

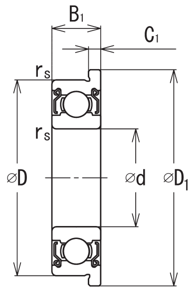
Load rating Cr	Load rating Cor	Limiting speed(3) Grease	Limiting speed(3) Oil	Cage type(4)	Ball Size	Ball Qty.	Abutment and fillet dimensions $d_{a\,(min)}$	$d_{a\,(max)}$	$r_{as\,(max)}$	Mass (Ref.) Open	Mass (Ref.) 2 Shields
N		min^{-1}			mm	pcs.	mm			g	
857	435	15 000	17 000	W	1.588	11	11.00	11.00	0.15	1.56	1.99
1 720	840	34 000	40 000	J	2.381	10	11.50	11.50	0.30	5.31	5.59
1 720	840	34 000	40 000	J	2.381	10	11.50	11.50	0.30	7.49	7.78
2 700	1 270	31 000	37 000	J	3.175	9	12.00	13.00	0.30	10.1	10.6
928	532	13 000	15 000	W	1.588	13	13.50	13.50	0.20	2.92	3.11
1 920	1 040	30 000	36 000	J	2.381	12	13.50	13.50	0.30	5.95	6.29
1 920	1 040	30 000	36 000	J	2.381	12	13.50	13.50	0.30	8.37	8.71
2 890	1 460	28 000	33 000	J	3.175	10	14.00	15.00	0.30	11.1	11.9
937	581	11 000	13 000	W	1.588	14	16.50	16.50	0.20	3.47	3.68
2 070	1 260	26 000	31 000	J	2.381	14	16.50	16.50	0.30	6.95	7.36
2 070	1 260	26 000	31 000	J	2.381	14	16.50	16.50	0.30	9.83	10.2
4 330	2 250	24 000	29 000	J	3.969	10	17.00	18.50	0.30	16.2	17.3
999	657	9 500	11 000	W	1.588	16	18.50	18.50	0.20	3.86	4.09
2 230	1 460	24 000	29 000	J	2.381	16	18.50	18.50	0.30	7.83	8.27
2 230	1 460	24 000	29 000	J	2.381	16	18.50	18.50	0.30	11.0	11.4
4 590	2 560	22 000	26 000	J	3.969	11	19.00	20.50	0.30	17.0	18.2
1 040	729	8 500	10 000	W	1.588	18	21.50	22.00	0.20	5.49	5.80
4 020	2 460	21 000	25 000	RJ	3.500	13	22.00	22.50	0.30	17.6	18.9
6 380	3 680	19 000	22 000	RJ	4.762	11	22.00	23.50	0.30	35.8	37.9
1 100	838	7 000	8 000	W	1.588	21	26.50	27.00	0.20	6.93	7.30
4 300	2 940	18 000	21 000	RJ	3.500	15	27.00	28.00	0.30	21.7	22.9
7 010	4 550	16 000	19 000	RJ	4.762	13	27.00	30.50	0.30	42.3	45.1
1 140	947	5 500	7 000	W	1.588	24	31.50	32.00	0.20	8.24	8.67
4 540	3 420	15 000	18 000	RJ	3.500	17	32.00	33.00	0.30	24.8	26.1
7 240	5 010	14 000	17 000	RJ	4.762	14	32.00	35.00	0.30	47.4	51.4

(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

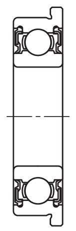
Flanged extra-thin-section bearings【Stainless-steel】

