MRC

MRC Engineering Handbook

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Introduction

Section 1-Introduction

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MRC® history

The historical perspective of MRC

MRC is the outgrowth of three of America's oldest bearing companies—Standard Roller Bearing Company, Gurney Ball Bearing Company, and Strom Bearing Company.

The Standard Roller Bearing Company was formed when a Philadelphia industrialist, S. S. Eveland, merged the Ball Bearing Company of Boston with seven other major ball bearing and ball-making equipment manufacturers. The company used the SRB Diamond trademark. SRB made many contributions to the advancement of anti-friction bearings; most notably, the development of 52100 steel, a high carbon, high chrome alloy steel that greatly improved bearing life.

In 1902, Frederick W. Gurney started the manufacture of ball bearing machinery in Jamestown, New York. He originated the Gurney "radial-thrust angular-contact" bearing (today's 7000 Series) in 1905, and the Gurney "radial-Type R" bearing (same designation today) in 1909. Gurney also developed duplex bearings—a matched pair of counterbored bearings—which were a major contribution to the accuracy of high speed machine tool spindles.

Stephen Snyder began manufacturing filling slot radial ball bearings in a small Chicago shop in 1908. His business was incorporated in 1909 as the U.S. Ball Bearing Manufacturing Company. Axel Strom became sole owner and changed the name to Strom Ball Bearing Manufacturing Company. The company established itself as a major supplier of precision ball bearings to the automotive and machinery industries. A major innovation by Strom was engineering service, provided to customers, "to aid in proper choice of ball bearings, their use, and guidance for mounting and maintenance."

Prior to World War I, Albert F. Rockwell, one of two brothers who founded New Departure Company, formed the Rockwell-Drake Corporation to manufacture ball bearings in Plainville, Connecticut. During the war, Rockwell combined Rockwell-Drake Corporation with several other corporations including the Standard Roller Bearing Company of Philadelphia.

After World War I, some of the manufacturing units were liquidated and the company was reorganized as Standard Steel and Bearing, Inc., Division of Marlin Rockwell Corporation. In 1923, the bearing manufacturing plants were consolidated at Plainville, Connecticut. The following year, Gurney Ball Bearing Company merged with Marlin Rockwell Corporation. MRC® purchased Strom Ball Bearing Manufacturing Corporation in 1925 and its assets were moved to Jamestown, New York, in 1931.

The manufacturing experience, technical background, and managerial skills of these antecedent companies provided Marlin Rockwell with a firm base out of which to develop and grow. In 1953, a new state-of-the-art plant was built at Falconer, New York, and an addition to the plant was completed in 1966. The plant was devoted to the manufacture of high-precision ball and roller bearings.

In 1964, Marlin Rockwell Corporation was merged with TRW, Incorporated, and renamed TRW Bearings Division in 1979. With the technological background and facilities of the parent company at its disposal, TRW Bearings Division entered a new period of growth. A ball manufacturing plant was acquired in 1964 at Winstead, Connecticut. In 1976, the Division built a new facility at Gainesville, Georgia, to specialize in high-volume bearing production.

In 1986, the Bearing Division was acquired by the SKF Group, which is an international manufacturing and marketing organization composing approximately 200 companies with 85 factories, together operating in more than 130 countries. SKF sales units are backed up by nearly 200 sales offices and over 10,000 distributors and retailers.

Catalog and speed rating disclaimer and warranty

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Listing in this catalog does not necessarily imply product availability. Cage type speed adjustment factor footnotes does not mean that particular cage variants are available.

The designs and load ratings shown in this catalog are those being used at the time of publication. The possibility exists that the designs and ratings may be changed to reflect product improvement or may be procured from a different company facility. To determine current conditions, contact MRC Engineering.

Interchange information

Interchanges provided in this catalog can provide a fast conversion of manufacturer numbers to MRC equivalents. Please note that interchanges are made on an application basis and may not be completely identical to MRC products. Basic interchanges indicate overall compatible design. The interchange information was compiled using data available at the time of publication; however, SKF USA Inc. and MRC assume no responsibility or liability for errors or omissions. Also, bearing illustrations depict closure grooves; however, actual bearings may or may not have closure grooves.

Warranty

MRC warrants that products sold by it shall be free from defects in material and workmanship. MRC's obligation under this warranty is expressly limited to furnishing without additional charge a replacement, or at its option, repairing or issuing credit for any product which shall within one year from the date of sale be returned freight prepaid to the plant designated by an MRC representative and which upon inspection is determined by MRC to be defective in materials or workmanship. Complete information as to service, mounting and relubrication should accompany any product returned for inspection. The provisions of this warranty shall not apply to any MRC product which has been subjected to misuse, improper mounting, assembly or lubrication; or which has been repaired or altered if such repair or alteration in the judgement of MRC would adversely affect performance of the product.

This warranty is in lieu of all other warranties, expressed or implied, including any limited warranty of merchantability or fitness for a particular purpose and is also in lieu of all other obligations or liabilities on the part of MRC, including any obligation or liability arising from contract, tort or otherwise for damages and in no event shall seller be liable hereunder or otherwise for loss of profits; special, incidental, or consequential damages of any kind. There are no warranties, expressed or implied, made by MRC, except the warranty against defects in material and workmanship set forth above. MRC and SKF USA Inc. neither assume nor authorize any other person or firm to assume for it any other obligation or liability in connection with its products.

Identification system for MRC bearings

Metric radial bearings

Bearing identification code

Example of marking on bearing box

R07

203SZZ-0001
Steel/C3/ABEC-1

0001 = MRC internal suffix code
R07 = Date code
H### = MRC external suffix code

Type prefix

F	One shield, non-standard location
G	Snap-ring, non-standard location
Z	One seal, non-standard location

Bore diameter

04 and up, multiply last two numbers by 5 to obtain bore diameter in mm

Code	Diameter
00	10
01	12
02	15
03	17
04	20

Accessories

F	One shield
FF	Two shields
FP	One rubber coated shield
FFP	Two rubber coated shields
G	Snap-ring
RSI	Seal for self-aligning bearing
Z	One seal
ZZ	Two seals

[ ] 2 03 S ZZ [ ]

Series

1800	Thin section	1200	Self-aligning
1900	Extremely light	1300	Self-aligning
100K	Extra light	1400	Self-aligning
200	Light	2200	Self-aligning
300	Medium	2300	Self-aligning
400	Heavy	11000	Self-aligning, extended inner

Type suffix

M	Maximum capacity, filling notch
S	Conrad deep groove
SWI	Conrad deep groove, wide inner ring
WI	Maximum capacity, wide inner ring

Additional features

C	Cartridge width bearing
K	Tapered bore self-aligning bearing
X	Tapered bore
HYB#1	Ceramic rolling elements ABEC-1 tolerances

Metric angular contact bearings

Bearing identification code

Example of marking on bearing box

R07

7308 PJDU - H501
Pressed brass/ABEC-3

H501 = MRC internal suffix code
R07 = Date code

Type

BB	Pumpac Diamond
C	Double-row, Conrad
M	Double-row, maximum capacity
P	40° contact angle, counterbored outer
PJ	40° contact angle, counterbored inner and outer
R	15° contact angle, counterbored outer
SB	Double-row, Conrad
SBK	Double-row, Conrad with closures
U	29° contact angle, split ring
UP	40° contact angle, split ring
U2	Matched set of 7000DT /9000UDT 29° contact angle
UP2	Matched set of 7000PDT /9000UPDT, 40° contact angle

Series

1900	Extremely light	7200	Angular contact, light
100K	Extra light	7300	Angular contact, medium
200	Light	7400	Angular contact, heavy
300	Medium	8000	Pumpac®
400	Heavy	9200	Angular contact, split ring, light
5200	Double-row, light	9300	Angular contact, split ring, medium
5300	Double-row, medium	97200	7200/9200 matched set, light
5400	Double-row, heavy	97300	7300/9300 matched set, medium
7100K	Angular contact, extra light		

Accessories

F	One shield
FF	Two shields
Z	One seal
ZZ	Two seals

73 08 PJ DU [ ]

Bore diameter

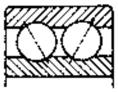
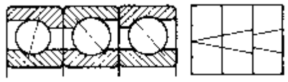
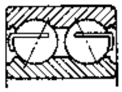
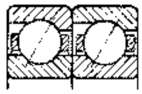
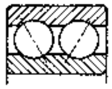
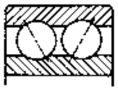
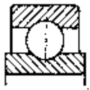
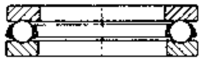
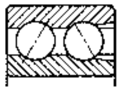
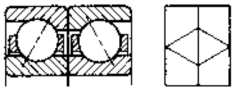
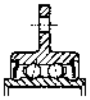
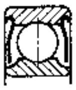
04 and up, multiply last two numbers by 5 to obtain bore diameter in mm

Code	Diameter
00	10
01	12
02	15
03	17
04	20

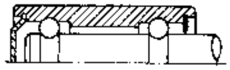
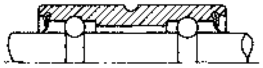
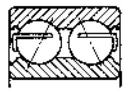
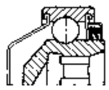
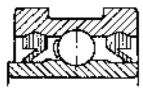
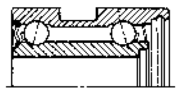
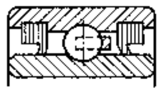
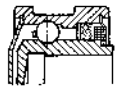
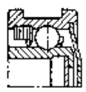
Duplex execution

DB	Pair, back-to-back mounting
DE	Half pair with endplay
DF	Pair, face-to-face mounting
DS	Half pair with preload
DT	Pair, tandem mounting
DU	Half pair, flush ground

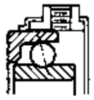
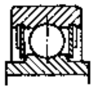
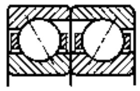
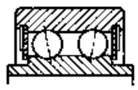
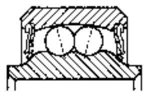
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	A	Double-row, angular contact, non-filling notch ball bearing with cast bronze finger type cage, inwardly convergent contact angles, non-rigid design.	5210A	
	AAB	A triplex set of PumPac bearings. Two 40° contact angle bearings in tandem mounting matched back-to-back with one 15° contact angle bearing. "V" etched on O.D.	8309AAB	
	AC	Double-row angular contact, non-filling notch ball bearing, with outwardly convergent contact angles, rigid design and heavy duty cage.	5308AC	
	ADT	Two PumPac "A" bearings in tandem.		
	AH	Double-row angular contact, non-filling notch ball bearing, with cast iron bronze finger type cage, narrow width, inwardly convergent contact angles, non-rigid design.	5210AH	
AN		Lock nut.	AN15	
	AS	Double-row, angular contact, non-filling notch ball bearing, with cast bronze finger type cage, and inwardly convergent contact angles, non-rigid design.	5210AS	
B		Torque tube type airframe bearing.	B540	
	B	Thrust ball bearing with grooved races.	4B	
	B	Outwardly convergent contact angle when used with 5000 series filling notch bearings. Rigid design.	5309B	
	B	Single-row, metric, high speed rotor ball bearing.	34B	
	BB	PumPac Diamond. Matched set of 15° contact angle bearings in back-to-back mounting. "V" etched on O.D. to form a diamond.	8309BB	
BC	W	Bell crank type airframe bearing.	BC4W10	
BIC		ABMA designation, non-filling notch, inch size, various configurations.	18BIC4800	

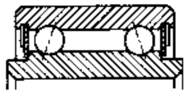
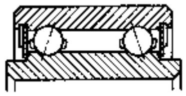
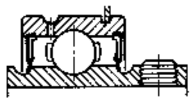
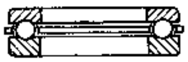
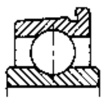
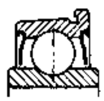
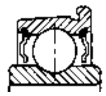
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
BTK		Double-row, integral shaft ball bearing, with seal and shield.	BTK4800	
BWF		Double-row, integral shaft ball bearing, with two seals.	BWF4800	
	C	Single-row deep groove type ball bearing, similar to S type.	208C	
	C	Thrust ball bearing, single acting, with flat races.	6C	
	C	Double-row angular contact, non-filling notch ball bearing, with outwardly convergent contact angles, rigid design.	5310C	
CB		Conveyor type ball bearing.	CB5043	
	CF	Single-row deep groove type ball bearing, with one shield, similar to SF type.	208CF	
	CFF	Single-row deep groove type ball bearing, with two shields, similar to SFF type.	208CFF	
CONV	A	Conveyor bearing, two seals, slotted for bracket mounting.	CONV4A	
CONV	E	Double-row conveyor bearing, seal and shield, slotted for bracket mounting, rigid design.	CONV4E2	
CONV	J	Conveyor bearing, two seals, direct roller mounting.	CONV4J	
CONV	SF	Conveyor bearing, seal and shield, slotted for bracket mounting.	CONV4SF	
CONV	SZ	Conveyor bearing, one seal, direct roller mounting.	CONV4SZ	
CONV	Y	Conveyor bearing, seal and shield, slotted for bracket mounting.	CONV3Y2	

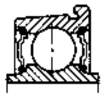
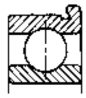
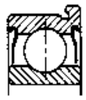
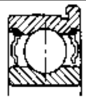
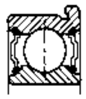
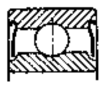
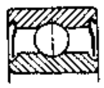
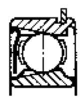
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	CT	Clutch release bearing, plain.	211CT	
	CTC	Clutch release bearing, with housing.	210CTC	
	CTQ	Clutch release bearing, with housing.	211CTQ	
	CTR	Clutch release bearing, with housing and grease fitting.	209CTR	
	CZ	Single-row deep groove type ball bearing with one seal, similar to SZ type.	208CZ	
	CZZ	Single-row deep groove type ball bearing with two seals, similar to SZZ type.	208CZZ	
	D	A duplex ground half pair matched with a similar half pair in a DE, DS, DT or DU arrangement.	7207D	
	DB	Matched set of duplex bearings, back-to-back mounting.	7207DB	
	DD	Two glass fabric reinforced PTFE (Teflon®) seals.	B540DD	
	DE	Matched set of duplex bearings, universal mounting, with endplay requirement.	7207DE	
	DF	Matched set of duplex bearings, face-to-face mounting.	7207DF	
DPP		Double-row airframe bearing with two glass reinforced PTFE (Teflon) seals, non- rigid design.	DPP4	
	DS	Matched set of duplex bearings, universal mounting, with preload requirement.	7207 DS DL	
DSP		Double-row, internally self-aligning, airframe bearing, with two glass reinforced PTFE (Teflon) seals.	DSP4	

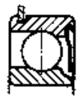
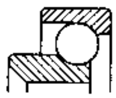
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	DT	Matched set of duplex bearings, tandem mounting.	7207 DT	
	DU	Half pair duplex bearings, universal mounting with no preload or endplay.	7207 DU	
DW		Double-row airframe bearing with two glass reinforced PTFE (Teflon) seals, rigid design.	DW4	
DW	K	Double-row airframe bearing with cage and two glass reinforced PTFE (Teflon) seals, rigid design.	DW4K	
E		Single-row magneto type ball bearing with separable outer ring.	E16	
	E	Self-aligning ball bearing with higher load rating than original design.	2205E	
ER		Power transmission type bearing, extended inner ring with set screws, with snap-ring and relube holes in outer ring.	ER16	
E	R	Single-row, counterbored outer ring, radial type ball bearing.	E16R1	
	ES	Single-row elevator type bearing with groove in outer ring and two shields.	203ES	
	F	Thrust bearing, single acting.	1115F	
	F	One shield.	207SF	
FB		Single-row flanged ball bearing with tapered O.D.	FB3	
FB	FFM	Single-row flanged ball bearing with tapered O.D. and two removable shields.	FB3FFM	
FB	FFP	Single-row flanged ball bearing with tapered O.D. and two rubber beaded shields.	FB3FFP	

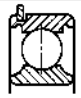
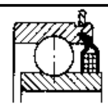
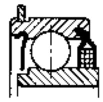
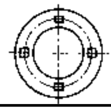
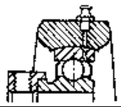
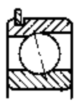
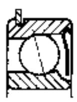
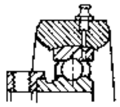
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
FB	ZZ	Single-row flanged ball bearing with tapered O.D. and two seals.	FB3ZZ	
FC		Single-row flanged ball bearing with cylindrical O.D.	FC3	
FC	FFM	Single-row flanged ball bearing with cylindrical O.D. and two removable shields.	FC3FFM	
FC	FFP	Single-row flanged ball bearing with cylindrical O.D. and two rubber beaded shields.	FC3FFP	
FC	ZZ	Single-row flanged ball bearing with cylindrical O.D. and two seals.	FC3ZZ	
	FF	Two shields.	207SFF	
	FFC	Single-row, inch size, cartridge width bearing with two shields.	R4FFC	
	FFM	Two removable shields.	R4FFM	
	FFMC	Single-row, inch size, cartridge width bearing with two removable shields.	R4FFMC	
	FFP	Two rubber coated shields.	R4FFP	
	FFS	Two felt seals, replaced by 88XXX.	203FFS	
	FFSG	Two felt seals and snap-ring, replaced by 488XXX.	203FFSG	
FG	M	Single-row maximum capacity ball bearing with shield on same side as filling notch and snap-ring on opposite side.	FG309M	
FG	R	Single-row counterbored outer ring ball bearing with shield and snap-ring on side opposite counterbore.	FG209R	

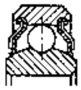
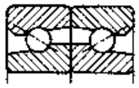
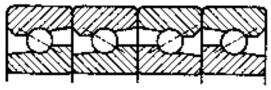
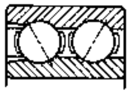
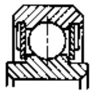
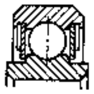
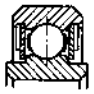
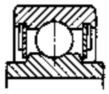
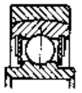
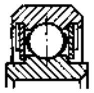
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	FM	One removable shield.	R4FM	
F	M	Single-row maximum capacity ball bearing with shield on same side as filling notch.	F309M	
F	MG	Single-row maximum capacity ball bearing with shield and snap-ring on same side as filling notch.	F309MG	
	FP	One rubber coated shield.	R4FP	
F	R	Single-row counterbored outer ring ball bearing with shield on side opposite counterbore.	F209R	
F	RG	Single-row counterbored outer ring ball bearing with snap-ring on counterbore side and shield on opposite side.	F209RG	
	FS	One felt seal, replaced by 8XXX.	203FS	
	FSF	One felt seal and one shield, replaced by 87XXX.	203FSF	
	FSFG	One felt seal and one shield with snap-ring on seal side.	203FSFG	
	FSG	One felt seal with snap-ring on open side of bearing.	209FSG	
	FW	Front wheel bearing.	41FW	
	FZ	One seal and one shield.	207SFZ	
FZG	M	Single-row maximum capacity ball bearing with seal on filling notch side and shield and snap-ring on opposite side.	FZG209M	
FZ	M	Single-row maximum capacity ball bearing with seal on filling notch side and shield on opposite side.	FZ209M	