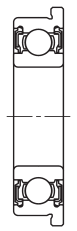


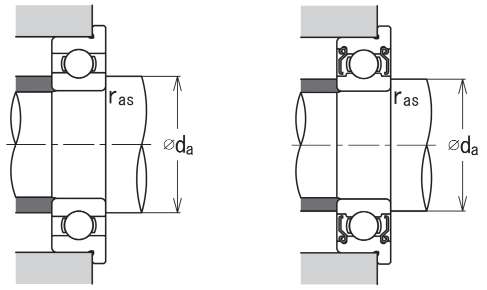
Open



Shielded: ZZ


Sealed: 2RS


Sealed: 2RU



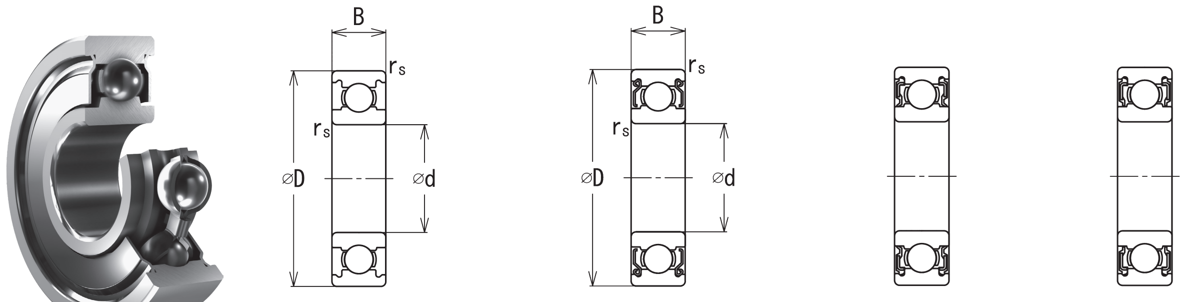
Abutment and fillet

Bore diameter d		Outer diameter D		Width Open B		Width Shielded, Sealed B_1		Flange outer diameter D_1		Flange width C_1		Chamfer $r_{s\,(min)}$		Bearing number Open	Bearing number 2 Shields(2)	2 Shields(2) 2RS	2 Shields(2) 2RU
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch				
10	0.3937	15	0.5906	3	0.1181	4	0.1575	16.5	0.6496	0.800	0.0315	0.15	0.0059	**F6700H**	**F6700HZZ**	**2RS**	—
		19	0.7480	5	0.1969	5	0.1969	21	0.8268	1.000	0.0394	0.30	0.0118	**F6800H**(1)	**F6800HZZ**	**2RS**	**2RU**
		19	0.7480	7	0.2756	7	0.2756	21	0.8268	1.500	0.0591	0.30	0.0118	**F63800H**(1)	**F63800HZZ**	**2RS**	**2RU**
		22	0.8661	6	0.2362	6	0.2362	25	0.9843	1.500	0.0591	0.30	0.0118	**F6900H**(1)	**F6900HZZ**	**2RS**	**2RU**
12	0.4724	18	0.7087	4	0.1575	4	0.1575	19.5	0.7677	0.800	0.0315	0.20	0.0079	**F6701H**(1)	**F6701HZZ**	**2RS**	—
		21	0.8268	5	0.1969	5	0.1969	23	0.9055	1.100	0.0433	0.30	0.0118	**F6801H**(1)	**F6801HZZ**	**2RS**	**2RU**
		24	0.9449	6	0.2362	6	0.2362	26.5	1.0433	1.500	0.0591	0.30	0.0118	**F6901H**(1)	**F6901HZZ**	**2RS**	**2RU**
15	0.5906	21	0.8268	4	0.1575	4	0.1575	22.5	0.8858	0.800	0.0315	0.20	0.0079	**F6702H**(1)	**F6702HZZ**	**2RS**	—
		24	0.9449	5	0.1969	5	0.1969	26	1.0236	1.100	0.0433	0.30	0.0118	**F6802H**(1)	**F6802HZZ**	**2RS**	**2RU**
		24	0.9449	7	0.2756	—	—	26	1.0236	1.500	0.0591	0.30	0.0118	**F63802H**(1)	—	—	—
		28	1.1024	7	0.2756	7	0.2756	30.5	1.2008	1.500	0.0591	0.30	0.0118	**F6902H**(1)	**F6902HZZ**	**2RS**	**2RU**

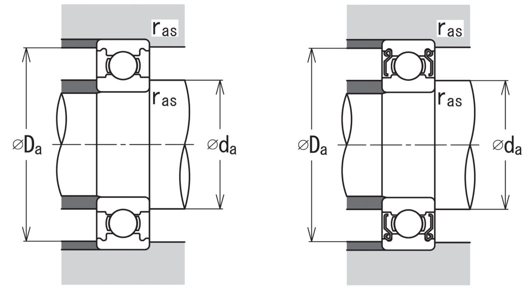
(1) Open bearings have shield/seal grooves.
(2) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(shielded/sealed at flanged side unless otherwise requested)
(3) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on “products” section of our website.
(4) Some items are also available with the TW cage. Please contact us for details.