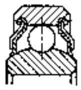
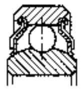
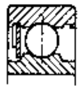
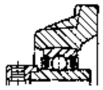
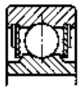
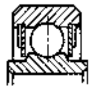
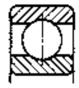
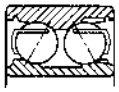
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
FZ	MG	Single-row maximum capacity ball bearing with seal and snap-ring on filling notch side and shield on opposite side.	FZ209MG	
	G	Snap-ring.	208SG	
G	FS	One felt seal with snap-ring on same side as seal.	G209FS	
G	FSF	One felt seal and one shield with snap-ring on shield side, replaced by 487XXX.	G209FSF	
G	MF	Single-row maximum capacity ball bearing with shield and snap-ring on side opposite filling notch.	G207MF	
G	MFZ	Single-row maximum capacity ball bearing with shield on filling notch side and seal and snap-ring on opposite side.	G207MFZ	
G	MS	Pressed flange housing, regreaseable, eccentric locking collar.	G62MS3	
GR		Pillow block, regreaseable, with two Flexigard seals, eccentric locking collar.	GR2	
G	R	Single-row counterbored outer ring ball bearing with snap-ring on side opposite counterbore. 15° contract angle.	G209R	
G	RF	Single-row counterbored outer ring ball bearing with shield on counterbore side and snap-ring on opposite side. 15° contact angle.	G209RF	
G	SF	Single-row deep groove ball bearing with shield and snap-ring on same side.	G208SF	
GT		Pillow block, regreaseable, with two seals, eccentric locking collar.	GT1½	
H		Adapter sleeve, nut and lock washer assembly used with self-aligning ball bearing with tapered bore.	H322	
	H	9000 series angular contact ball bearing with split outer ring.	9310H	

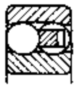
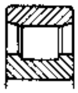
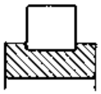
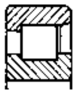
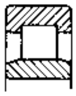
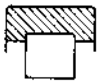
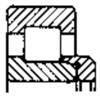
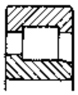
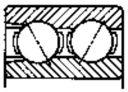
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
HH		Combined glass reinforced PTFE (Teflon) seal and stainless steel shield.	HH-KSP8	
J	DF	Ball screw support, duplex pair, face-to-face mounting.	J150DF	
J	DFDT	Ball screw support, quadruplex set, tandem pair matched face-to-face with a tandem pair.	J150DFDT	
	JR	Single-row, counterbored outer ring, radial type bearing, reduced O.D. and narrow width. 15° contact angle.	114JR	
	K	Double-row angular contact, filling notch type bearing, standard width and inwardly converging contact angles, non-rigid design.	5210K	
	K	Self-aligning ball bearing with 1:12 tapered bore.	1215K	
K	L	Single-row airframe type bearing with two stainless steel shields.	K3L	
KP		Single-row airframe type bearing with two glass reinforced PTFE (Teflon) seals.	KP3	
KP	A	Single-row airframe type bearing with two glass reinforced PTFE (Teflon) seals, similar to KP type except reduced O.D. and width.	KP3A	
KP	AK	Single-row airframe type bearing with two glass reinforced PTFE (Teflon) seals, and cage, same as KP-A except includes cage.	KP3AK	
KP	B	Single-row airframe type bearing with two glass reinforced PTFE (Teflon) seals.	KP16B	
KP	BS	Single-row airframe type bearing with two glass reinforced PTFE (Teflon) seals, and self-aligning ring in O.D.	KP16BS	
KP	K	Single-row airframe type bearing with two glass reinforced PTFE (Teflon) seals, and cage.	KP4K	
	KR	Single-row, counterbored outer ring, radial type, ball bearing. 15° contact angle.	104KR	

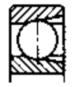
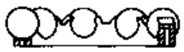
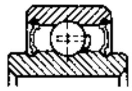
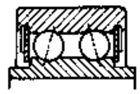
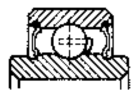
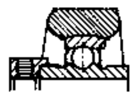
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	KS	Single-row deep groove type ball bearing.	104KS	
	KSB	Single-row, extra precision, separable inner ring, radial type bearing.	106KSB	
	KSJ	Single-row, extra precision, low shoulder one side of inner, non-separable, radial type bearing.	106KSJ	
KSP		Single-row, airframe type bearing, internally self-aligning, with two glass reinforced PTFE (Teflon) seals.	KSP4	
KSP	A	Single-row, airframe type bearing, internally self-aligning, with two glass reinforced PTFE (Teflon) seals. Similar to KSP except reduced O.D. and width.	KSP4A	
KSP	L	Single-row airframe type bearing, internally self-aligning, with two glass reinforced PTFE (Teflon) seals. Similar to KSP except reduced O.D. and width.	KSP3L	
L	KS	One glass reinforced PTFE (Teflon) seal.	L105KS	
LB		Flange unit, non-regreaseable, with two labyrinth seals, and eccentric locking collar.	LB1	
LL	KS	Two glass reinforced PTFE (Teflon) seals.	LL105KS	
LZ		Flange unit, non-regreaseable, with two seals and eccentric locking collars.	LZ2	
M		Airframe bearing with special close tolerances.	MKP16B	
M		Single-row, miniature, inch size bearing, ABEC-5 precision.	M0620	
	M	Single-row, maximum capacity, filling notch type ball bearing.	208M	
	M	Double-row angular contact, filling notch ball bearing with outwardly convergent contact angles.	5210M	

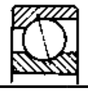
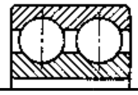
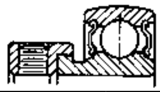
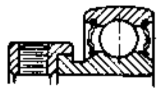
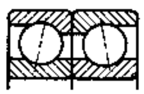
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	M	Machined bronze cage for self-aligning ball bearings.	2314M	
	MC2	Machined bronze cage and ABMA C2 internal clearance for self-aligning ball bearing.	2315MC2	
	MFZG	Single-row maximum capacity, filling notch ball bearing with shield and snap-ring on filling notch side and seal on opposite side.	209MFZG	
MR	C	Cylindrical roller bearing, with two flanges on inner ring, none on outer ring.	MR208C	
MR	CQ	Cylindrical roller bearing, outer ring only, no flanges.	MR208CQ	
MR	CY	Cylindrical roller bearing, inner ring, roller and cage assembly only, two flanges on inner ring.	MR208CY	
MR	D	Cylindrical roller bearing, with two flanges on inner ring, one on outer ring.	MR208D	
MR	E	Cylindrical roller bearing, two flanges on outer ring, none on inner ring.	MR208E	
MR	EJ	Cylindrical roller bearing, inner ring only, no flanges.	MR208EJ	
MR	EX	Cylindrical roller bearing, outer ring, roller and cage assembly only, two flanges on outer ring.	MR208EX	
MR	F	Cylindrical roller bearing, two flanges on outer ring, one flange on inner ring, with side plate.	MR208F	
MR	G	Cylindrical roller bearing, two flanges on outer ring, one flange on inner ring.	MR208G	
	MW	Double-row angular contact, filling notch ball bearing with inwardly convergent contact angles.	5210MW	
N		Lock nut.	N06	

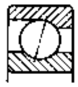
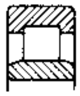
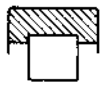
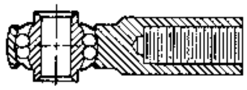
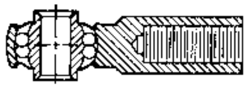
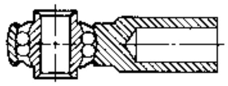
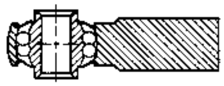
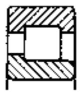
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	N	Single-row, maximum capacity, filling notch type ball bearing, narrow width.	112N	
	NYL	Fiberglass reinforced 6/6 polyamide cage.	206S-NYL	
0	B	Single-row, metric, high speed rotor bearing, less inner ring.	034B	
OR	B	Single-row, inch size, high speed rotor bearing, less inner ring.	OR4B	
P		Single-row airframe type bearing, two seals, aircraft pulley type.	P8	
	P	Single-row angular contact, counterbored outer ring, heavy duty bearing, with 40° contact angle.	7308P	
PB		Pillow block, non-regreaseable, with two labyrinth seals and eccentric locking collar.	PB1 7/16	
	PD	A duplex ground half pair, 40° angular contact bearing, counterbored outer ring, matched with a similar half pair in a DE, DS, DT, or DU arrangement.	7308PD	
PD	K	Double-row airframe type bearing, two seals, aircraft pulley type, rigid design.	PD5K	
	PJ	Single-row angular contact, counterbored inner and outer ring, heavy duty bearing, with a 40° contact angle.	7308PJ	
	PJD	A duplex ground half pair, 40° angular contact bearing, counterbored inner and outer rings, matched with a similar half pair in a DE, DS, DT, or DU arrangement.	7308PJD	
P	K	Single-row airframe type bearing, with two seals, aircraft pulley type.	P5K	
PZ		Pillow block, non-regreaseable, with two seals and eccentric locking collar.	PZ2 7/16	
R		Single-row, small inch size bearing.	R6	

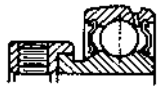
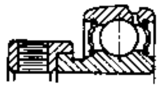
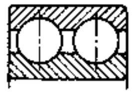
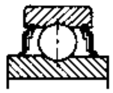
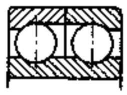
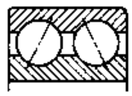
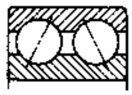
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	R	Single-row, counterbored outer ring, radial type bearing, 15° contact angle.	207R	
	R	Double-row, radial type, non-filling notch ball bearing with cast bronze finger type cage. 0° contact angles.	5306R	
R	A	Single-row, small inch size bearing, with increased O.D. and width.	R4A	
RA	ATT	Power transmission type, inner extended one side only, cylindrical O.D., two Flexigard seals, non-regreaseable, eccentric locking collar.	RA008ATT	
RA	AZZ	Power transmission type, inner extended one side only, cylindrical O.D., two seals, non-regreaseable, eccentric locking collar.	RA008AZZ	
RA	BTT	Power transmission type, inner ring extended one side only, spherical O.D., two Flexigard seals, non-regreaseable, eccentric locking collar.	RA008BTT	
RA	BZZ	Power transmission type, inner ring extended one side only, spherical O.D., two seals, non-regreaseable, eccentric locking collar.	RA008BZZ	
RAP	M	Airframe bearing, rod end type, with male threaded shank.	RAP3M	
R	B	Single-row, small inch size, high speed rotor bearing, with separable inner ring.	R3B	
R	C	Cylindrical roller bearing, with two flanges on inner ring, none on outer ring.	R208C	
R	CQ	Cylindrical roller bearing, outer ring only, no flanges.	R208CQ	
R	CY	Cylindrical roller bearing, inner ring, roller and cage assembly only, two flanges on inner ring.	R208CY	
R	D	Cylindrical roller bearing, with two flanges on inner ring, one on outer ring.	R208D	
	RD	Single-row, counterbored outer ring, radial type bearing, with controlled relationship of ring faces, used in duplex sets.	306RD	

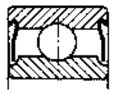
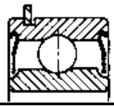
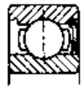
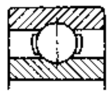
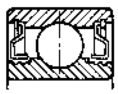
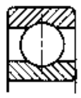
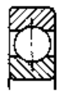
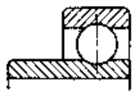
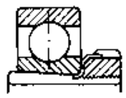
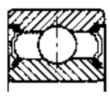
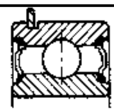
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	RDM	Dynamometer bearing, ABEC-5 inner ring, ABEC-1 outer ring, phenolic cage, 15° contact angle.	316RDM	
	RDT	Single-row, split inner ring bearing, 20° contact angle.	309RDT1½	
R	E	Cylindrical roller bearing, two flanges on outer ring, none on inner ring.	R208E	
R	EJ	Cylindrical roller bearing, inner ring only, no flanges.	R208EJ	
R	EX	Cylindrical roller bearing, outer ring, roller and cage assembly only, two flanges on outer ring.	R208EX	
REPB	N	Airframe bearing, rod end type, with female threaded shank.	REPB3N	
REP	F	Airframe bearing, rod end type, with female threaded shank.	REP4F7	
REP	H	Airframe bearing, rod end type, with hollow shank.	REP3H5	
REP	M	Airframe bearing, rod end type, with male threaded shank.	REP4M6	
REP	S	Airframe bearing, rod end type, with solid shank.	REP4S10	
R	F	Cylindrical roller bearing, two flanges on outer ring, one flange on inner ring, with side plate.	R208F	
	RF	Single-row, counterbored outer ring, radial type bearing, with shield on counterbored side, 15° contact angle.	208RF	
	RFG	Single-row, counterbored outer ring, radial type bearing, with shield and snap-ring on counterbored side, 15° contact angle.	208RFG	
R	G	Cylindrical roller bearing, two flanges on outer ring, one flange on inner ring.	R208G	

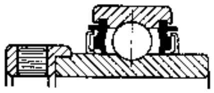
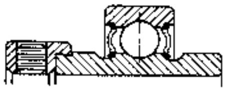
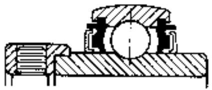
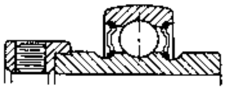
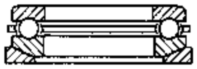
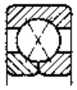
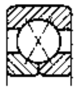
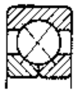
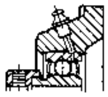
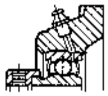
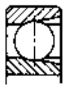
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	RG	Single-row, counterbored outer ring, radial type bearing, with snap-ring on counterbored side, 15° contact angle.	208RG	
	RJ	Single-row, counterbored inner and outer rings, extra precision, radial type bearing, 15° contact angle.	106RJ	
RRA	BTT	Power transmission bearing, inner ring extended one side only, spherical O.D., two Flexigard seals, regreaseable, eccentric locking collar.	RRA008BTT	
RRA	BZZ	Power transmission bearing, inner ring extended one side only, spherical O.D., two seals, regreaseable, eccentric locking collar.	RRA008BZZ	
	RS	Double-row, radial type, non-filling notch ball bearing, with cast bronze finger type cage.	5312RS	
	2RS1	Self-aligning ball bearing with two synthetic rubber seals.	22102RS1	
RT	BZZ	Power transmission bearing, inner ring extended both sides, two seals, regreaseable, eccentric locking collar.	RT107BZZ	
RW		Single-row deep groove, rear wheel type bearing with two seals.	RW716	
	RZ	Single-row, counterbored outer ring, radial type bearing, with seal on counterbored side, 15° contact angle.	306RZ	
	R2	Double-row, split outer ring, radial type bearing.	5206R2	
	S	Single-row deep groove ball bearing.	207S	
	S	9000 series angular contact angle bearing with one-piece inner and outer rings, 20° contact angle.	9212S1	
	SB	Double-row, angular contact, non-filling notch bearing, with outwardly convergent contact angles, rigid design.	5203SB	
	SBK	Double-row, angular contact, non-filling notch, standard width bearing, with outwardly convergent contact angles, rigid design.	5203SBK	

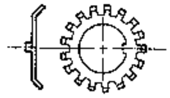
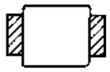
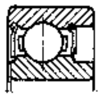
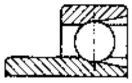
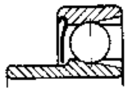
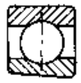
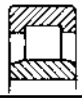
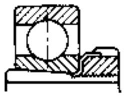
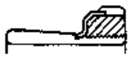
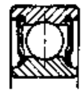
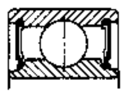
Bearing symbols

Prefix	Suffix	Description	Example	Illustration
	SFFC	Single-row deep groove, cartridge width bearing, with two shields.	210SFFC	
	SFFCG	Single-row deep groove, cartridge width bearing, with two shields and snap-ring.	210SFFCG	
	SFFP	Single-row deep groove ball bearing with two rubber beaded shields.	1910SFFP	
	SFP	Single-row deep groove ball bearing with rubber beaded shield.	1806SFP	
	SH	Single-row deep groove bearing, wider than standard.	105SH	
	SLLC	Single-row deep groove, cartridge width bearing, with two removable shields.	210SLLC	
	SRRC	Single-row deep groove, cartridge width bearing, with two labyrinth seals.	210SRRC	
S	S	Single-row, small inch size bearing.	S3S	
	ST	Stainless steel (440C) rings and rolling elements.	207SST	
	SV	Single-row deep groove bearing, narrower than standard.	209SV	
	SWI	Single-row deep groove bearing, with inner ring extended one side.	311SWI	
	SXY	Single-row deep groove bearing, tapered bore, with adapter sleeve and nut.	210SXY	
	SZZC	Single-row deep groove bearing, cartridge width, with two seals.	210SZZC	
	SZZCG	Single-row deep groove bearing, cartridge width, with two seals and snap-ring.	210SZZCG	

Bearing symbols

Prefix	Suffix	Description	Example	Illustration
T	ARR	Power transmission bearing, inner ring extended both sides, cylindrical O.D., two labyrinth seals, non-regreaseable, eccentric locking collar.	T1100ARR	
T	AZZ	Power transmission bearing, inner ring extended both sides, cylindrical O.D., two seals, non-regreaseable, eccentric locking collar.	T1100AZZ	
T	BRR	Power transmission bearing, inner ring extended both sides, spherical O.D., two labyrinth seals, non-regreaseable, eccentric locking collar.	T1100BRR	
T	BZZ	Power transmission bearing, inner ring extended both sides, spherical O.D., two seals, non-regreaseable, eccentric locking collar.	T1100BZZ	
	TT	Two metal shrouded synthetic rubber seals.	205STT	
	U	Thrust bearing, single acting, with self-aligning washer.	1109U	
	U	9000 series angular contact ball bearing with split inner ring, 29° contact angle.	9309U	
	UH	9000 series angular contact ball bearing with split inner and outer rings, 29° contact angle.	9213UH	
	UK	9000 series, extra light, angular contact ball bearing with split inner ring, 29° contact angle.	9107UK	
	UP	9000 series, 40° angular contact ball bearing with split inner ring.	9308UP	
UR		Flange unit, two seals, regreaseable, with eccentric locking collar.	UR2	
UT		Flange unit, two Flexigard seals, regreaseable, with eccentric locking collar.	UT1½	
	V	Single-row, maximum capacity, filling notch type ball bearing, with narrow width.	209V	
	V	Felt seal replacement bearing with one seal and one shield with snap-ring on seal side.	487508V	

Bearing symbols

Prefix	Suffix	Description	Example	Illustration
W		Lock washer.	W06	
	W	Cylindrical roller bearing, roller and cage assembly only.	R207W	
WC		Single-row felt seal replacement bearing with inner and outer ring faces flush on one side.	WC87504	
	WI	Single-row, maximum capacity, filling notch type ball bearing, with inner ring extended one side only.	318WI	
	WIF	Single-row maximum capacity ball bearing with inner ring extended one side, and shield on extended inner side.	318WIF	
	X	Tapered bore bearing.	206SX	
XLR		Cylindrical roller bearing, inch size.	XLR3 1/2E	
XLS		Single-row, counterbored outer ring, 15° angular contact ball bearing, inch size.	XLS2	
XO	RBDS	Excello replacement bearing.	XO90RBDS	
	XY	Tapered bore bearing with adapter sleeve.	208SXY	
	Y	Adapter sleeve and nut.	6Y	
Y	PWI-DB	Duplex pair of airframe bearings, seals on outboard side, aircraft pulley type.	Y96PWID2B	
	Z	One synthetic rubber seal.	206SZ	
	ZZ	Two synthetic rubber seals.	206SZZ	
	ZZC	Single-row, cartridge width bearing, extra small size, with two synthetic rubber seals.	38ZZC	

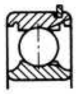
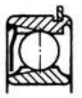
Prefix/suffix symbols for single-row bearing non-standard variants

Nomenclature

S-Single-row deep groove type
M-Single-row filling notch type
R-15° angular contact type
WI-Wide inner ring filling notch type
SWI-Wide inner ring non-filling notch type

F-Shield
Z-Seal
G-Snap-ring
FS-Felt seal
X-Tapered bore

When single seal is used, seal symbol (Z) replaces (F) in designations shown except for filling notch (M) type.

Prefix-Suffix	Illustration	Prefix-Suffix	Illustration	Prefix-Suffix	Illustration
-MF		X-M		G-MFZ	
-MG		F-MX		FZG-M	
-MFG		X-MF		-MXFZ	
G-M		-MFX		XFZ-M	
F-M		XF-M		X-MFZ	
F-MG		-MFZ		FZ-MX	
G-MF		FZ-M		-SFG	
FG-M		-MFZG		G-SF	
-MX		FZ-MG		-SFX	

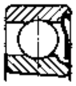
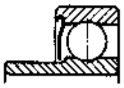
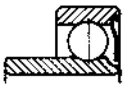
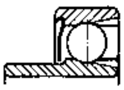
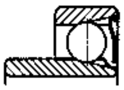
Prefix/suffix symbols for single-row bearing non-standard variants

Nomenclature

S-Single-row deep groove type
M-Single-row filling notch type
R-15° angular contact type
WI-Wide inner ring filling notch type
SWI-Wide inner ring non-filling notch type

F-Shield
Z-Seal
G-Snap-ring
FS-Felt seal
X-Tapered bore

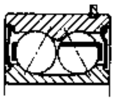
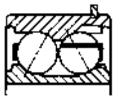
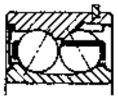
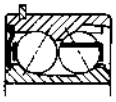
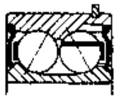
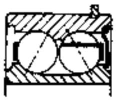
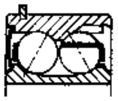
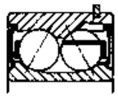
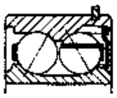
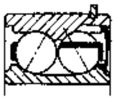
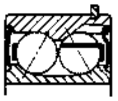
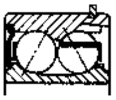
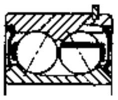
When single seal is used, seal symbol (Z) replaces (F) in designations shown except for filling notch (M) type.

Prefix-Suffix	Illustration	Prefix-Suffix	Illustration	Prefix-Suffix	Illustration
-SXF		G-FSF		F-RG	
-SWIF		-RF		-RX	
F-SWI		-RG		X-R	
-WIF		-RFG		-RFX	
F-WI		F-R		X-RF	
-FSG		G-R		F-RX	
G-FS		FG-R		FX-R	
-FSFG		G-RF			

Prefix/suffix symbols for double-row bearing non-standard variants

Nomenclature

M-Filling notch type
C-Non-filling notch type
F-Shield
Z-Seal
G-Snap-ring

Prefix–Suffix	Illustration	Prefix–Suffix	Illustration	Prefix–Suffix	Illustration
G-CFZ		G-M		ZG-M	
G-CZ		F-MG		G-MFF	
G-CF		Z-MG		G-MZZ	
F-MZ		G-MF		F-MZG	
F-M		G-MZ		G-MFZ	
Z-M		FG-M		FG-MZ	

MRC manufacturing suffixes

The manufacturing suffix is specified on packing lists, invoices and all unit cartons. Whenever possible the manufacturing suffix is also shown on the bearing steel. It is separated from the standard MRC part number by several spaces. Example:

204SZZ	H501
Standard MRC part no.	**Manufacturing suffix**

A four digit manufacturing suffix is used by MRC internally to define bearing specifications as well as to track such information as plant-of-manufacture as product is distributed throughout the MRC warehousing network. This suffix is assigned sequentially within the MRC computer system and can only be cross-referenced internally by the MRC Customer Service Representative.

The standard MRC part number is sufficient for specifying customer requirements for all “stock” sizes. The use of a non-descriptive manufacturing suffix permits minor changes to the design and manufacture of standard product without a confusing nomenclature change. The revised product may still be tracked through distribution by the four digit manufacturing suffix.

MRC descriptive part suffixes

A descriptive part suffix is frequently combined with the standard MRC part number to provide a more complete description of bearing design specifications. Descriptive suffixes are found on MRC price sheets, packing lists and invoices. Preload and endplay descriptive suffixes are only displayed on the bearing steel away from the basic part number.

Descriptive part suffixes are physically separated from the standard MRC part number by a dash “-”.

213RDS - BKE#7

Basic part no. Descriptive suffix

	Descriptive part suffix definitions
BKE	Machined phenolic composition (Bakelite)
BRS	Pressed brass cage
BRZ	Machined bronze cage
CA	Less than normal endplay designation for duplexed bearings
CB	Normal endplay designation for duplexed bearings
CC	Greater than normal endplay designation for duplexed bearings
CX	Special endplay designation for duplexed bearings
C0	ABMA #0 radial clearance (MRC-ST Fit)
C2	ABMA #2 radial clearance (MRC-TI Fit)
C3	ABMA #3 radial clearance (MRC-LO Fit)
C4	ABMA #4 radial clearance (MRC-XL Fit)
DE	Endplay designation for duplexed bearings
DL	Light preload designation for duplexed bearings
DM	Medium preload designation for duplexed bearings
DH	Heavy preload designation for duplexed bearings
DX	Special preload designation for duplexed bearings
EA	Each, sold as half pair (example: 9218UDT-BRZEA)
HT	High temperature heat treat
HYB#1	Ceramic rolling elements and ABEC-1 tolerances
M	Machined brass cage for self-aligning ball bearing
RB	Texaco premium RB grease
#3	ABEC-3 tolerances
#5	ABEC-5 tolerances
#7	ABEC-7 tolerances
EMQ	Electric motor quality
NYL	Glass fiber reinforced polyamide
PO	Poly-oil treatment
STL	Steel cage
TDC	Thin dense chrome plated
TN9	Glass fiber reinforced polyamide cage
T44	MRC code #44 radial clearance

MRC customer service features

- MRC is always one 1-888-753-3477 phone call away—saving time in response to your customer.
- MRC fax number: 267-436-6022.
- Immediate attention is given to technical questions by our in-house engineering department, call 1-888-753-2000.
- MRC technical services experts are able to address bearing problems in the field and offer solutions.
- MRC provides bearing failure analysis in problem applications.
- Friendly, knowledgeable customer service people are able to take important action on your requests.
- Many servicing warehouses assure inventory accessibility in all parts of the country.

Bearing specification tables

Section 2-Bearing specification tables

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Table of contents

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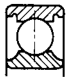
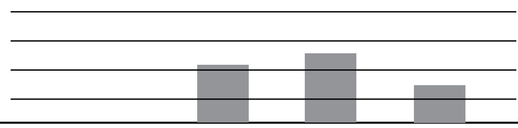
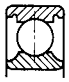
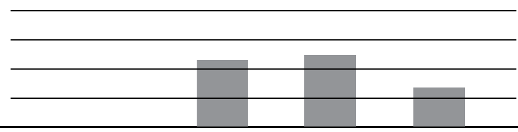
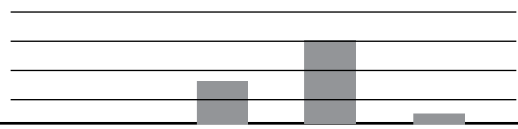
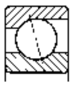
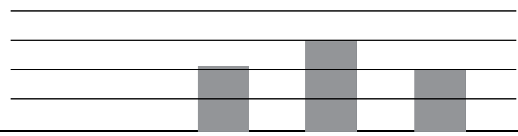
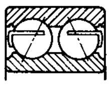
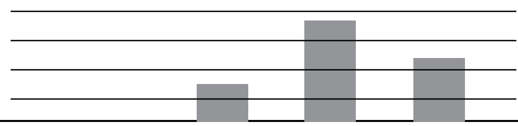
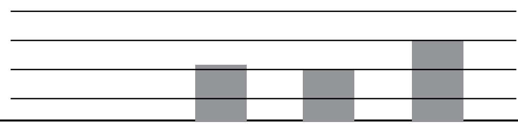
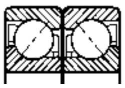
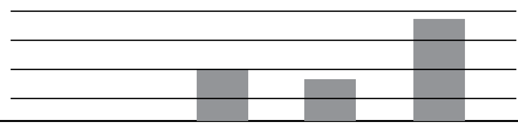
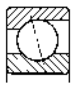
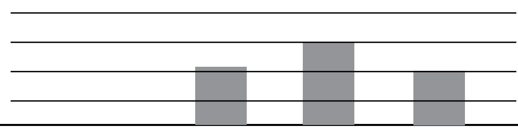
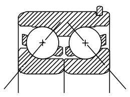
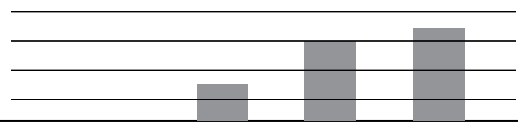
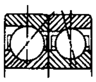
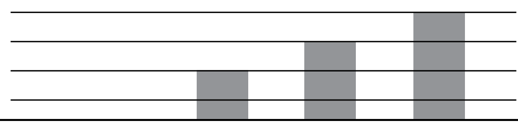
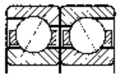
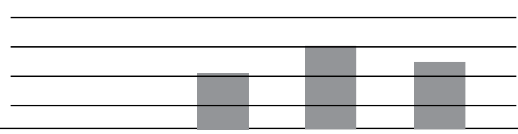
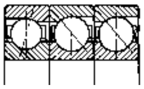
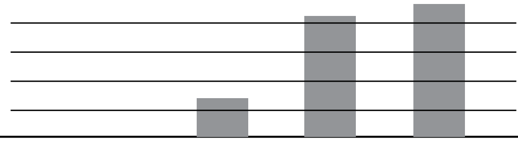
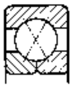
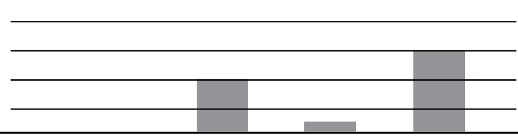
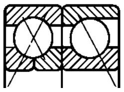
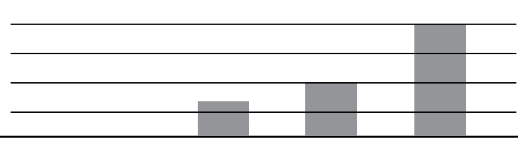
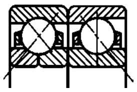
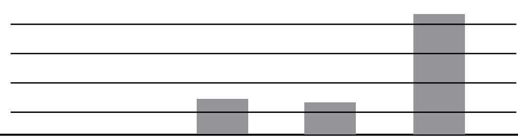
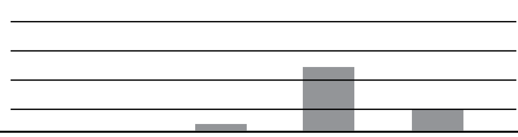
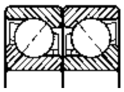
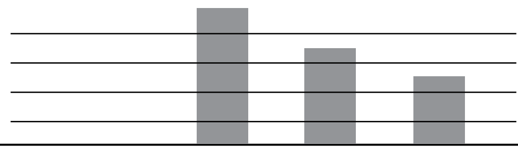
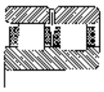
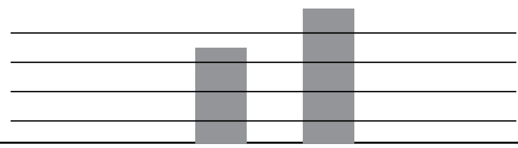
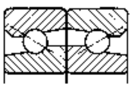
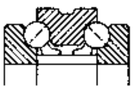
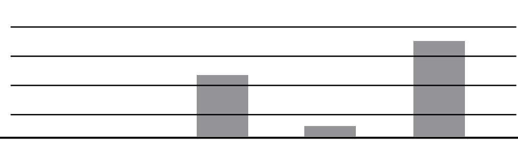
Bearing types summary chart

Bearing type		Cage	Contact angle	Performance level	Characteristics: Speed, Radial capacity, Axial capacity
Type "S" Conrad deep groove		Pressed steel	0°	Extremely high Very high High Moderate	
"R" inch series Conrad deep groove		Pressed steel	0°	Extremely high Very high High Moderate	
Type "M" maximum capacity filling notch		Pressed steel	0°	Extremely high Very high High Moderate	
Type "R" 15° angular contact		Pressed steel	15°	Extremely high Very high High Moderate	
5000 series double-row "C" type Conrad, "M" type maximum capacity		Pressed steel	30°	Extremely high Very high High Moderate	
7000 series 29° angular contact		Pressed steel	29°	Extremely high Very high High Moderate	
7000P series 40° angular contact		Machined and pressed brass	40°	Extremely high Very high High Moderate	
"XLS" inch series angular contact		Bakelite	15°	Extremely high Very high High Moderate	
5300UPG series split inner ring double-row		Machined brass	40°	Extremely high Very high High Moderate	
8000 PumPac series angular contact assembly		Machined brass	40° and 15°	Extremely high Very high High Moderate	

Description
Ordinarily supplied with loose internal clearance. Outer and inner races have full shoulders. Has equal load-carrying capacity in either direction. Recommended for moderately heavy radial loads, thrust loads in either direction, or combination loads.
Ordinarily supplied with standard internal clearance. Has inch boundary dimensions. Outer and inner races have full shoulders. Has equal load-carrying capacity in either direction. Recommended for moderately heavy radial loads, thrust loads in either direction, or combination loads.
Ordinarily supplied with standard internal clearance. This type has a filling notch on one side of the inner and outer rings to insert a maximum ball complement. Can carry heavy radial load or combined radial and thrust load where the radial load predominates. Not recommended for pure thrust loads or combined loads where thrust load predominates.
Supplied with loose internal clearance for normal applications. Counterbored outer ring to assemble maximum ball complement. Outer ring is heated in order to assemble. Can carry heavy radial load, moderate thrust load in one direction only, or combined loads where thrust load is against the heavy shoulder on the outer ring.
C type ordinarily supplied with loose internal clearance. Has full shoulders and no filling notches. Has outwardly converging contact angles. C type will support heavy radial loads, and equally heavy thrust load in either direction, or heavy combined radial and thrust loads. M type ordinarily supplied with loose internal clearance. Has filling notches on one side only for inserting maximum ball complement. Has outwardly converging contact angles. M type has heavy radial capacity. Also has moderate thrust capacity in one direction and can take light thrust load in reversing direction.
Counterbored outer ring, non-separable type. Ordinarily available in single and paired variants. Paired variants typically supplied with line-to-line internal clearance. Other degrees of internal clearance/preload may be necessary for special conditions. Two-piece pressed steel cage for normal use or one-piece non-metallic or solid brass cage for high speed, high operating temperature, or severe vibration application. High thrust load in one direction, combined radial and thrust load where thrust load predominates. Should not be used for radial loads only.
Similar in design to the 7000 series bearing. Thrust capacity is 1.18 to 1.4 times that of the 7000 series, varies with individual sizes. Restricted to primarily thrust loads. Should not be used for radial loads only or combined radial and thrust loads where radial load predominates.
Counterbored outer ring, non-separable type. Similar to the type R angular contact except that it has inch dimensions. It also has a relatively light cross section for space constraints. Can carry heavy radial load, moderate thrust load in one direction only, or combined loads where thrust load is against the heavy shoulder on the outer ring.
Designed with two-piece inner ring and one-piece outer ring and snap-ring. Differs from the 5000C and M types because of its 40° contact angle and split inner ring. Also has a machined brass cage and reduced axial clearance. Can carry very heavy thrust loads in either direction or combined loads where the thrust load predominates.
Bearing assembly consists of a 40° and 15° bearing, ABEC-3 precision tolerances, reduced axial clearance, and machined brass cages. Can carry high thrust load in one direction and light reversing thrust load in the opposite direction. The lower contact angle of the back bearing helps prevent ball skidding during periods of no load.

Bearing types summary chart

Bearing type		Cage	Contact angle	Performance level	Characteristics: Speed / Radial capacity / Axial capacity
8000BB PumPac series angular contact assembly		Machined brass	15° and 15°	Extremely high Very high High Moderate	
8000AAB PumPac series angular contact assembly		Machined brass	40° and 40° and 15°	Extremely high Very high High Moderate	
9000U series split inner ring angular contact		Machined brass	29° or 40°	Extremely high Very high High Moderate	
97000U2 series angular contact assembly		Machined brass	29°	Extremely high Very high High Moderate	
97000UP2 series angular contact assembly		Machined brass	40°	Extremely high Very high High Moderate	
Marathon® series		Polyamide	0°	Extremely high Very high High Moderate	
Type DS high precision angular contact		Phenolic	15° or 25°	Extremely high Very high High Moderate	
Type NN3100 double-row cylindrical		Polyamide	0°	Extremely high Very high High Moderate	
Type J ball screw support		Phenolic	60°	Extremely high Very high High Moderate	
Type DT double direction angular contact		Polyamide or machined brass	60°	Extremely high Very high High Moderate	

Description

Consists of two 15° bearings as opposed to one 40° and one 15°, ABEC-3 precision tolerances, reduced axial clearance, and machined brass cages. Can carry predominantly radial load with intermittent thrust load in either direction. Very similar performance to the 7000R series, except that it is a back-to-back paired arrangement.

Can carry very high thrust loads in one direction and light reversing thrust load in the opposite direction. The pair of 40° "A" bearings in tandem provides very high thrust capacity in the primary direction, while the 15° "B" bearing handles any reversing thrust load.

Designed with solid one-piece outer ring and two-piece inner ring, maximum ball complement and one-piece machined brass cage. Can carry greater thrust in either direction than the type S. May be used where there is substantial radial load providing there is always sufficient thrust load present. Often paired with another angular contact ball bearing in an assembly.