Load rating Cr	Load rating Cor	Limiting speed(3) Grease	Limiting speed(3) Oil	Cage type(4)	Ball Size	Ball Qty.	Abutment and fillet dimensions $d_{a\,(min)}$	$d_{a\,(max)}$	$r_{as\,(max)}$	Mass (Ref.) Open	Mass (Ref.) 2 Shields
N		min-1			mm	pcs.	mm			g	
729	348	15 000	17 000	W	1.588	11	11.00	11.00	0.15	1.54	1.96
1 460	672	34 000	40 000	J	2.381	10	11.50	11.50	0.30	5.24	5.53
1 460	672	34 000	40 000	J	2.381	10	11.50	11.50	0.30	7.40	7.68
2 290	1 020	31 000	37 000	J	3.175	9	12.00	13.00	0.30	9.93	10.5
789	425	13 000	15 000	W	1.588	13	13.50	13.50	0.20	2.89	3.07
1 630	834	30 000	36 000	J	2.381	12	13.50	13.50	0.30	5.88	6.22
2 460	1 170	28 000	33 000	J	3.175	10	14.00	15.00	0.30	10.9	11.8
797	465	11 000	13 000	W	1.588	14	16.50	16.50	0.20	3.43	3.64
1 760	1 010	26 000	31 000	J	2.381	14	16.50	16.50	0.30	6.86	7.27
1 760	1 010	26 000	31 000	J	2.381	14	16.50	16.50	0.30	9.71	—
3 680	1 800	24 000	29 000	J	3.969	10	17.00	18.50	0.30	16.0	17.1