Paired assembly of a 9000U and a 7000 angular contact bearing. Assembly comes with axial clearance as standard and provides the capacity of a triplex set in the boundary dimensions of a pair. Very heavy thrust load capacity because of tandem assembly of 9000U and 7000 bearing in one direction. 9000U supports reversing thrust load in the opposite direction.

Very similar to the 97000U2 series except that it has a 40° contact angle. Because of the higher contact angle, this assembly has the highest thrust carrying capacity for its given boundary dimensions.

Series of corrosion resistant housings and bearings used in heavy wash down and contaminated environments such as food, car wash, gypsum, etc. The unique double sealing arrangement makes Marathon units very effective at keeping out solid and liquid contamination. These units incorporate an insert bearing based on the type S Conrad bearing so they can handle moderate radial loads and light thrust loads in either direction. However, since they are set screwed to the shaft, the axial load carrying capacity is determined by the holding power of the set screws.

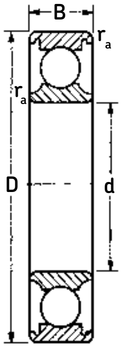
ABEC-7 tolerances for machine tool applications that require high speeds and precise running accuracies. Type DS are available in 15° and 25° contact angles. These bearings are normally used in paired arrangements. They function very similarly to the type R and 7000 series bearings except for the fact that they are much higher precision.

ABEC-7 tolerances for high speeds required by machine tool spindles. Very high radial stiffness because of its double-row roller design. Very high radial load carrying capacity. Zero axial load carrying capacity because of the shoulderless outer ring which allows the bearing to expand with shaft thermal growth.

ABEC-7 tolerances for high speed. Counterbored inner and outer ring construction. Very high axial stiffness because of the 60° contact angle and larger quantity of small balls. Usually used in paired, triplex, or quad sets in order to provide adequate stiffness and capacity for the given application conditions. Primarily designed for high thrust loads and very little radial load because of the 60° contact angle.

Type DT has a one-piece outer ring construction with a two-piece inner ring construction. Like the type J bearing, it has a 60° contact angle. It is also a paired assembly. Its large quantity of small balls also provides high axial stiffness as with the type J bearings. The type DT bearing can handle high thrust load in either direction and virtually zero radial load. It is usually paired with a radial type bearing in order to isolate it from any radial loading.

Single-row deep groove ball bearings S-type

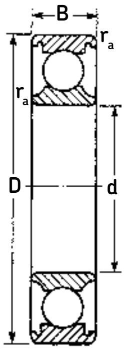


The MRC Conrad ball bearing is a single-row radial deep groove bearing with no filling notches. It can carry significant radial loads, and, because of the uninterrupted raceway grooves and the high degree of conformity between balls and raceways, it can carry substantial thrust loads in either direction, even at very high speeds. Single-row deep groove ball bearings are offered open or with single or double shields or seals, as well as with snap-rings in various combinations.

Cage types and materials

This type of bearing is supplied with a pressed steel cage as standard; however, for special requirements, it can be supplied with a two-piece riveted machined cage of phenolic composition or bronze material.

30 series
extra small size



F
One shield

Z
One seal

FF
Two shields

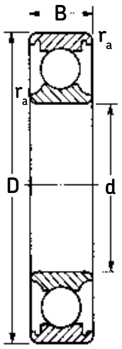
ZZ
Two seals

These single-row radial conrad-type bearings have 4 mm to 9 mm bores (approximately 5/32 in. to 3/8 in.), and are designed for very small shafts. They are suitable for high speed fractional horsepower motors and small turbines. MRC offers open, shielded, and sealed types. Some sizes are available in stainless steel. The 30 series is supplied with ABMA CO radial clearance unless otherwise specified.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic $C^{3)}$ N	Dynamic $C^{3)}$ lbf	Static C_0 N	Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
34	4	**.1575**	16	**.6299**	5	**.1969**	.30	**.012**	45	**.07**	1 470	**330**	600	**135**	43 000	50 000	30 000
35	5	**.1969**	19	**.7480**	6	**.2362**	.30	**.012**	96	**.15**	2 210	**497**	950	**214**	36 000	43 000	26 000
36	6	**.2362**	19	**.7480**	6	**.2362**	.30	**.012**	96	**.15**	2 210	**497**	950	**214**	36 000	43 000	26 000
37	7	**.2756**	22	**.8661**	7	**.2756**	.30	**.012**	110	**.17**	3 250	**731**	1 360	**306**	36 000	43 000	23 000
38	8	**.3150**	22	**.8661**	7	**.2756**	.30	**.012**	110	**.17**	3 250	**731**	1 360	**306**	36 000	43 000	23 000
39	9	**.3543**	26	**1.0236**	8	**.3150**	.64	**.025**	161	**.25**	4 620	**1 040**	1 960	**441**	28 000	34 000	20 000

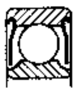
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.

R series
small inch size



F
One shield

Z
One seal



FF
Two shields

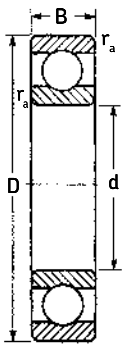
ZZ
Two seals

R series bearings are single-row radial conrad-type bearings that are available in inch sizes for shafts from 1/8 in. to 1 1/2 in. diameter. Open, shielded, and sealed types are available, and many sizes are available in stainless steel. The R series is supplied with ABMA CO radial clearance unless otherwise specified.

MRC bearing number	Bore d		Outside diameter D		Width B		Width Shielded or sealed		Fillet radius[1] r_a		Fillet radius[1] ZD^2		Basic radial load rating Dynamic C[3]		Basic radial load rating Static C_0		Speed rating[2] Open and shielded Grease	Speed rating[2] Open and shielded Oil	Speed rating[2] Single and double sealed Grease
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm	rpm
R2	3.2	**.1250**	9.5	**.3750**	4.0	**.1562**	4.0	**.1562**	.30	**.012**	19	**.03**	312	**70**	120	**27**	75 000	91 000	52 000
R2A	3.2	**.1250**	12.7	**.5000**	4.4	**.1719**	4.4	**.1719**	.30	**.012**	19	**.03**	312	**70**	120	**27**	75 000	91 000	52 000
R3	4.8	**.1875**	12.7	**.5000**	4.0	**.1562**	5.0	**.1960**	.30	**.012**	39	**.06**	956	**215**	490	**110**	57 000	69 000	40 000
R4	6.4	**.2500**	15.9	**.6250**	5.0	**.1960**	5.0	**.1960**	.30	**.012**	45	**.07**	1 480	**332**	620	**139**	44 000	54 000	31 000
R4A	6.4	**.2500**	19.1	**.7500**	5.6	**.2188**	7.1	**.2812**	.41	**.016**	71	**.11**	2 810	**632**	1 160	**261**	39 000	48 000	27 000
R6	9.5	**.3750**	22.2	**.8750**	5.6	**.2188**	7.1	**.2812**	.41	**.016**	110	**.17**	3 320	**746**	1 340	**301**	31 000	38 000	21 000
R8	12.7	**.5000**	28.6	**1.1250**	6.4	**.2500**	7.9	**.3125**	.41	**.016**	181	**.28**	5 070	**1 140**	2 400	**540**	24 000	29 000	16 000
R10	15.9	**.6250**	34.9	**1.3750**	7.1	**.2812**	8.7	**.3438**	.79	**.031**	226	**.35**	6 050	**1 360**	3 250	**731**	18 000	22 000	13 000
R12	19.1	**.7500**	41.3	**1.6250**	7.9	**.3125**	11.1	**.4375**	.79	**.031**	361	**.56**	9 360	**2 100**	5 100	**1 150**	16 000	19 000	11 000
R14	22.2	**.8750**	47.6	**1.8750**	9.5	**.3750**	12.7	**.5000**	.79	**.031**	406	**.63**	10 100	**2 270**	5 850	**1 320**	14 000	17 000	9 600
R16	25.4	**1.0000**	50.8	**2.0000**	9.5	**.3750**	12.7	**.5000**	.79	**.031**	406	**.63**	10 100	**2 270**	6 000	**1 350**	13 000	16 000	9 000
R18	28.6	**1.1250**	54.0	**2.1250**	9.5	**.3750**	12.7	**.5000**	.79	**.031**	510	**.79**	12 500	**2 810**	7 500	**1 690**	11 000	14 000	7 900
R20	31.8	**1.2500**	57.2	**2.2500**	9.5	**.3750**	12.7	**.5000**	.79	**.031**	613	**.95**	14 000	**3 150**	9 300	**2 090**	11 000	13 000	7 500
R24	38.1	**1.5000**	66.7	**2.6250**	11.1	**.4375**	14.3	**.5625**	.79	**.031**	755	**1.17**	16 800	**3 780**	11 800	**2 650**	9 000	11 000	6 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.

1800S
thin section series




SZ
One seal


SZZ
Two seals


SFP
One shield

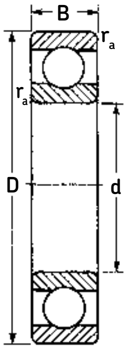

SFFP
Two shields

1800S series bearings are single-row radial conrad-type bearings that can accommodate light radial loads, two-directional thrust loads, or a combination of both. They are designed for applications where space or weight is very limited. The 1800S series is supplied with an ABMA C0 radial internal clearance unless otherwise specified.

MRC bearing number	Bore d		Outside diameter D		Width B		Fillet radius[1)] r_a		ZD^2		Basic radial load rating Dynamic $C^{3)}$		Static C_0		Speed rating[2)] Open and shielded Grease	Oil	Single and double sealed Grease
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm	rpm
1800S	10	**.3937**	19	**.7480**	5	**.1969**	.30	**.012**	62	**.10**	1 820	**410**	930	**209**	36 000	43 000	20 000
1801S	12	**.4724**	21	**.8268**	5	**.1969**	.30	**.012**	68	**.11**	1 900	**427**	1 040	**234**	32 000	38 000	19 000
1802S	15	**.5906**	24	**.9449**	5	**.1969**	.30	**.012**	80	**.12**	2 080	**468**	1 250	**281**	28 000	34 000	17 000
1803S	17	**.6693**	26	**1.0236**	5	**.1969**	.30	**.012**	91	**.14**	2 250	**505**	1 460	**328**	24 000	30 000	16 000
1804S	20	**.7874**	32	**1.2598**	7	**.2756**	.30	**.012**	141	**.22**	3 510	**790**	2 240	**504**	19 000	24 000	13 000
1805S	25	**.9843**	37	**1.4567**	7	**.2756**	.30	**.012**	184	**.28**	4 360	**980**	2 900	**652**	17 000	20 000	11 000
1806S	30	**1.1811**	42	**1.6535**	7	**.2756**	.30	**.012**	208	**.32**	4 490	**1 010**	3 400	**764**	15 000	18 000	9 500
1807S	35	**1.3780**	47	**1.8504**	7	**.2756**	.30	**.012**	233	**.36**	4 750	**1 070**	3 800	**854**	13 000	16 000	8 000
1808S	40	**1.5748**	52	**2.0472**	7	**.2756**	.30	**.012**	257	**.40**	4 940	**1 110**	4 150	**933**	11 000	14 000	7 500
1809S	45	**1.7717**	58	**2.2835**	7	**.2756**	.30	**.012**	315	**.49**	6 050	**1 360**	5 100	**1 150**	9 500	12 000	6 700
1810S	50	**1.9685**	65	**2.5591**	7	**.2756**	.30	**.012**	347	**.54**	6 240	**1 400**	5 500	**1 240**	9 000	11 000	6 000
1811S	55	**2.1654**	72	**2.8346**	9	**.3543**	.30	**.012**	454	**.70**	8 320	**1 870**	7 350	**1 650**	8 500	10 000	5 180
1812S	60	**2.3622**	78	**3.0709**	10	**.3937**	.30	**.012**	499	**.77**	8 710	**1 960**	8 000	**1 800**	7 500	9 000	4 800
1813S	65	**2.5591**	85	**3.3465**	10	**.3937**	.60	**.025**	679	**1.05**	11 700	**2 630**	11 000	**2 470**	7 000	8 500	4 500
1814S	70	**2.7559**	90	**3.5433**	10	**.3937**	.60	**.025**	741	**1.15**	12 100	**2 720**	11 800	**2 650**	6 700	8 000	4 300
1815S	75	**2.9528**	95	**3.7402**	10	**.3937**	.60	**.025**	803	**1.24**	12 500	**2 810**	12 900	**2 900**	6 300	7 500	4 000
1816S	80	**3.1496**	100	**3.9370**	10	**.3937**	.60	**.025**	864	**1.32**	13 000	**2 920**	13 700	**3 080**	6 000	7 000	3 600
1817S	85	**3.3465**	110	**4.3307**	13	**.5118**	1.0	**.040**	1 230	**1.90**	19 500	**4 380**	19 600	**4 410**	5 300	6 300	3 400
1818S	90	**3.5433**	115	**4.5276**	13	**.5118**	1.0	**.040**	1 280	**1.98**	19 500	**4 380**	20 400	**4 590**	5 300	6 300	3 200
1819S	95	**3.7402**	120	**4.7244**	13	**.5118**	1.0	**.040**	1 330	**2.06**	19 900	**4 470**	21 200	**4 770**	5 000	6 000	3 000
1820S	100	**3.9370**	125	**4.9213**	13	**.5118**	1.0	**.040**	1 380	**2.14**	20 300	**4 560**	22 000	**4 950**	4 800	5 600	3 000
1821S	105	**4.1339**	130	**5.1181**	13	**.5118**	1.0	**.040**	1 480	**2.29**	20 800	**4 680**	23 600	**5 310**	4 500	5 300	2 800
1822S	110	**4.3307**	140	**5.5118**	16	**.6299**	1.0	**.040**	1 910	**2.95**	28 100	**6 320**	30 500	**6 860**	4 300	5 000	2 600
1824S[4)]	120	**4.7244**	150	**5.9055**	16	**.6299**	1.0	**.040**	2 060	**3.19**	29 100	**6 540**	32 500	**7 310**	3 800	4 500	2 400
1826S[4)]	130	**5.1181**	165	**6.4961**	18	**.7087**	1.0	**.040**	2 660	**4.13**	37 700	**8 480**	43 000	**9 670**	3 600	4 300	2 200
1828S[4)]	140	**5.5118**	175	**6.8898**	18	**.7087**	1.0	**.040**	2 870	**4.46**	39 000	**8 770**	46 500	**10 500**	3 400	4 000	2 000
1830S[4)]	150	**5.9055**	190	**7.4803**	20	**.7874**	1.0	**.040**	3 540	**5.49**	48 800	**11 000**	57 000	**12 800**	3 000	3 600	—

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel cage for 1800S through 1830S. All others for outer land guided machined bronze.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

1900S
extremely light series



SZ
One seal

SZZ
Two seals

SFP
One shield

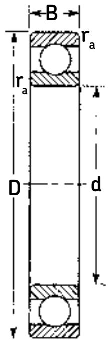
SFFP
Two shields

1900S series bearings are single-row radial conrad-type bearings that can accommodate light radial loads, two-directional thrust loads, or a combination of both. They are designed for applications where a lack of space or limitations on weight require a bearing with a thinner section than 100KS series bearings. Some sizes are available with shields or seals.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	Fillet radius[1)] r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3)] N	Dynamic C[3)] lbf	Static C_0 N	Static C_0 lbf	Speed rating[2)] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
1900S	10	.3937	22	.8661	6	.2362	.30	.012	840	.13	2 510	565	1 120	252	34 000	40 000	19 000
1901S	12	.4724	24	.9449	6	.2362	.30	.012	103	.16	2 910	655	1 500	337	30 000	36 000	18 000
1902S	15	.5906	28	1.1024	7	.2756	.30	.012	142	.22	4 030	906	2 040	459	24 000	30 000	16 000
1903S	17	.6693	30	1.1811	7	.2756	.30	.012	155	.24	4 360	980	2 320	522	22 000	28 000	14 000
1904S	20	.7874	37	1.4567	9	.3543	.30	.012	252	.39	6 370	1 430	3 650	821	18 000	22 000	12 000
1905S	25	.9843	42	1.6535	9	.3543	.30	.012	271	.42	6 630	1 490	4 150	933	16 000	19 000	10 000
1906S	30	1.1811	47	1.8504	9	.3543	.30	.012	317	.49	7 280	1 640	5 000	1 120	14 000	17 000	8 500
1907S	35	1.3780	55	2.1654	10	.3937	.64	.025	432	.67	9 560	2 150	6 800	1 530	11 000	14 000	7 500
1908S	40	1.5748	62	2.4409	12	.4724	.64	.025	637	.99	13 800	3 100	10 000	2 250	10 000	13 000	6 700
1909S	45	1.7717	68	2.6772	12	.4724	.64	.025	683	1.06	14 000	3 150	10 800	2 430	9 000	11 000	6 000
1910S	50	1.9685	72	2.8346	12	.4724	.64	.025	728	1.13	14 600	3 280	11 800	2 650	8 500	10 000	5 600
1911S	55	2.1654	80	3.1496	13	.5118	1.00	.040	864	1.34	16 500	3 710	14 000	3 150	8 000	9 500	5 000
1912S	60	2.3622	85	3.3465	13	.5118	1.00	.040	864	1.34	16 500	3 710	14 300	3 210	7 500	9 000	4 500
1913S	65	2.5591	90	3.5433	13	.5118	1.00	.040	968	1.50	17 400	3 910	16 000	3 600	6 700	8 000	4 300
1914S	70	2.7559	100	3.9370	16	.6299	1.00	.040	1 300	2.01	23 800	5 350	21 200	4 770	6 300	7 500	4 000
1915S	75	2.9528	105	4.1339	16	.6299	1.00	.040	1 370	2.13	24 200	5 440	22 400	5 040	6 000	7 000	3 600
1916S	80	3.1496	110	4.3307	16	.6299	1.00	.040	1 450	2.25	25 100	5 640	24 000	5 400	5 600	6 700	3 400
1917S	85	3.3465	120	4.7244	18	.7087	1.00	.040	1 810	2.81	31 900	7 170	30 000	6 740	5 300	6 300	3 200
1918S	90	3.5433	125	4.9213	18	.7087	1.00	.040	1 920	2.97	32 500	7 310	31 500	7 080	5 000	6 000	3 100
1919S	95	3.7402	130	5.1181	18	.7087	1.00	.040	2 025	3.14	33 800	7 600	33 500	7 530	4 800	5 600	2 900
1920S	100	3.9370	140	5.5118	20	.7874	1.00	.040	2 550	3.96	42 300	9 510	41 500	9 330	4 500	5 300	2 700
1921S	105	4.1339	145	5.7087	20	.7874	1.00	.040	2 770	4.18	44 200	9 940	44 000	9 890	4 300	5 000	2 600
1922S	110	4.3307	150	5.9055	20	.7874	1.00	.040	2 770	4.18	43 600	9 800	44 000	9 890	4 000	4 800	2 500
1924S	120	4.7244	165	6.4961	22	.8661	1.00	.040	3 460	5.36	55 300	12 400	57 000	12 800	3 600	4 300	2 300
1926S[4)]	130	5.1181	180	7.0866	24	.9449	1.50	.060	4 100	6.35	65 000	14 600	67 000	15 100	3 400	4 000	2 100
1928S[4)]	140	5.5118	190	7.4803	24	.9449	1.50	.060	4 320	6.70	66 300	14 900	71 000	16 000	3 200	3 800	2 000
1930S[4)]	150	5.9055	210	8.2677	28	1.1024	2.00	.080	5 670	8.78	88 400	19 900	93 000	20 900	2 800	3 400	1 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

100S
narrow-type light series



The 100S narrow-type light series is made up of single-row radial conrad-type bearings with bores ranging from 10 mm to 95 mm.

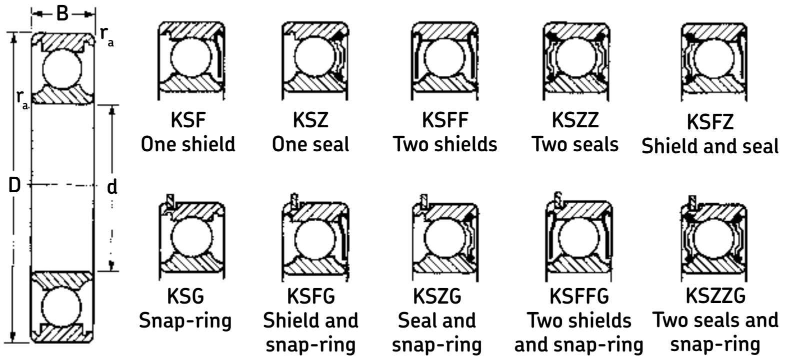
Note: This series is obsoleted but is still manufactured in a few sizes for replacement parts. Please check availability before designing into equipment.

	Bore		Outside diameter		Width		Fillet radius[1)]				Basic radial load rating				Speed rating[2)]	
											Dynamic		Static		Open and shielded	
MRC bearing number	d mm	in.	D mm	in.	B mm	in.	r_a mm	in.	ZD^2 mm	in.	C[3)] N	lbf	C_0 N	lbf	Grease rpm	Oil rpm
102S	10	**.3937**	32	**1.2598**	9	**.3543**	.51	**.02**	181	**.28**	5 200	**1 170**	2 450	**551**	24 000	29 000
103S	15	**.5906**	37	**1.4567**	9	**.3543**	.51	**.02**	284	**.44**	7 800	**1 750**	3 550	**798**	21 000	26 000
104S	20	**.7874**	42	**1.6535**	9	**.3543**	.51	**.02**	361	**.56**	9 360	**2 100**	5 100	**1 150**	17 000	21 000
105S	25	**.9843**	52	**2.0472**	9	**.3543**	1.00	**.04**	458	**.71**	12 100	**2 710**	6 700	**1 510**	14 000	17 000
106S	30	**1.1811**	62	**2.4409**	10	**.3937**	1.00	**.04**	632	**.98**	15 600	**3 500**	9 300	**2 090**	11 000	14 000
107S	35	**1.3780**	70	**2.7559**	10	**.3937**	1.00	**.04**	755	**1.17**	16 800	**3 780**	11 600	**2 610**	10 000	12 000
108S	40	**1.5748**	80	**3.1496**	11	**.4331**	1.00	**.04**	819	**1.27**	18 200	**4 100**	12 900	**2 900**	9 000	11 000
109S	45	**1.7717**	85	**3.3465**	11	**.4331**	1.00	**.04**	1 010	**1.56**	19 800	**4 450**	16 300	**3 670**	8 000	9 700
110S	50	**1.9685**	90	**3.5433**	11	**.4331**	1.00	**.04**	1 010	**1.56**	19 900	**4 470**	16 600	**3 730**	7 400	9 000
111S	55	**2.1654**	100	**3.9370**	12	**.4724**	1.00	**.04**	1 220	**1.89**	23 400	**5 260**	20 000	**4 500**	6 800	8 300
112S	60	**2.3622**	105	**4.1339**	12	**.4724**	1.00	**.04**	1 450	**2.25**	27 000	**6 080**	23 600	**5 300**	6 100	7 400
113S	65	**2.5591**	115	**4.5276**	14	**.5512**	1.00	**.04**	1 450	**2.25**	27 000	**6 080**	23 600	**5 300**	6 100	7 400
114S	70	**2.7559**	120	**4.7244**	14	**.5512**	1.00	**.04**	1 700	**2.64**	31 200	**7 010**	28 000	**6 300**	5 400	6 600
115S	75	**2.9528**	130	**5.1181**	16	**.6299**	1.50	**.06**	2 260	**3.50**	42 300	**9 520**	36 000	**8 090**	5 100	6 200
116S	80	**3.1496**	135	**5.3150**	16	**.6299**	1.50	**.06**	2 420	**3.75**	44 200	**9 940**	39 000	**8 770**	4 800	5 900
117S	85	**3.3465**	145	**5.7087**	18	**.7087**	1.50	**.06**	2 850	**4.42**	52 700	**11 800**	45 500	**10 200**	4 500	5 500
118S	90	**3.5433**	150	**5.9055**	18	**.7087**	1.50	**.06**	2 850	**4.42**	52 700	**11 800**	46 500	**10 500**	4 300	5 200
119S	95	**3.7402**	160	**6.2992**	20	**.7874**	1.50	**.06**	3 530	**5.47**	63 700	**14 300**	57 000	**12 800**	4 000	4 900

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.

100KS extra light series

(see pg. 52 for hybrid series)



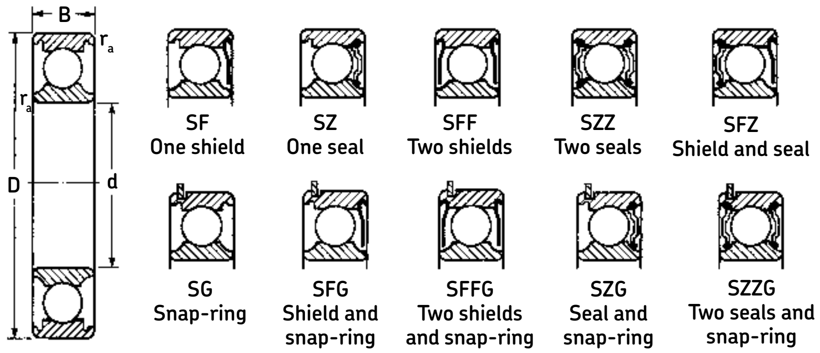
The 100KS extra light series consists of single-row radial conrad-type bearings made with bores from 10 mm to 320 mm for light to moderate radial loads, two-directional thrust loads, or a combination of both, where space is somewhat limited. This series is available in plain, shielded, or sealed types, as well as with snap-rings.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	Fillet radius r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3)] N	Dynamic lbf	Static C_0 N	Static lbf	Speed rating[2)] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
100KS	10	.3937	26	1.0236	8	.3150	.30	.012	181	.28	4 620	1 040	1 960	440	30 000	36 000	19 000
101KS	12	.4724	28	1.1024	8	.3150	.30	.012	181	.28	5 070	1 140	2 360	530	26 000	32 000	17 000
102KS	15	.5906	32	1.2598	9	.3543	.30	.012	206	.32	5 590	1 260	2 850	640	22 000	28 000	14 000
103KS	17	.6693	35	1.3780	10	.3937	.30	.012	226	.35	6 050	1 360	3 250	730	19 000	24 000	13 000
104KS	20	.7874	42	1.6535	12	.4724	.64	.025	361	.56	9 360	2 100	5 000	1 120	17 000	20 000	11 000
105KS	25	.9843	47	1.8504	12	.4724	.64	.025	458	.71	11 200	2 520	6 550	1 470	15 000	18 000	9 500
106KS	30	1.1811	55	2.1654	13	.5118	1.00	.040	561	.87	13 300	2 990	8 300	1 870	12 000	15 000	8 000
107KS	35	1.3780	62	2.4409	14	.5512	1.00	.040	691	1.07	15 800	3 570	10 200	2 290	10 000	13 000	7 000
108KS	40	1.5748	68	2.6772	15	.5906	1.00	.040	909	1.41	20 800	4 680	11 600	2 610	9 500	12 000	6 300
109KS	45	1.7717	75	2.9528	16	.6299	1.00	.040	1 090	1.69	23 400	5 270	16 600	3 730	9 000	11 000	5 600
110KS	50	1.9685	80	3.1496	16	.6299	1.00	.040	1 180	1.83	24 700	5 560	18 000	4 050	8 500	10 000	5 000
111KS	55	2.1654	90	3.5433	18	.7087	1.00	.040	1 390	2.16	28 100	6 320	21 600	4 880	7 500	9 000	4 500
112KS	60	2.3622	95	3.7402	18	.7087	1.00	.040	1 610	2.49	32 500	7 310	25 000	5 620	6 700	8 000	4 300
113KS	65	2.5591	100	3.9370	18	.7087	1.00	.040	1 730	2.68	33 800	7 600	27 000	6 070	6 300	7 500	4 000
114KS	70	2.7559	110	4.3307	20	.7874	1.00	.040	2 100	3.25	41 000	9 220	32 500	7 310	6 000	7 000	3 600
115KS	75	2.9528	115	4.5276	20	.7874	1.00	.040	2 260	3.50	42 300	9 510	35 500	7 970	5 600	6 700	3 400
116KS	80	3.1496	125	4.9213	22	.8661	1.00	.040	2 650	4.11	50 700	11 400	41 500	9 330	5 300	6 300	3 200
117KS	85	3.3465	130	5.1181	22	.8661	1.00	.040	2 860	4.43	52 700	11 800	45 000	10 100	5 000	6 000	3 000
118KS	90	3.5433	140	5.5118	24	.9449	1.50	.060	3 280	5.08	61 800	13 900	51 000	11 500	4 800	5 600	2 800
119KS	95	3.7402	145	5.7087	24	.9449	1.50	.060	3 530	5.47	63 700	14 300	54 000	12 100	4 500	5 300	2 800
120KS	100	3.9370	150	5.9055	24	.9449	1.50	.060	3 530	5.47	63 700	14 300	54 000	12 100	4 300	5 000	2 600
121KS	105	4.1339	160	6.2992	26	1.0236	2.00	.080	4 330	6.72	79 300	17 800	65 500	14 700	4 000	4 800	2 400
122KS	110	4.3307	170	6.6929	28	1.1024	2.00	.080	4 660	7.23	81 800	18 400	73 500	16 500	3 800	4 500	2 400
124KS	120	4.7244	180	7.0866	28	1.1024	2.00	.080	5 000	7.75	85 200	19 100	80 000	18 000	3 400	4 000	2 200
126KS	130	5.1181	200	7.8740	33	1.2992	2.00	.080	5 960	9.24	106 000	23 800	100 000	22 500	3 200	3 800	2 000
128KS[4)]	140	5.5118	210	8.2677	33	1.2992	2.00	.080	6 900	10.70	111 000	25 000	108 000	24 300	3 000	3 600	1 800
130KS[4)]	150	5.9055	225	8.8583	35	1.3780	2.00	.080	8 385	13.00	125 000	28 100	125 000	28 100	2 600	3 200	1 700
132KS[4)]	160	6.2992	240	9.4488	38	1.4961	2.00	.080	9 030	14.00	143 000	32 100	143 000	32 100	2 400	3 000	1 600
134KS[4)]	170	6.6929	260	10.2362	42	1.6535	2.00	.080	11 800	18.30	168 000	37 800	173 000	38 900	2 200	2 800	1 500
136KS[4)]	180	7.0866	280	11.0236	46	1.8110	2.00	.080	11 400	17.70	190 000	42 700	200 000	45 000	2 000	2 600	1 400
138KS[4)]	190	7.4803	290	11.4173	46	1.8110	2.00	.080	13 400	20.80	195 000	43 800	216 000	48 600	2 000	2 600	1 400
140KS[4)]	200	7.8740	310	12.2047	51	2.0079	2.00	.080	15 900	24.60	216 000	48 600	245 000	55 100	1 900	2 400	1 300
144KS[4)]	220	8.6614	340	13.3868	56	2.2047	2.50	.100	18 600	28.90	247 000	55 500	290 000	65 200	1 800	2 200	1 100
148KS[4)]	240	9.4488	360	14.1732	56	2.2047	2.50	.100	19 500	30.20	255 000	57 300	315 000	70 800	1 700	2 000	1 000
152KS[4)]	260	10.2362	400	15.7480	65	2.5591	3.00	.120	23 900	37.00	291 000	65 400	375 000	84 300	1 500	1 800	940
156KS[4)]	280	11.0236	420	16.5354	65	2.5591	3.00	.120	25 700	39.90	302 000	67 900	405 000	91 000	1 400	1 700	890
160KS[4)]	300	11.8110	460	18.1102	74	2.9134	3.00	.120	31 700	49.20	358 000	80 500	500 000	112 000	1 200	1 500	780
164KS[4)]	320	12.5984	480	18.8976	74	2.9134	3.00	.120	34 000	52.70	371 000	83 400	540 000	121 000	1 100	1 400	730

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

200S light series

(see pg. 54 for hybrid series)



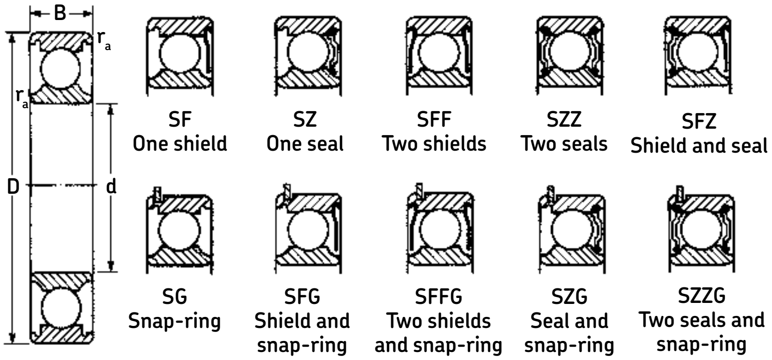
200S light series bearings are single-row radial conrad-type bearings made with bores from 10 mm to 120 mm. They are used in applications with moderate to heavy radial loads, two-directional thrust loads, or a combination of both.

MRC bearing number	Bore d		Outside diameter D		Width B		Fillet radius[1] r_a		ZD^2		Basic radial load rating Dynamic C[3]		Static C_0		Speed rating[2] Open and shielded Grease	Oil	Single and double sealed Grease
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm	rpm
200S	10	**.3937**	30	**1.1811**	9	**.3543**	.64	**.025**	181	**.28**	5 070	**1 140**	2 360	**531**	24 000	30 000	17 000
201S	12	**.4724**	32	**1.2598**	10	**.3937**	.64	**.025**	252	**.39**	6 890	**1 550**	3 100	**697**	22 000	28 000	15 000
202S	15	**.5906**	35	**1.3780**	11	**.4331**	.64	**.025**	290	**.45**	7 800	**1 750**	3 250	**843**	19 000	24 000	13 000
203S	17	**.6693**	40	**1.5748**	12	**.4724**	.64	**.025**	361	**.56**	9 560	**2 150**	4 750	**1 070**	17 000	20 000	12 000
204S	20	**.7874**	47	**1.8504**	14	**.5512**	1.00	**.040**	503	**.78**	12 700	**2 860**	6 550	**1 470**	15 000	18 000	10 000
205S	25	**.9843**	52	**2.0472**	15	**.5906**	1.00	**.040**	568	**.88**	14 000	**3 150**	7 800	**1 750**	12 000	15 000	8 500
206S	30	**1.1811**	62	**2.4409**	16	**.6299**	1.00	**.040**	819	**1.27**	19 500	**4 380**	11 200	**2 520**	10 000	13 000	7 500
207S	35	**1.3780**	72	**2.8346**	17	**.6693**	1.00	**.040**	1 110	**1.72**	25 500	**5 730**	15 300	**3 440**	9 000	11 000	6 300
208S	40	**1.5748**	80	**3.1496**	18	**.7087**	1.00	**.040**	1 360	**2.11**	30 700	**6 900**	19 000	**4 270**	8 500	10 000	5 600
209S	45	**1.7717**	85	**3.3465**	19	**.7480**	1.00	**.040**	1 510	**2.35**	33 200	**7 460**	21 600	**4 860**	7 500	9 000	5 000
210S	50	**1.9685**	90	**3.5433**	20	**.7874**	1.00	**.040**	1 610	**2.50**	35 100	**7 890**	23 200	**5 220**	7 000	8 500	4 800
211S	55	**2.1654**	100	**3.9370**	21	**.8268**	1.50	**.060**	2 040	**3.16**	43 600	**9 800**	29 000	**6 520**	6 300	7 500	4 300
212S	60	**2.3622**	110	**4.3307**	22	**.8661**	1.50	**.060**	2 280	**3.53**	47 500	**10 700**	32 500	**7 310**	6 000	7 000	4 000
213S	65	**2.5591**	120	**4.7244**	23	**.9055**	1.50	**.060**	2 770	**4.30**	55 900	**12 600**	40 500	**9 110**	5 300	6 300	3 600
214S	70	**2.7559**	125	**4.9213**	24	**.9449**	1.50	**.060**	3 060	**5.18**	60 500	**13 600**	45 000	**10 100**	5 000	6 000	3 400
215S	75	**2.9528**	130	**5.1181**	25	**.9843**	1.50	**.060**	3 350	**5.20**	66 300	**14 900**	49 000	**11 000**	4 800	5 600	3 200
216S	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.00	**.080**	3 630	**5.63**	72 800	**16 400**	53 000	**11 900**	4 500	5 300	3 000
217S	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.00	**.080**	4 260	**6.60**	83 200	**18 700**	64 000	**14 400**	4 300	5 000	2 800
218S	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.00	**.080**	5 050	**7.83**	95 600	**21 500**	73 500	**16 500**	3 800	4 500	2 600
219S	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.00	**.080**	5 670	**8.79**	108 000	**24 300**	81 500	**18 300**	3 600	4 300	2 400
220S	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.00	**.080**	6 450	**10.00**	124 000	**27 900**	93 000	**20 900**	3 400	4 000	2 400
221S	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.00	**.080**	7 280	**11.30**	133 000	**29 900**	104 000	**23 400**	3 200	3 800	2 200
222S	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.00	**.080**	8 190	**12.70**	143 000	**32 100**	118 000	**26 500**	3 000	3 600	2 000
224S	120	**4.7244**	215	**8.4646**	40	**1.5748**	2.00	**.080**	8 970	**13.90**	146 000	**32 800**	118 000	**26 500**	2 800	3 400	1 900

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

300S medium series

(see pg. 56 for hybrid series)