Large stainless-steel bearings



Open   Shielded: ZZ   Sealed: 2RS   Sealed: 2RU



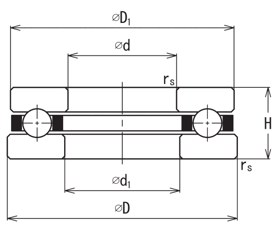
Abutment and fillet

Bore diameter d		Outer diameter D		Width B		Chamfer rs (min)		Bearing number				Load rating		Limiting speed(4)		Cage type(5)
								Open	2 Shields(3)	2 Seals(3)		Cr	Cor	Grease	Oil	
mm	inch	mm	inch	mm	inch	mm	inch			2RS	2RU	N		min⁻¹		
10	0.3937	26	1.0236	8	0.3150	0.30	0.0118	6000H(1),(2)	6000HZZ(2)	2RS	2RU	3 890	1 570	28 000	33 000	J
		30	1.1811	9	0.3543	0.60	0.0236	6200H(1),(2)	6200HZZ(2)	2RS	2RU	4 350	1 910	25 000	30 000	RJ
		35	1.3780	11	0.4331	0.60	0.0236	6300H(1)	6300HZZ	2RS	—	6 880	2 750	23 000	27 000	RJ
12	0.4724	28	1.1024	8	0.3150	0.30	0.0118	6001H(1),(2)	6001HZZ(2)	2RS	2RU	4 350	1 910	25 000	30 000	J
		32	1.2598	10	0.3937	0.60	0.0236	6201H(1),(2)	6201HZZ(2)	2RS	2RU	5 780	2 440	24 000	28 000	RJ
		37	1.4567	12	0.4724	1.00	0.0394	6301H(1)	6301HZZ	2RS	—	8 250	3 350	22 000	25 000	RJ
15	0.5906	32	1.2598	9	0.3543	0.30	0.0118	6002H(1),(2)	6002HZZ(2)	2RS	2RU	4 750	2 270	22 000	26 000	RJ
		35	1.3780	11	0.4331	0.60	0.0236	6202H(1)	6202HZZ	2RS	2RU	6 490	2 980	21 000	25 000	RJ
		42	1.6535	13	0.5118	1.00	0.0394	6302H(1)	6302HZZ	2RS	—	9 720	4 350	18 000	21 000	RJ
17	0.6693	35	1.3780	10	0.3937	0.30	0.0118	6003H(1),(2)	6003HZZ(2)	2RS	2RU	5 100	2 610	20 000	24 000	RJ
		40	1.5748	12	0.4724	0.60	0.0236	6203H(1)	6203HZZ	2RS	2RU	8 130	3 830	18 000	22 000	RJ
		47	1.8504	14	0.5512	1.00	0.0394	6303H(1)	6303HZZ	2RS	—	11 600	5 290	16 000	19 000	RJ
20	0.7874	42	1.6535	12	0.4724	0.60	0.0236	6004H(1)	6004HZZ	2RS	2RU	7 980	4 050	17 000	20 000	RJ
		47	1.8504	14	0.5512	1.00	0.0394	6204H(1)	6204HZZ	2RS	2RU	10 900	5 320	16 000	19 000	RJ
		52	2.0472	15	0.5906	1.10	0.0433	6304H(1)	6304HZZ	2RS	—	13 500	6 270	15 000	18 000	RJ
25	0.9843	47	1.8504	12	0.4724	0.60	0.0236	6005H(1)	6005HZZ	2RS	2RU	8 550	4 680	15 000	18 000	RJ
		52	2.0472	15	0.5906	1.00	0.0394	6205H(1)	6205HZZ	2RS	2RU	11 900	6 300	14 000	16 000	RJ
		62	2.4409	17	0.6693	1.10	0.0433	6305H(1)	6305HZZ	2RS	—	17 500	9 000	12 000	14 000	RJ
30	1.1811	55	2.1654	13	0.5118	1.00	0.0394	6006H(1)	6006HZZ	2RS	—	11 200	6 620	13 000	15 000	RJ
		62	2.4409	16	0.6299	1.00	0.0394	6206H(1)	6206HZZ	2RS	—	16 500	9 070	12 000	14 000	RJ
		72	2.8346	19	0.7480	1.10	0.0433	6306H(1)	6306HZZ	2RS	—	22 700	12 000	11 000	12 000	RJ
35	1.3780	62	2.4409	14	0.5512	1.00	0.0394	6007H(1)	6007HZZ	2RS	—	13 600	8 240	11 000	13 000	RJ
		72	2.8346	17	0.6693	1.10	0.0433	6207H(1)	6207HZZ	2RS	—	21 800	12 300	10 000	12 000	RJ
		80	3.1496	21	0.8268	1.50	0.0591	6307H(1)	6307HZZ	2RS	—	28 300	15 400	9 400	11 000	RJ
40	1.5748	68	2.6772	15	0.5906	1.00	0.0394	6008H(1)	6008HZZ	2RS	—	14 300	9 240	10 000	12 000	RJ
		80	3.1496	18	0.7087	1.10	0.0433	6208H(1)	6208HZZ	2RS	—	24 700	14 300	9 100	11 000	RJ
45	1.7717	75	2.9528	16	0.6299	1.00	0.0394	6009H(1)	6009HZZ	2RS	—	17 800	12 100	9 100	11 000	RJ
		85	3.3465	19	0.7480	1.10	0.0433	6209H(1)	6209HZZ	2RS	—	27 800	16 400	8 400	10 000	RJ
50	1.9685	80	3.1496	16	0.6299	1.00	0.0394	6010H(1)	6010HZZ	2RS	—	18 500	13 300	8 400	9 900	RJ
		90	3.5433	20	0.7874	1.10	0.0433	6210H(1)	6210HZZ	2RS	—	29 800	18 600	7 800	9 200	RJ
55	2.1654	90	3.5433	18	0.7087	1.10	0.0433	6011H(1)	6011HZZ	2RS	—	24 000	17 000	7 500	8 900	RJ
		100	3.9370	21	0.8268	1.50	0.0591	6211H(1)	6211HZZ	2RS	—	36 900	23 500	6 900	8 200	RJ
60	2.3622	95	3.7402	18	0.7087	1.10	0.0433	6012H(1)	6012HZZ	2RS	—	25 000	18 500	7 000	8 300	RJ
		110	4.3307	22	0.8661	1.50	0.0591	6212H(1)	6212HZZ	2RS	—	44 600	29 000	6 300	7 400	RJ