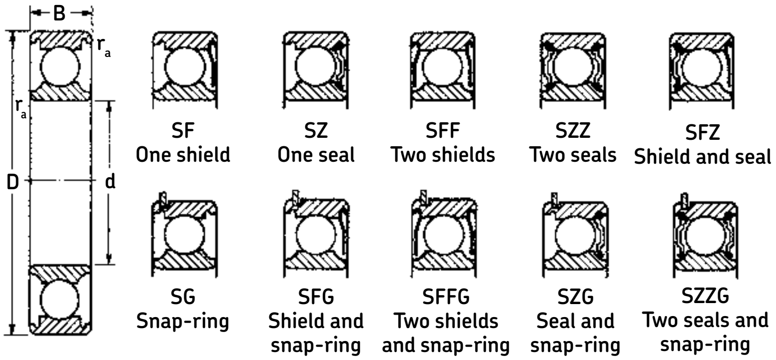


300S medium series bearings are used with heavy radial loads, two-directional thrust loads, or a combination of both.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3] N	Dynamic C[3] lbf	Static C_0 N	Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
300S	10	**.3937**	35	**1.3780**	11	**.4331**	.64	**.025**	303	**.47**	8 060	**1 810**	3 400	**764**	20 000	26 000	15 000
301S	12	**.4724**	37	**1.4567**	12	**.4724**	1.00	**.040**	381	**.59**	9 750	**2 190**	4 150	**933**	19 000	24 000	14 000
302S	15	**.5906**	42	**1.6535**	13	**.5118**	1.00	**.040**	439	**.68**	11 400	**2 560**	5 400	**1 210**	17 000	20 000	12 000
303S	17	**.6693**	47	**1.8504**	14	**.5512**	1.00	**.040**	535	**.83**	13 500	**3 030**	6 550	**1 470**	16 000	19 000	11 000
304S	20	**.7874**	52	**2.0472**	15	**.5906**	1.00	**.040**	632	**.98**	15 900	**3 570**	7 800	**1 750**	13 000	16 000	9 500
305S	25	**.9843**	62	**2.4409**	17	**.6693**	1.00	**.040**	864	**1.34**	21 200	**4 760**	10 800	**2 430**	11 000	14 000	7 500
306S	30	**1.1811**	72	**2.8346**	19	**.7480**	1.00	**.040**	1 210	**1.88**	28 100	**6 320**	16 000	**3 600**	9 000	11 000	6 300
307S	35	**1.3780**	80	**3.1496**	21	**.8268**	1.50	**.060**	1 460	**2.26**	33 200	**7 460**	19 000	**4 270**	8 500	10 000	6 000
308S	40	**1.5748**	90	**3.5433**	23	**.9055**	1.50	**.060**	1 820	**2.82**	41 000	**9 220**	24 000	**5 400**	7 500	9 000	5 000
309S	45	**1.7717**	100	**3.9370**	25	**.9843**	1.50	**.060**	2 440	**3.62**	52 700	**11 900**	31 500	**7 080**	6 700	8 000	4 500
310S	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.00	**.080**	2 900	**4.50**	61 800	**13 900**	38 000	**8 540**	6 300	7 500	4 300
311S	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.00	**.080**	3 410	**5.28**	71 500	**16 100**	45 000	**10 100**	5 600	6 700	3 800
312S	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.00	**.08**	3 950	**6.13**	81 900	**18 400**	52 000	**11 700**	5 000	6 000	3 400
313S	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.080**	4 540	**7.03**	92 300	**20 800**	60 000	**13 500**	4 800	5 600	3 200
314S	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.00	**.080**	5 160	**8.00**	104 000	**23 400**	68 000	**15 300**	4 500	5 300	3 000
315S	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.00	**.080**	5 820	**9.03**	114 000	**25 600**	76 500	**17 200**	4 300	5 000	2 800
316S	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.00	**.080**	6 515	**10.1**	124 000	**27 900**	86 500	**19 400**	3 800	4 500	2 600
317S	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**.100**	7 290	**11.3**	133 000	**29 900**	96 500	**21 700**	3 600	4 300	2 400
318S	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.50	**.100**	8 060	**12.5**	143 000	**32 100**	108 000	**24 300**	3 400	4 000	2 400
319S	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.50	**.100**	8 900	**13.8**	153 000	**34 400**	118 000	**26 500**	3 200	3 800	2 200
320S	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.50	**.100**	10 600	**16.5**	174 000	**39 100**	140 000	**31 500**	3 000	3 600	2 100
321S	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.50	**.100**	11 600	**18.0**	182 000	**40 800**	153 000	**34 400**	2 800	3 400	2 000
322S	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.50	**.100**	13 600	**21.1**	203 000	**45 600**	180 000	**40 500**	2 600	3 200	1 800
324S	120	**4.7244**	260	**10.2362**	55	**2.1654**	2.50	**.100**	13 600	**21.1**	208 000	**46 700**	186 000	**41 800**	2 400	3 000	—

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

400S heavy series

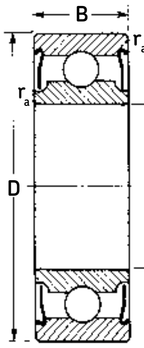


This series is made up of single-row radial conrad-type bearings made with bores ranging from 17 mm to 110 mm. They are used in applications with very heavy radial loads, two-directional thrust loads, or a combination of both.

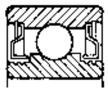
MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	Fillet radius[1)] r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3)] N	Basic radial load rating Dynamic C[3)] lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating[2)] Open and shielded Grease rpm	Speed rating[2)] Open and shielded Oil rpm	Speed rating[2)] Single and double sealed Grease rpm
403S	17	**.6693**	62	**2.4409**	17	**.6693**	1.0	**.04**	968	**1.50**	22 900	**5 150**	10 800	**2 430**	12 000	15 000	8 500
404S	20	**.7874**	72	**2.8346**	19	**.7480**	1.0	**.04**	1 370	**2.12**	30 700	**6 900**	15 000	**3 370**	10 000	13 000	7 300
405S	25	**.9843**	80	**3.1496**	21	**.8268**	1.5	**.06**	1 590	**2.47**	35 800	**8 050**	19 300	**4 340**	9 000	11 000	6 400
406S	30	**1.1811**	90	**3.5433**	23	**.9055**	1.5	**.06**	1 950	**3.02**	43 600	**9 800**	23 600	**5 310**	8 500	10 000	5 600
407S	35	**1.3780**	100	**3.9370**	25	**.9843**	1.5	**.06**	2 540	**3.94**	55 300	**12 400**	31 000	**6 970**	7 000	8 500	4 900
408S	40	**1.5748**	110	**4.3307**	27	**1.0630**	2.0	**.08**	2 980	**4.62**	63 700	**14 300**	36 500	**8 210**	6 700	8 000	4 400
409S	45	**1.7717**	120	**4.7244**	29	**1.1417**	2.0	**.08**	3 710	**5.75**	76 100	**17 100**	45 000	**10 100**	6 000	7 000	4 000
410S	50	**1.9685**	130	**5.1181**	31	**1.2205**	2.0	**.08**	4 520	**7.00**	87 100	**19 600**	52 000	**11 700**	5 200	6 300	3 700
411S	55	**2.1654**	140	**5.5118**	33	**1.2992**	2.0	**.08**	5 100	**7.90**	99 500	**22 400**	62 000	**13 900**	5 000	6 000	3 400
412S	60	**2.3622**	150	**5.9055**	35	**1.3780**	2.0	**.08**	5 710	**8.86**	108 000	**24 300**	69 500	**15 600**	4 800	5 600	3 100
413S	65	**2.5591**	160	**6.2992**	37	**1.4567**	2.0	**.08**	6 370	**9.87**	119 000	**26 800**	78 000	**17 500**	4 500	5 300	2 900
414S	70	**2.7559**	180	**7.0866**	42	**1.6535**	2.5	**.10**	8 510	**13.2**	143 000	**32 100**	104 000	**23 400**	3 800	4 500	2 600
415S	75	**2.9528**	190	**7.4803**	45	**1.7717**	2.5	**.10**	9 350	**14.50**	153 000	**34 400**	114 000	**25 600**	3 600	4 300	2 500
416S	80	**3.1496**	200	**7.8740**	48	**1.8898**	2.5	**.10**	10 200	**15.80**	163 000	**36 600**	125 000	**28 100**	3 400	4 000	2 300
417S	85	**3.3465**	210	**8.2677**	52	**2.0472**	3.0	**.12**	11 000	**17.10**	174 000	**39 100**	137 000	**30 800**	3 200	3 800	2 200
418S	90	**3.5433**	225	**8.8583**	54	**2.1260**	3.0	**.12**	12 800	**19.90**	186 000	**41 800**	150 000	**33 700**	3 000	3 600	2 100
419S[4)]	95	**3.7402**	250	**9.8425**	55	**2.1654**	3.0	**.12**	13 800	**21.40**	203 000	**45 600**	173 000	**38 900**	2 700	3 300	1 900
420S[4)]	100	**3.9370**	265	**10.4331**	60	**2.3622**	3.0	**.12**	15 900	**24.60**	225 000	**50 600**	200 000	**45 000**	2 500	3 100	1 800
421S[4)]	105	**4.1339**	290	**11.4173**	65	**2.5591**	3.0	**.12**	18 100	**28.00**	247 000	**55 500**	228 000	**51 300**	2 400	2 900	1 600
422S[4)]	110	**4.3307**	320	**12.5984**	70	**2.7559**	3.0	**.12**	20 300	**31.60**	270 000	**60 700**	260 000	**58 500**	2 100	2 600	1 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

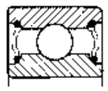
Cartridge-type bearings
SFFC, SZZC, SLLC



SFFC metal shields



SLLC removable metal shields



SZZC synthetic rubber shields

Cartridge-type bearings have an extra large grease chamber packed with high quality lubricant. For applications where space for a lubrication system is limited or conditions demand a larger grease supply inside bearing.

Note: Bearings designated SFFC have non-removable metal shields.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3] N	Dynamic C[3] lbf	Static C_0 N	Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
200SFFC	10	**.3937**	30	**1.1811**	14.29	**$^{9}/_{16}$**	.64	**.025**	181	**.28**	5 070	**1 140**	2 400	**540**	24 000	30 000	17 000
201SFFC	12	**.4724**	32	**1.2598**	15.88	**$^{5}/_{8}$**	.64	**.025**	252	**.39**	6 760	**1 520**	3 000	**674**	22 000	28 000	15 000
202SFFC	15	**.5906**	35	**1.3780**	15.88	**$^{5}/_{8}$**	.64	**.025**	290	**.45**	7 610	**1 710**	3 750	**843**	19 000	24 000	13 000
203SFFC	17	**.6693**	40	**1.5748**	17.46	**$^{11}/_{16}$**	.64	**.025**	361	**.56**	9 560	**2 150**	4 500	**1 010**	17 000	20 000	12 000
204SFFC	20	**.7874**	47	**1.8504**	20.64	**$^{13}/_{16}$**	1.0	**.04**	503	**.78**	13 000	**2 920**	6 700	**1 510**	15 000	18 000	10 000
205SFFC	25	**.9843**	52	**2.0472**	20.64	**$^{13}/_{16}$**	1.0	**.04**	568	**.88**	15 100	**3 390**	8 150	**1 830**	12 000	15 000	8 500
206SFFC	30	**1.1811**	62	**2.4409**	23.81	**$^{15}/_{16}$**	1.0	**.04**	819	**1.27**	20 800	**4 680**	11 400	**2 560**	10 000	13 000	7 500
207SFFC	35	**1.3780**	72	**2.8346**	26.99	**$1^{1}/_{16}$**	1.0	**.04**	1 140	**1.76**	26 500	**5 960**	15 300	**3 440**	9 000	11 000	6 300
208SFFC	40	**1.5748**	80	**3.1496**	30.16	**$1^{3}/_{16}$**	1.0	**.04**	1 450	**2.25**	32 500	**7 310**	20 000	**4 550**	8 500	10 000	5 600
209SFFC	45	**1.7717**	85	**3.3465**	30.16	**$1^{3}/_{16}$**	1.0	**.04**	1 640	**2.54**	36 400	**8 180**	22 800	**5 130**	7 500	9 000	5 000
210SFFC	50	**1.9685**	90	**3.5433**	30.16	**$1^{3}/_{16}$**	1.0	**.04**	1 610	**2.50**	35 100	**7 890**	23 200	**5 220**	7 000	8 500	4 800
211SFFC	55	**2.1654**	100	**3.9370**	33.34	**$1^{5}/_{16}$**	1.5	**.06**	2 040	**3.16**	39 700	**8 920**	29 000	**6 520**	6 300	7 500	4 300
213SFFC	65	**2.5591**	120	**4.7244**	38.10	**$1^{1}/_{2}$**	1.5	**.06**	3 050	**4.73**	62 400	**14 000**	44 000	**9 890**	5 300	6 300	3 600
214SFFC	70	**2.7559**	125	**4.9213**	39.69	**$1^{9}/_{16}$**	1.5	**.06**	3 050	**4.73**	62 400	**14 000**	44 000	**9 890**	5 000	6 000	3 400
216SFFC	80	**3.1496**	140	**5.5118**	44.45	**$1^{3}/_{4}$**	2.0	**.08**	3 630	**5.63**	78 000	**17 500**	53 000	**11 900**	4 500	5 300	3 000
304SFFC	20	**.7874**	52	**2.0472**	22.23	**$^{7}/_{8}$**	1.0	**.04**	632	**.98**	15 900	**3 570**	7 800	**1 750**	13 000	16 000	9 500
305SFFC	25	**.9843**	62	**2.4409**	25.40	**1**	1.0	**.04**	864	**1.34**	21 000	**4 770**	11 000	**2 470**	11 000	14 000	7 500
306SFFC	30	**1.1811**	72	**2.8346**	30.16	**$1^{3}/_{16}$**	1.0	**.04**	1 290	**2.00**	29 600	**6 650**	16 600	**3 730**	9 000	11 000	6 300
307SFFC	35	**1.3780**	80	**3.1496**	34.93	**$1^{3}/_{8}$**	1.5	**.06**	1 590	**2.47**	36 400	**8 180**	20 000	**4 500**	8 500	10 000	6 000
308SFFC	40	**1.5748**	90	**3.5433**	36.51	**$1^{7}/_{16}$**	1.5	**.06**	2 020	**3.13**	44 200	**9 940**	26 000	**5 850**	7 500	9 000	5 000
309SFFC	45	**1.7717**	100	**3.9370**	39.69	**$1^{9}/_{16}$**	1.5	**.06**	2 330	**3.62**	52 000	**11 700**	30 000	**6 740**	6 700	8 000	4 500
310SFFC	50	**1.9685**	110	**4.3307**	44.45	**$1^{3}/_{4}$**	2.0	**.08**	2 900	**4.50**	61 800	**13 900**	38 000	**8 540**	6 300	7 500	4 300
311SFFC	55	**2.1654**	120	**4.7244**	49.21	**$1^{15}/_{16}$**	2.0	**.08**	3 410	**5.28**	71 500	**16 100**	45 000	**10 100**	5 600	6 700	3 800
312SFFC	60	**2.3622**	130	**5.1181**	53.98	**$2^{1}/_{8}$**	2.0	**.08**	3 950	**6.13**	81 900	**18 400**	52 000	**11 700**	5 000	6 000	3 400
313SFFC	65	**2.5591**	140	**5.5118**	58.74	**$2^{5}/_{16}$**	2.0	**.08**	4 530	**7.03**	92 300	**20 700**	60 000	**13 500**	4 800	5 600	3 200
314SFFC	70	**2.7559**	150	**5.9055**	63.50	**$2^{1}/_{2}$**	2.0	**.08**	5 160	**8.00**	104 000	**23 400**	68 000	**15 300**	4 500	5 300	3 000
315SFFC	75	**2.9528**	160	**6.2992**	68.26	**$2^{11}/_{16}$**	2.0	**.08**	6 530	**10.1**	124 000	**27 900**	85 000	**19 100**	4 300	5 000	2 800
316SFFC	80	**3.1496**	170	**6.6929**	68.26	**$2^{11}/_{16}$**	2.0	**.08**	7 280	**11.3**	133 000	**29 900**	95 000	**21 400**	3 800	4 500	2 600
317SFFC	85	**3.3465**	180	**7.0866**	73.03	**$2^{7}/_{8}$**	2.5	**.10**	7 280	**11.3**	133 000	**29 900**	96 500	**21 700**	3 600	4 300	2 400
318SFFC	90	**3.5433**	190	**7.4803**	73.03	**$2^{7}/_{8}$**	2.5	**.10**	8 060	**12.5**	143 000	**32 100**	108 000	**24 300**	3 400	4 000	2 400
320SFFC	100	**3.9370**	215	**8.4646**	82.55	**$3^{1}/_{4}$**	2.5	**.10**	11 600	**18.0**	182 000	**40 900**	150 000	**33 700**	3 000	3 600	2 100

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = XF_R + YF_A$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Z = Number of balls

D = Ball diameter

X = Radial load factor

Y = Thrust load factor

e = Limiting factor for F_A/F_R

Internal radial clearance	$\frac{F_A}{ZD^2}$ Units N, mm	$\frac{F_A}{ZD^2}$ Units lb, in.	$\frac{F_A}{F_R} > e$ X	$\frac{F_A}{F_R} > e$ Y	e
	0.172	25		2.30	0.19
	0.345	50		1.99	0.22
Standard	0.689	100		1.71	0.26
(ABMA C0)	1.03	150		1.56	0.28
	1.38	200	0.56	1.45	0.30
	2.07	300		1.31	0.34
	3.45	500		1.15	0.38
	5.17	750		1.04	0.42
	6.89	1000		1.00	0.44
	0.172	25		1.47	0.38
	0.345	50		1.40	0.40
	0.689	100		1.30	0.43
Loose	1.03	150		1.23	0.46
(ABMA C3)	1.38	200	0.44	1.19	0.47
	2.07	300		1.12	0.50
	3.45	500		1.02	0.55
	5.17	750		1.00	0.56
	6.89	1000		1.00	0.56

When $F_A/F_R \le e$, use X = 1.0, Y = 0.
Values of Y and e for loads not shown are obtained from chart below.