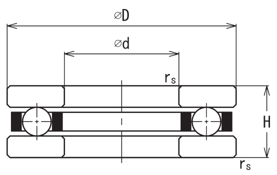
Ball		Abutment and fillet dimensions					Mass (Ref.)	
Size	Qty.	$d_{a\,(min)}$	$d_{a\,(max)}$	$D_{a\,(min)}$	$D_{a\,(max)}$	$r_{as\,(max)}$	Open	2 Shields
mm	pcs.	mm					g	
4.762	7	12.00	13.50	22.50	24.00	0.30	17.1	18.2
4.762	8	14.00	15.00	25.50	26.00	0.60	28.5	30.0
7.144	6	14.00	17.50	29.50	31.00	0.60	49.7	52.3
4.762	8	14.00	15.50	25.50	26.00	0.30	18.2	19.5
5.953	7	16.00	18.00	28.00	28.50	0.60	33.7	35.4
7.938	6	17.00	19.00	32.00	32.50	1.00	55.3	58.4
4.762	9	17.00	18.50	29.50	30.00	0.30	26.7	28.5
5.953	8	19.00	21.50	31.50	32.00	0.60	41.4	43.5
7.938	7	20.00	24.00	37.00	37.50	1.00	77.1	80.9
4.762	10	19.00	23.00	32.00	33.00	0.30	35.8	37.9
6.747	8	21.00	24.50	36.00	37.50	0.60	61.3	64.5
8.731	7	22.00	27.00	41.50	42.00	1.00	107	111
6.350	9	24.00	27.50	39.00	39.50	0.60	60.6	63.6
7.938	8	25.00	29.00	41.00	42.00	1.00	100	104
9.525	7	26.50	29.50	45.50	46.00	1.00	135	141
6.350	10	29.00	31.50	43.00	44.50	0.60	71.4	76.5
7.938	9	30.00	33.50	46.00	47.00	1.00	122	128
10.319	8	31.50	38.00	53.50	55.50	1.00	224	232
7.144	11	35.00	37.50	50.00	50.50	1.00	105	111
9.525	9	35.00	40.50	55.50	57.00	1.00	185	193
11.906	8	36.50	44.50	62.50	65.50	1.00	331	340
7.938	11	40.00	43.50	57.50	57.50	1.00	138	146
11.112	9	41.50	47.50	65.00	65.50	1.00	262	273
13.494	8	43.00	46.50	72.00	73.50	1.50	418	432
7.938	12	45.00	49.00	63.00	63.50	1.00	171	180
11.906	9	46.50	50.00	71.00	73.50	1.00	342	354
8.731	13	50.00	54.00	69.50	70.00	1.00	223	233
12.700	9	51.50	53.00	76.50	78.50	1.00	372	386
8.731	14	55.00	59.50	75.00	75.50	1.00	241	252
12.700	10	56.50	59.50	82.50	83.50	1.00	425	446
10.319	13	61.50	62.00	83.00	83.50	1.00	344	357
14.288	10	63.00	65.50	92.50	93.50	1.50	545	571
10.319	14	66.00	66.00	88.00	88.50	1.00	366	381
15.875	10	68.00	72.50	102.00	103.50	1.50	713	745

(1) Open bearings have shield/seal grooves.
(2) SUJ2 type (without "H") of the same sizes are also available. Load ratings of SUJ2 types can be obtained by Cr/0.85 and Cor/0.80 of stainless-steel types of the same sizes in the above table.
(3) Single-shielded/single-sealed bearings are also available; suffix Z, RS, RU or TS.
(4) Applicable only for open, single Z, ZZ, single RU and 2RU types in inner ring rotating conditions.
Limiting speeds for the contact rubber seal(s) types can be lower than the above-mentioned values, so please check the detailed values per item on "products" section of our website.
(5) Some items are also available with the TW cage. Please contact us for details.

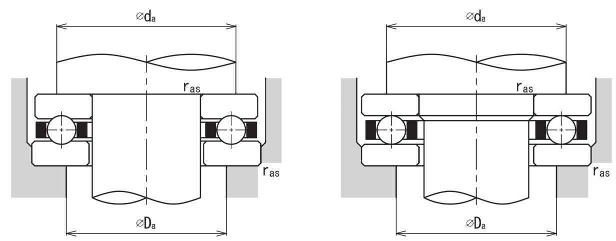
Thrust bearings



FM (with raceways)



F (without raceways)



Abutment and fillet

FM series (with raceways)

Bore diameter d		Outer diameter D		Outer ring inner diameter d_1		Inner ring outer diameter D_1		Chamfer $r_{s\,(min)}$		Height H		Bearing number	Load rating		Limiting speed	Cage type	Ball		Abutment and fillet dimensions			Mass (Ref.)
													C_a	C_{0a}	Oil		Size	Qty.	$d_{a\,min}$	$D_{a\,max}$	$r_{as\,max}$	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch		(N)		min^{-1}		mm	pcs.	mm			g
3	0.1181	8	0.3150	3.2	0.1260	7.8	0.3071	0.15	0.0059	3.5	0.1378	**F3-8M**	994	932	24 000	TP	1.588	6	6.00	5.00	0.15	0.84
4	0.1575	9	0.3543	4.2	0.1654	8.8	0.3465	0.15	0.0059	4.0	0.1575	**F4-9M**	945	932	22 000	TP	1.588	6	7.00	6.00	0.15	1.17
		10	0.3937	4.2	0.1654	9.8	0.3858	0.15	0.0059	4.0	0.1575	**F4-10M**	925	932	21 000	TP	1.588	6	7.60	6.40	0.15	1.49
5	0.1969	12	0.4724	5.2	0.2047	11.8	0.4646	0.20	0.0079	4.0	0.1575	**F5-12M**	1 060	1 240	19 000	TP	1.588	8	9.20	7.80	0.20	2.10
6	0.2362	12	0.4724	6.2	0.2441	11.8	0.4646	0.20	0.0079	4.5	0.1772	**F6-12M**	1 820	2 220	18 000	TP	2.000	9	9.60	8.40	0.20	2.20
		14	0.5512	6.25	0.2461	13.8	0.5433	0.20	0.0079	5.0	0.1969	**F6-14M**	2 160	2 440	16 000	TP	2.381	7	10.80	9.20	0.20	3.54
7	0.2756	13	0.5118	7.2	0.2835	12.8	0.5039	0.20	0.0079	4.5	0.1772	**F7-13M**	1 770	2 220	18 000	TP	2.000	9	10.60	9.40	0.20	2.42
		17	0.6693	7.2	0.2835	16.8	0.6614	0.30	0.0118	6.0	0.2362	**F7-17M**	3 090	3 800	14 000	TP	2.778	8	13.00	11.00	0.30	6.32
8	0.3150	16	0.6299	8.2	0.3228	15.8	0.6220	0.30	0.0118	5.0	0.1969	**F8-16M**	3 920	4 990	16 000	TP	3.000	9	12.80	11.20	0.30	3.94
		19	0.7480	8.2	0.3228	18.8	0.7402	0.30	0.0118	7.0	0.2756	**F8-19M**	3 940	4 970	12 000	TP	3.175	8	14.60	12.40	0.30	9.27
9	0.3543	20	0.7874	9.2	0.3622	19.8	0.7795	0.30	0.0118	7.0	0.2756	**F9-20M**	3 860	4 970	12 000	TP	3.175	8	15.60	13.40	0.30	9.86
10	0.3937	18	0.7087	10.2	0.4016	17.8	0.7008	0.30	0.0118	5.5	0.2165	**F10-18M**	2 470	3 490	14 000	TP	2.381	10	14.80	13.20	0.30	5.34

F series (without raceways)

Bore diameter d		Outer diameter D		Chamfer $r_{s\,(min)}$		Height H		Bearing number	Load rating		Cage type	Ball		Abutment and fillet dimensions			Mass (Ref.)
									C_a	C_{0a}		Size	Qty.	$d_{a\,min}$	$D_{a\,max}$	$r_{as\,max}$	
mm	inch	mm	inch	mm	inch	mm	inch		(N)			mm	pcs.	mm	mm	mm	g
2	0.0787	6	0.2362	0.10	0.0039	3.0	0.1181	**F2-6**	143	83	TD	6	1.000	4.40	3.60	0.10	0.50
3	0.1181	8	0.3150	0.10	0.0039	3.5	0.1378	**F3-8**	212	140	TD	7	1.200	6.00	5.00	0.10	1.03
4	0.1575	9	0.3543	0.15	0.0059	4.0	0.1575	**F4-9**	220	160	TD	8	1.200	7.00	6.00	0.15	1.39
		10	0.3937	0.15	0.0059	4.5	0.1772	**F4-10**	355	245	TD	7	1.588	7.60	6.40	0.15	1.94
5	0.1969	11	0.4331	0.15	0.0059	4.5	0.1772	**F5-11**	341	245	TD	7	1.588	8.60	7.40	0.15	2.22
6	0.2362	12	0.4724	0.15	0.0059	4.5	0.1772	**F6-12**	389	314	TD	9	1.588	9.60	8.40	0.15	2.49
7	0.2756	15	0.5906	0.20	0.0079	5.0	0.1969	**F7-15**	793	628	TD	8	2.381	11.80	10.20	0.20	4.24
8	0.3150	16	0.6299	0.20	0.0079	5.0	0.1969	**F8-16**	537	443	TD	8	2.000	12.70	11.10	0.20	4.88
9	0.3543	17	0.6693	0.20	0.0079	5.0	0.1969	**F9-17**	567	499	TD	9	2.000	13.70	12.10	0.20	5.25
10	0.3937	18	0.7087	0.20	0.0079	5.5	0.2165	**F10-18**	800	707	TD	9	2.381	14.70	13.10	0.20	6.11

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