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

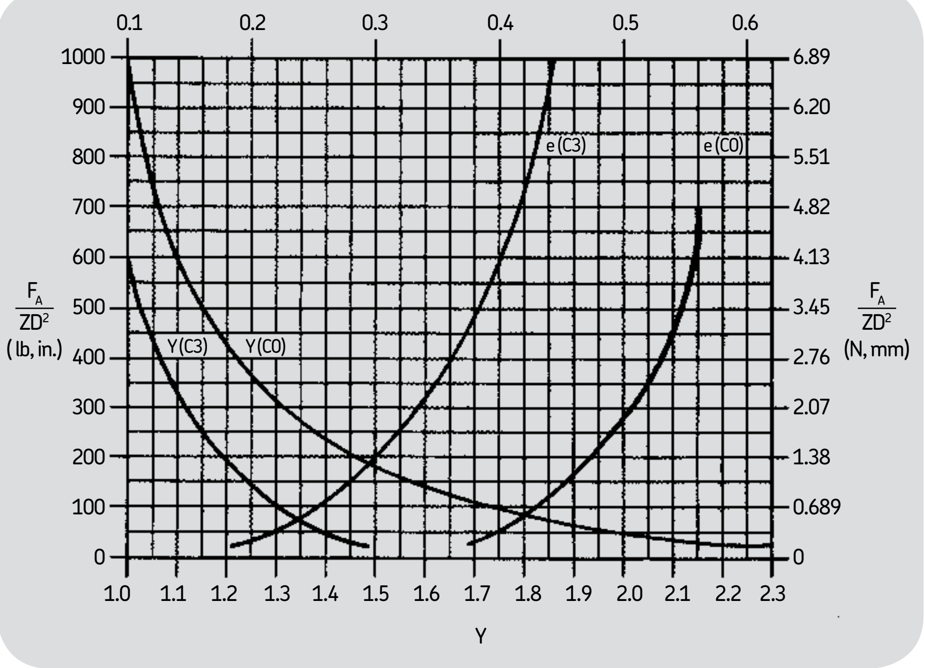
or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic load rating

P = Dynamic equivalent radial load

n = Speed in rpm



Static equivalent radial load

$P_0 = 0.6\ F_R + 0.5\ F_A$

P_0 is always $\ge F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Single-row deep groove ball bearings, S-type

Dynamic equivalent radial load and life calculation examples

Bearing size: 309S
Speed = 2000 rpm
Basic dynamic load rating (C) = 11900 lbf
ZD^2 = 3.62

ABMA C0 internal clearance

Case 1

Radial load (F_R) = 1890

Equivalent load (P) = $X F_R + Y F_A$

$P = F_R = 1890$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11900}{1890}\right)^3 = 249.6 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11900}{1890}\right)$$

= 2080 Hrs

Case 2

Radial load (F_R) = 1890
Thrust load (F_A) = 1250
Equivalent load (P) = $X F_R + Y F_A$
$F_A/ZD^2 = 1250/3.62 = 345$
$X = 0.56$
$Y = 1.27$
$P = 0.56 \times 1890 + 1.27 \times 1250 = 2646$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11900}{2646}\right)^3 = 91.0 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11900}{2646}\right)^3$$

= 758 Hrs

Case 3

Thrust load (F_A) = 1250
Equivalent load (P) = $X F_R + Y F_A$
$F_A/ZD^2 = 1250/3.62 = 345$
$Y = 1.27$
$P = 1.27 \times 1250 = 1588$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11900}{1588}\right)^3 = 420.8 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L 10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11900}{1588}\right)^3$$

= 3507 Hrs

ABMA C3 internal clearance

Case 1

Radial load (F_R) = 1890

Equivalent load (P) = $X F_R + Y F_A$

$P = F_R = 1890$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11900}{1890}\right)^3 = 249.6 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11900}{1890}\right)^3$$

= 2080 Hrs

Case 2

Radial load (F_R) = 1890
Thrust load (F_A) = 1250
Equivalent load (P) = $X F_R + Y F_A$
$F_A/ZD^2 = 1250/3.62 = 345$
$X = 0.44$
$Y = 1.08$
$P = 0.44 \times 1890 + 1.08 \times 1250 = 2182$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11900}{2182}\right)^3 = 162.2 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L 10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11900}{2182}\right)^3$$

= 1352 Hrs

Case 3

Thrust load (F_A) = 1250
Equivalent load (P) = $X F_R + Y F_A$
$F_A/ZD^2 = 1250/3.62 = 345$
$Y = 1.08$
$P = 1.08 \times 1250 = 1350$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11900}{1350}\right)^3 = 684.9 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L 10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11900}{1350}\right)^3$$

= 5708 Hrs

Hybrid ceramic ball bearings

Because turnaround time is critical in the electric motor and generator repair business, a complete range of MRC hybrid bearings (including XL-bore sizes and sealed or shielded configurations) are in stock and readily available when you need them. That's the MRC brand advantage.

In addition to those listed, other sizes of the 200S and 300S series can be supplied through the MTO program. Most series of angular contact ball bearings can also be supplied through MTO.

Prevents electrical arcing

When electrical current passes across bearings, a washboard or fluting pattern appears on the raceways, in addition to a darkened grey appearance. This damage usually results in excessive noise which requires that the bearing be removed. Besides the surface damage, premature aging of the lubricant also occurs. The natural insulating properties of ceramic material eliminates this type of damage.

Lower maintenance costs

Maintenance costs can quickly add up if a bearing must be changed frequently. Anything that extends the service life of a bearing without increasing maintenance costs will reduce the operating cost of the equipment. Though the initial cost of a hybrid bearing is higher than a standard steel bearing, the difference is quickly recovered in maintenance savings. Less friction also results in lower energy costs.

Extended service life

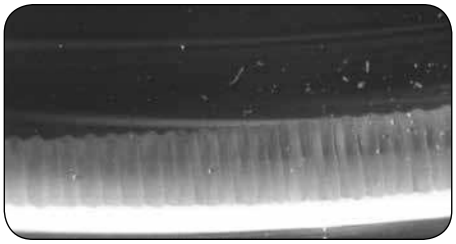
Most bearings are designed into applications based on loading conditions and do not take into account factors such as lubrication, contamination and maintenance. Without proper attention to these external factors, a steel bearing rarely reaches its design L10 life and therefore has a shortened service life. Because of the properties of ceramics, the service life of a hybrid bearing is up to 10 times that of a standard steel bearing. And longer service life reduces the need for maintenance on your machine as well as the costly interruptions in production.

Extended grease life

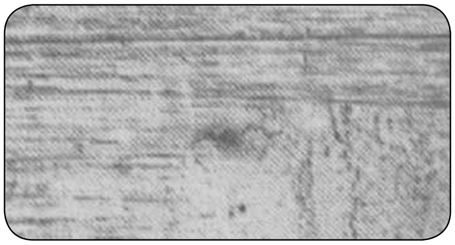
In environments that place high demands on the bearing lubricant, standard bearings experience surface wear because of insufficient lubricant film. Bearings can fail if the initial grease charge is not replenished within an acceptable period of time. Hybrid bearings run cooler and can operate with thinner lubricant films, so there is less aging of the grease and the required relubrication interval will be longer. The result is increased service life compared to standard bearings in the same operating conditions.

Lower operating temperatures

The heat generated in bearings is attributable to viscous friction from lubrication and load dependent friction between the balls and raceways. The source of the loading is external as well as internal. There is little that can be done to reduce the external loads. However, since ceramic balls have only 40% of the density of steel balls, the centrifugal load generated by the balls is less and the internal friction is lower. This provides cooler running for the same operating conditions or, if applicable, a higher rotational speed while maintaining the same temperature.



Fluting created by electrical arcing



Wear caused by static vibration

Reduced wear from contamination

In contaminated environments, solid particles create dents in the rolling surfaces and raised edges around those dents. This condition causes noise and premature wear as the steel balls roll over those surfaces. The harder ceramic ball material smooths the surface roughness with no material removal. Also, there is little evidence of adhesive wear as seen in steel bearings. This reduces the noise and wear, which extends the bearing service life.

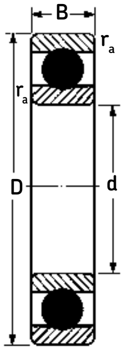
Reduced wear from vibration

In equipment exposed to static vibration, there is an inherent risk of false brinelling, (the wearing away of the surfaces within the ball and raceway contacts) which can eventually lead to spalling and premature failure. Because of the lighter weight ceramic balls and dissimilar materials, the risk of false brinelling damage is much less.

Hybrid ceramic ball bearings

Material properties	Bearing steel	Bearing silicon nitride	Benefit
Mechanical properties			
Density [g/cm3]	7.9	3.2	Lower density reduces the centrifugal force and thereby reduces bearing friction.
Hardness, HV10 [kg/mm2]	700	1600	Higher hardness promotes wear resistance against hard particles and lower plastic deformation.
Modulus of elasticity, E [GPa]	210	310	Higher modulus of elasticity increases the bearing stiffness. Hybrid bearings deflect less under load, providing more predictable performance.
Coefficient of thermal expansion [/C]	12×10^{-6}	63×10^{-6}	Lower coefficient of expansion reduces the effects of ring temperature difference resulting in more stable clearance or preload.
Electrical properties			
Electrical resistivity [Wm]	0.4×10^{-6} (conductor)	10^{12} (insulator)	The ceramic balls break the electrical current (DC) path and act as an insulator.
Relative dielectric constant	N/A	4.2 to 6.1	The ceramic balls break the electrical current (AC) path and act as a large impedance.
Magnetic field influence	Yes	No	Ceramic balls do not respond to magnetic forces.
Chemical resistance	Reactive	Inert	Ceramic to steel contacts show no micro-welding and do not seize during poor lubrication.

100KS
extra light hybrid series



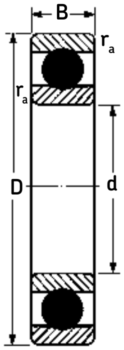
The 100KS extra light hybrid series consists of single-row radial conrad-type bearings made with bores from 25 mm to 100 mm for use in applications that would use the characteristics of traditional 100KS series, but also utilize the benefits of the hybrid solution.

MRC bearing number	Bore		Outside diameter		Width		Fillet radius[1]		Basic radial load rating				Speed rating	
									Dynamic		Static			
	d		D		B		r_a		C[2]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
105KS-HYB#1	25	**0.9843**	47	**1.8504**	12	**0.4724**	0.64	**0.025**	11 900	**2 680**	6 550	**1 470**	18 000	21 600
105KSFF-HYB#1	25	**0.9843**	47	**1.8504**	12	**0.4724**	0.64	**0.025**	11 900	**2 680**	6 550	**1 470**	18 000	-
105KSZZ-HYB#1	25	**0.9843**	47	**1.8504**	12	**0.4724**	0.64	**0.025**	11 900	**2 680**	6 550	**1 470**	9 500	-
106KS-HYB#1	30	**1.1811**	55	**2.1654**	13	**0.5118**	1.00	**0.039**	13 800	**3 100**	8 300	**1 870**	14 400	18 000
106KSFF-HYB#1	30	**1.1811**	55	**2.1654**	13	**0.5118**	1.00	**0.039**	13 800	**3 100**	8 300	**1 870**	14 400	-
106KSZZ-HYB#1	30	**1.1811**	55	**2.1654**	13	**0.5118**	1.00	**0.039**	13 800	**3 100**	8 300	**1 870**	8 000	-
107KS-HYB#1	35	**1.3780**	62	**2.4409**	14	**0.5512**	1.00	**0.039**	16 800	**3 780**	10 200	**2 290**	12 000	15 600
107KSFF-HYB#1	35	**1.3780**	62	**2.4409**	14	**0.5512**	1.00	**0.039**	16 800	**3 780**	10 200	**2 290**	12 000	15 600
107KSZZ-HYB#1	35	**1.3780**	62	**2.4409**	14	**0.5512**	1.00	**0.039**	16 800	**3 780**	10 200	**2 290**	7 000	-
108KS-HYB#1	40	**1.5748**	68	**2.6772**	15	**0.5906**	1.00	**0.039**	17 800	**4 000**	11 000	**2 470**	11 400	14 400
108KSFF-HYB#1	40	**1.5748**	68	**2.6772**	15	**0.5906**	1.00	**0.039**	17 800	**4 000**	11 000	**2 470**	11 400	14 400
108KSZZ-HYB#1	40	**1.5748**	68	**2.6772**	15	**0.5906**	1.00	**0.039**	17 800	**4 000**	11 000	**2 470**	6 300	-
109KS-HYB#1	45	**1.7717**	75	**2.9528**	16	**0.6299**	1.00	**0.039**	22 100	**4 970**	14 600	**3 280**	10 800	13 200
109KSFF-HYB#1	45	**1.7717**	75	**2.9528**	16	**0.6299**	1.00	**0.039**	22 100	**4 970**	14 600	**3 280**	10 800	13 200
109KSZZ-HYB#1	45	**1.7717**	75	**2.9528**	16	**0.6299**	1.00	**0.039**	22 100	**4 970**	14 600	**3 280**	5 600	-
110KS-HYB#1	50	**1.9685**	80	**3.1496**	16	**0.6299**	1.00	**0.039**	22 900	**5 150**	16 000	**3 600**	10 200	12 000
110KSFF-HYB#1	50	**1.9685**	80	**3.1496**	16	**0.6299**	1.00	**0.039**	22 900	**5 150**	16 000	**3 600**	10 200	12 000
110KSZZ-HYB#1	50	**1.9685**	80	**3.1496**	16	**0.6299**	1.00	**0.039**	22 900	**5 150**	16 000	**3 600**	5 000	-
111KS-HYB#1	55	**2.1654**	90	**3.5433**	18	**0.7087**	1.00	**0.039**	29 600	**6 650**	21 200	**4 770**	9 000	10 800
111KSFF-HYB#1	55	**2.1654**	90	**3.5433**	18	**0.7087**	1.00	**0.039**	29 600	**6 650**	21 200	**4 770**	9 000	10 800
111KSZZ-HYB#1	55	**2.1654**	90	**3.5433**	18	**0.7087**	1.00	**0.039**	29 600	**6 650**	21 200	**4 770**	4 500	-
112KS-HYB#1	60	**2.3622**	95	**3.7402**	18	**0.7087**	1.00	**0.039**	30 700	**6 900**	23 200	**5 220**	8 040	9 600
112KSFF-HYB#1	60	**2.3622**	95	**3.7402**	18	**0.7087**	1.00	**0.039**	30 700	**6 900**	23 200	**5 220**	8 040	9 600
112KSZZ-HYB#1	60	**2.3622**	95	**3.7402**	18	**0.7087**	1.00	**0.039**	30 700	**6 900**	23 200	**5 220**	4 300	-
113KS-HYB#1	65	**2.5591**	100	**3.9370**	18	**0.7087**	1.00	**0.039**	31 900	**7 170**	25 000	**5 620**	7 560	9 000
113KSFF-HYB#1	65	**2.5591**	100	**3.9370**	18	**0.7087**	1.00	**0.039**	31 900	**7 170**	25 000	**5 620**	7 560	9 000
113KSZZ-HYB#1	65	**2.5591**	100	**3.9370**	18	**0.7087**	1.00	**0.039**	31 900	**7 170**	25 000	**5 620**	4 000	-
114KS-HYB#1	70	**2.7559**	110	**4.3307**	20	**0.7874**	1.00	**0.039**	39 700	**8 920**	31 000	**6 970**	7 200	8 400
114KSFF-HYB#1	70	**2.7559**	110	**4.3307**	20	**0.7874**	1.00	**0.039**	39 700	**8 920**	31 000	**6 970**	7 200	8 400
114KSZZ-HYB#1	70	**2.7559**	110	**4.3307**	20	**0.7874**	1.00	**0.039**	39 700	**8 920**	31 000	**6 970**	3 600	-

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.

	Bore		Outside diameter		Width		Fillet radius[1)]		Basic radial load rating				Speed rating	
									Dynamic		Static			
MRC bearing number	d		D		B		r_a		$C^{2)}$		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
115KS-HYB#1	75	**2.9528**	115	**4.5276**	20	**0.7874**	1.00	**0.039**	41600	**9350**	33500	**7530**	6720	8040
115KSFF-HYB#1	75	**2.9528**	115	**4.5276**	20	**0.7874**	1.00	**0.039**	41600	**9350**	33500	**7530**	6720	8040
115KSZZ-HYB#1	75	**2.9528**	115	**4.5276**	20	**0.7874**	1.00	**0.039**	41600	**9350**	33500	**7530**	3400	-
116KS-HYB#1	80	**3.1496**	125	**4.9213**	22	**0.8661**	1.00	**0.039**	49400	**11110**	40000	**8990**	6360	7560
116KSFF-HYB#1	80	**3.1496**	125	**4.9213**	22	**0.8661**	1.00	**0.039**	49400	**11110**	40000	**8990**	6360	7560
116KSZZ-HYB#1	80	**3.1496**	125	**4.9213**	22	**0.8661**	1.00	**0.039**	49400	**11110**	40000	**8990**	3200	-
117KS-HYB#1	85	**3.3465**	130	**5.1181**	22	**0.8661**	1.00	**0.039**	52000	**11690**	43000	**9670**	6000	7200
117KSFF-HYB#1	85	**3.3465**	130	**5.1181**	22	**0.8661**	1.00	**0.039**	52000	**11690**	43000	**9670**	6000	7200
117KSZZ-HYB#1	85	**3.3465**	130	**5.1181**	22	**0.8661**	1.00	**0.039**	52000	**11690**	43000	**9670**	3000	-
118KS-HYB#1	90	**3.5433**	140	**5.5118**	24	**0.9449**	1.50	**0.059**	60500	**13600**	50000	**11240**	5760	6720
118KSFF-HYB#1	90	**3.5433**	140	**5.5118**	24	**0.9449**	1.50	**0.059**	60500	**13600**	50000	**11240**	5760	6720
118KSZZ-HYB#1	90	**3.5433**	140	**5.5118**	24	**0.9449**	1.50	**0.059**	60500	**13600**	50000	**11240**	2800	-
119KS-HYB#1	95	**3.7402**	145	**5.7087**	24	**0.9449**	1.50	**0.059**	63700	**14320**	54000	**12140**	5400	6360
119KSFF-HYB#1	95	**3.7402**	145	**5.7087**	24	**0.9449**	1.50	**0.059**	63700	**14320**	54000	**12140**	5400	6360
119KSZZ-HYB#1	95	**3.7402**	145	**5.7087**	24	**0.9449**	1.50	**0.059**	63700	**14320**	54000	**12140**	2800	-
120KS-HYB#1	100	**3.9370**	150	**5.9055**	24	**0.9449**	1.50	**0.059**	63700	**14320**	54000	**12140**	5160	6000
120KSFF-HYB#1	100	**3.9370**	150	**5.9055**	24	**0.9449**	1.50	**0.059**	63700	**14320**	54000	**12140**	5160	6000
120KSZZ-HYB#1	100	**3.9370**	150	**5.9055**	24	**0.9449**	1.50	**0.059**	63700	**14320**	54000	**12140**	2600	-

200S
light hybrid series



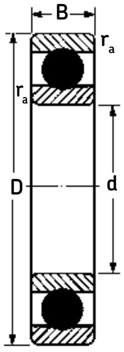
The 200S light hybrid series consists of single-row radial conrad-type bearings made with bores from 25 mm to 180 mm for use in applications that would use the characteristics of traditional 200S series, but also utilize the benefits of the hybrid solution.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	Basic radial load rating Dynamic $C^{2)}$ N	lbf	Static C_0 N	lbf	Speed rating Grease rpm	Oil rpm
205S-HYB#1	25	**0.9843**	52	**2.0472**	15	**0.5906**	1.0	**0.039**	14800	**3330**	7800	**1750**	14400	18000
205SFF-HYB#1	25	**0.9843**	52	**2.0472**	15	**0.5906**	1.0	**0.039**	14800	**3330**	7800	**1750**	14400	18000
205SZZ-HYB#1	25	**0.9843**	52	**2.0472**	15	**0.5906**	1.0	**0.039**	14800	**3330**	7800	**1750**	8500	-
206S-HYB#1	30	**1.1811**	62	**2.4409**	16	**0.6299**	1.0	**0.039**	20300	**4560**	11200	**2520**	12000	15600
206SFF-HYB#1	30	**1.1811**	62	**2.4409**	16	**0.6299**	1.0	**0.039**	20300	**4560**	11200	**2520**	12000	15600
206SZZ-HYB#1	30	**1.1811**	62	**2.4409**	16	**0.6299**	1.0	**0.039**	20300	**4560**	11200	**2520**	7500	-
207S-HYB#1	35	**1.3780**	72	**2.8346**	17	**0.6693**	1.0	**0.039**	27000	**6070**	15300	**3440**	10800	13200
207SFF-HYB#1	35	**1.3780**	72	**2.8346**	17	**0.6693**	1.0	**0.039**	27000	**6070**	15300	**3440**	10800	13200
207SZZ-HYB#1	35	**1.3780**	72	**2.8346**	17	**0.6693**	1.0	**0.039**	27000	**6070**	15300	**3440**	6300	-
208S-HYB#1	40	**1.5748**	80	**3.1496**	18	**0.7087**	1.0	**0.039**	32500	**7310**	19000	**4270**	10200	12000
208SFF-HYB#1	40	**1.5748**	80	**3.1496**	18	**0.7087**	1.0	**0.039**	32500	**7310**	19000	**4270**	10200	12000
208SZZ-HYB#1	40	**1.5748**	80	**3.1496**	18	**0.7087**	1.0	**0.039**	32500	**7310**	19000	**4270**	5600	-
209S-HYB#1	45	**1.7717**	85	**3.3465**	19	**0.7480**	1.0	**0.039**	35100	**7890**	21600	**4860**	9000	10800
209SFF-HYB#1	45	**1.7717**	85	**3.3465**	19	**0.7480**	1.0	**0.039**	35100	**7890**	21600	**4860**	9000	10800
209SZZ-HYB#1	45	**1.7717**	85	**3.3465**	19	**0.7480**	1.0	**0.039**	35100	**7890**	21600	**4860**	5000	-
210S-HYB#1	50	**1.9685**	90	**3.5433**	20	**0.7874**	1.0	**0.039**	37100	**8340**	23200	**5220**	8400	10200
210SFF-HYB#1	50	**1.9685**	90	**3.5433**	20	**0.7874**	1.0	**0.039**	37100	**8340**	23200	**5220**	8400	10200
210SZZ-HYB#1	50	**1.9685**	90	**3.5433**	20	**0.7874**	1.0	**0.039**	37100	**8340**	23200	**5220**	4800	-
211S-HYB#1	55	**2.1654**	100	**3.9370**	21	**0.8268**	1.5	**0.059**	46200	**10390**	29000	**6520**	7500	9000
211SFF-HYB#1	55	**2.1654**	100	**3.9370**	21	**0.8268**	1.5	**0.059**	46200	**10390**	29000	**6520**	7500	9000
211SZZ-HYB#1	55	**2.1654**	100	**3.9370**	21	**0.8268**	1.5	**0.059**	46200	**10390**	29000	**6520**	4300	-
212S-HYB#1	60	**2.3622**	110	**4.3307**	22	**0.8661**	1.5	**0.059**	55300	**12430**	36000	**8090**	7200	8400
212SFF-HYB#1	60	**2.3622**	110	**4.3307**	22	**0.8661**	1.5	**0.059**	55300	**12430**	36000	**8090**	7200	8400
212SZZ-HYB#1	60	**2.3622**	110	**4.3307**	22	**0.8661**	1.5	**0.059**	55300	**12430**	36000	**8090**	4000	-
213S-HYB#1	65	**2.5591**	120	**4.7244**	23	**0.9055**	1.5	**0.059**	58500	**13150**	40500	**9100**	6300	7500
213SFF-HYB#1	65	**2.5591**	120	**4.7244**	23	**0.9055**	1.5	**0.059**	58500	**13150**	40500	**9100**	6300	7500
213SZZ-HYB#1	65	**2.5591**	120	**4.7244**	23	**0.9055**	1.5	**0.059**	58500	**13150**	40500	**9100**	3600	-
214S-HYB#1	70	**2.7559**	125	**4.9213**	24	**0.9449**	1.5	**0.059**	63700	**14320**	45000	**10120**	6000	7200
214SFF-HYB#1	70	**2.7559**	125	**4.9213**	24	**0.9449**	1.5	**0.059**	63700	**14320**	45000	**10120**	6000	7200
214SZZ-HYB#1	70	**2.7559**	125	**4.9213**	24	**0.9449**	1.5	**0.059**	63700	**14320**	45000	**10120**	3400	-

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Basic radial load rating Dynamic $C^{2)}$ N	lbf	Static C_0 N	lbf	Speed rating Grease rpm	Oil rpm
215S-HYB#1	75	**2.9528**	130	**5.1181**	25	**0.9843**	1.5	**0.059**	68900	**15490**	49000	**11020**	5700	6700
215SFF-HYB#1	75	**2.9528**	130	**5.1181**	25	**0.9843**	1.5	**0.059**	68900	**15490**	49000	**11020**	5700	6700
215SZZ-HYB#1	75	**2.9528**	130	**5.1181**	25	**0.9843**	1.5	**0.059**	68900	**15490**	49000	**11020**	3200	-
216S-HYB#1	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.0	**0.079**	72800	**16370**	55000	**12360**	5400	6300
217S-HYB#1	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.0	**0.079**	87100	**19580**	64000	**14390**	5100	6000
218S-HYB#1	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.0	**0.079**	101000	**22710**	73500	**16520**	4500	5400
219S-HYB#1	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.0	**0.079**	114000	**25630**	81500	**18320**	4300	5100
220S-HYB#1	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.0	**0.079**	127000	**28550**	93000	**20910**	4000	4900
222S-HYB#1	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.0	**0.079**	151000	**33950**	118000	**26530**	3600	4300
224S-HYB#1	120	**4.7244**	215	**8.4646**	40	**1.5748**	2.0	**0.079**	146000	**32820**	118000	**26530**	3300	4000
226S-HYB#1	130	**5.1181**	230	**9.0551**	40	**1.5748**	3.0	**0.118**	156000	**35070**	132000	**29670**	2900	3600
228S-HYB#1	140	**5.5118**	250	**9.8425**	42	**1.6535**	3.0	**0.118**	165000	**37090**	150000	**33720**	2700	3400
230S-HYB#1	150	**5.9055**	270	**10.6299**	45	**1.7717**	3.0	**0.118**	174000	**39120**	166000	**37320**	2500	3200
232S-HYB#1	160	**6.2992**	290	**11.4173**	48	**1.8898**	3.0	**0.118**	186000	**41810**	186000	**41810**	2300	3000
236S-HYB#1	180	**7.0866**	320	**12.5984**	52	**2.0472**	4.0	**0.157**	229000	**51480**	240000	**53950**	2000	2600

300S
medium hybrid series



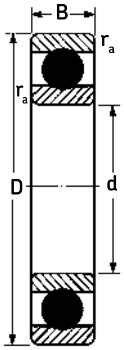
The 300S medium hybrid series consists of single-row radial conrad-type bearings made with bores from 30 mm to 180 mm for use in applications that would use the characteristics of traditional 300S series, but also utilize the benefits of the hybrid solution.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating Dynamic $C^{2)}$ N	Basic radial load rating Dynamic $C^{2)}$ lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating Grease rpm	Speed rating Oil rpm
306S-HYB#1	30	1.1811	72	2.8346	19	0.7480	1	0.039	29600	6650	16000	3600	10800	13200
306SFF-HYB#1	30	1.1811	72	2.8346	19	0.7480	1	0.039	29600	6650	16000	3600	10800	13200
306SZZ-HYB#1	30	1.1811	72	2.8346	19	0.7480	1	0.039	29600	6650	16000	3600	6300	-
307S-HYB#1	35	1.3780	80	3.1496	21	0.8268	1.5	0.059	35100	7890	19000	4270	10200	12000
307SFF-HYB#1	35	1.3780	80	3.1496	21	0.8268	1.5	0.059	35100	7890	19000	4270	10200	12000
307SZZ-HYB#1	35	1.3780	80	3.1496	21	0.8268	1.5	0.059	35100	7890	19000	4270	6000	-
308S-HYB#1	40	1.5748	90	3.5433	23	0.9055	1.5	0.059	42300	9510	24000	5400	9000	10800
308SFF-HYB#1	40	1.5748	90	3.5433	23	0.9055	1.5	0.059	42300	9510	24000	5400	9000	10800
308SZZ-HYB#1	40	1.5748	90	3.5433	23	0.9055	1.5	0.059	42300	9510	24000	5400	5000	-
309S-HYB#1	45	1.7717	100	3.9370	25	0.9843	1.5	0.059	55300	12430	31500	7080	8000	9600
309SFF-HYB#1	45	1.7717	100	3.9370	25	0.9843	1.5	0.059	55300	12430	31500	7080	8000	9600
309SZZ-HYB#1	45	1.7717	100	3.9370	25	0.9843	1.5	0.059	55300	12430	31500	7080	4500	-
310S-HYB#1	50	1.9685	110	4.3307	27	1.0630	2	0.079	65000	14610	38000	8540	7500	9000
310SFF-HYB#1	50	1.9685	110	4.3307	27	1.0630	2	0.079	65000	14610	38000	8540	7500	9000
310SZZ-HYB#1	50	1.9685	110	4.3307	27	1.0630	2	0.079	65000	14610	38000	8540	4300	-
311S-HYB#1	55	2.1654	120	4.7244	29	1.1417	2	0.079	74100	16660	45000	10120	6700	8000
311SFF-HYB#1	55	2.1654	120	4.7244	29	1.1417	2	0.079	74100	16660	45000	10120	6700	8000
311SZZ-HYB#1	55	2.1654	120	4.7244	29	1.1417	2	0.079	74100	16660	45000	10120	3800	-
312S-HYB#1	60	2.3622	130	5.1181	31	1.2205	2	0.079	85200	19150	52000	11690	6000	7200
312SFF-HYB#1	60	2.3622	130	5.1181	31	1.2205	2	0.079	85200	19150	52000	11690	6000	7200
312SZZ-HYB#1	60	2.3622	130	5.1181	31	1.2205	2	0.079	85200	19150	52000	11690	3400	-
313S-HYB#1	65	2.5591	140	5.5118	33	1.2992	2	0.079	97500	21920	60000	13490	5700	6800
313SFF-HYB#1	65	2.5591	140	5.5118	33	1.2992	2	0.079	97500	21920	60000	13490	5700	6800
313SZZ-HYB#1	65	2.5591	140	5.5118	33	1.2992	2	0.079	97500	21920	60000	13490	3200	-
314S-HYB#1	70	2.7559	150	5.9055	35	1.3780	2	0.079	111000	24950	68000	15290	5400	6400
314SFF-HYB#1	70	2.7559	150	5.9055	35	1.3780	2	0.079	111000	24950	68000	15290	5400	6400
314SZZ-HYB#1	70	2.7559	150	5.9055	35	1.3780	2	0.079	111000	24950	68000	15290	3000	-
315S-HYB#1	75	2.9528	160	6.2992	37	1.4567	2	0.079	119000	26750	76500	17200	5100	6100
315SFF-HYB#1	75	2.9528	160	6.2992	37	1.4567	2	0.079	119000	26750	76500	17200	5100	6100
315SZZ-HYB#1	75	2.9528	160	6.2992	37	1.4567	2	0.079	119000	26750	76500	17200	2800	-

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating: Dynamic $C^{2)}$ N	Basic radial load rating: Dynamic lbf	Basic radial load rating: Static C_0 N	Basic radial load rating: Static lbf	Speed rating: Grease rpm	Speed rating: Oil rpm
316S-HYB#1	80	**3.1496**	170	**6.6929**	39	**1.5354**	2	**0.079**	130000	**29230**	86500	**19450**	4500	5400
316SF-HYB#1	80	**3.1496**	170	**6.6929**	39	**1.5354**	2	**0.079**	130000	**29230**	86500	**19450**	4500	5400
316SFF-HYB#1	80	**3.1496**	170	**6.6929**	39	**1.5354**	2	**0.079**	130000	**29230**	86500	**19450**	4500	5400
317S-HYB#1	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**0.098**	140000	**31470**	96500	**21690**	4300	5100
318S-HYB#1	90	**3.5433**	180	**7.0866**	41	**1.6142**	2.5	**0.098**	151000	**33950**	108000	**24280**	4000	4800
319S-HYB#1	95	**3.7402**	200	**7.8740**	41	**1.6142**	2.5	**0.098**	159000	**35740**	118000	**26530**	3800	4500
320S-HYB#3	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**0.098**	174000	**39120**	140000	**31470**	3600	4300
322S-HYB#3	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**0.098**	187500	**42150**	174800	**39300**	3100	3700
322SF-HYB#3	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**0.098**	187500	**42150**	174800	**39300**	3100	3700
324S-HYB#3	120	**4.7244**	260	**10.2362**	55	**2.1654**	2.5	**0.098**	200300	**45030**	198700	**44670**	2800	3600
326S-HYB#3	130	**5.1181**	280	**11.0236**	58	**2.2835**	4	**0.157**	212200	**47700**	222800	**50090**	2600	3400
328S-HYB#3	140	**5.5118**	300	**11.8110**	62	**2.4409**	4	**0.157**	265900	**59780**	265900	**59780**	2400	3200
330S-HYB#3	150	**5.9055**	320	**12.5984**	65	**2.5591**	4	**0.157**	288700	**64900**	306500	**68900**	2200	3000
332S-HYB#3	160	**6.2992**	340	**13.3858**	68	**2.6772**	4	**0.157**	330900	**74390**	391100	**87920**	2000	2800
334S-HYB#3	170	**6.6929**	360	**14.1732**	72	**2.8346**	4	**0.157**	330900	**74390**	391100	**87920**	1800	2600
336S-HYB#3	180	**7.0866**	380	**14.9606**	75	**2.9528**	4	**0.157**	330900	**74390**	391100	**87920**	1600	2400

HNCR
hybrid series single-row deep groove (SRDG) ball bearings



Next-generation bearing steel

Featuring extreme corrosion resistance, superior fatigue life and increase material hardness, HNCR represents the next-generation bearing material of choice – one that's enabled MRC to produce the industry's first corrosion-resistant steel ball bearing.

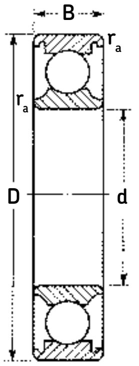
All MRC HNCR hybrid SRDG ball bearings can also be specified with a lubricant option that meets the needs of the application's specifications and requirements. Other sizes not listed in the chart, can be supplied through a MTO program.

MRC bearing number	Bore		Outside diameter		Width		Fillet radius[1]		Basic radial load rating				Speed rating	
									Dynamic		Static			
	d		D		B		r_a		C[2]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
200S-HNCR-HYB	10	0.3937	30	1.1811	9	0.3543	0.64	0.025	5100	1150	2370	530	28800	36000
200SZZ-HNCR-HYB	10	0.3937	30	1.1811	9	0.3543	0.64	0.025	5100	1150	2370	530	17000	-
201S-HNCR-HYB	12	0.4724	32	1.2598	10	0.3937	0.64	0.025	6800	1530	3050	685	26400	33600
201SZZ-HNCR-HYB	12	0.4724	32	1.2598	10	0.3937	0.64	0.025	6800	1530	3050	685	15000	-
202S-HNCR-HYB	15	0.5906	35	1.3780	11	0.4331	0.64	0.025	7600	1710	3700	830	22800	28800
202SZZ-HNCR-HYB	15	0.5906	35	1.3780	11	0.4331	0.64	0.025	7600	1710	3700	830	13000	-
203S-HNCR-HYB	17	0.6693	40	1.5748	12	0.4724	0.64	0.025	9550	2150	4760	1070	20400	24000
203SZZ-HNCR-HYB	17	0.6693	40	1.5748	12	0.4724	0.64	0.025	9550	2150	4760	1070	12000	-
204S-HNCR-HYB	20	0.7874	47	1.8504	14	0.5512	1.00	0.039	12800	2870	6580	1480	18000	21600
204SZZ-HNCR-HYB	20	0.7874	47	1.8504	14	0.5512	1.00	0.039	12800	2870	6580	1480	10000	-
205S-HNCR-HYB	25	0.9843	52	2.0472	15	0.5906	1.00	0.039	14000	3150	7830	1760	14400	18000
205SZZ-HNCR-HYB	25	0.9843	52	2.0472	15	0.5906	1.00	0.039	14000	3150	7830	1760	8500	-
206S-HNCR-HYB	30	1.1811	62	2.4409	16	0.6299	1.00	0.039	19500	4370	11300	2530	12000	15600
206SZZ-HNCR-HYB	30	1.1811	62	2.4409	16	0.6299	1.00	0.039	19500	4370	11300	2530	7500	-
207S-HNCR-HYB	35	1.3780	72	2.8346	17	0.6693	1.00	0.039	25500	5730	15300	3440	10800	13200
207SZZ-HNCR-HYB	35	1.3780	72	2.8346	17	0.6693	1.00	0.039	25500	5730	15300	3440	6300	-
208S-HNCR-HYB	40	1.5748	80	3.1496	18	0.7087	1.00	0.039	30700	6900	19000	4270	10200	12000
208SZZ-HNCR-HYB	40	1.5748	80	3.1496	18	0.7087	1.00	0.039	30700	6900	19000	4270	5600	-
209S-HNCR-HYB	45	1.7717	85	3.3465	19	0.7480	1.00	0.039	33200	7460	21600	4860	9000	10800
209SZZ-HNCR-HYB	45	1.7717	85	3.3465	19	0.7480	1.00	0.039	33200	7460	21600	4860	5000	-
210S-HNCR-HYB	50	1.9685	90	3.5433	20	0.7874	1.00	0.039	35100	7890	23200	5220	8400	10200
210SZZ-HNCR-HYB	50	1.9685	90	3.5433	20	0.7874	1.00	0.039	35100	7890	23200	5220	4800	-
100KS-HNCR-HYB	10	0.3937	26	1.0236	8	0.3150	0.30	0.012	4620	1040	1960	440	36000	43200
100KSZZ-HNCR-HYB	10	0.3937	26	1.0236	8	0.3150	0.30	0.012	4620	1040	1960	440	19000	-
101KS-HNCR-HYB	12	0.4724	28	1.1024	8	0.3150	0.30	0.012	5070	1140	2360	530	31200	38400
101KSZZ-HNCR-HYB	12	0.4724	28	1.1024	8	0.3150	0.30	0.012	5070	1140	2360	530	17000	-
102KS-HNCR-HYB	15	0.5906	32	1.2598	89	3.5039	0.30	0.012	5590	1260	2850	640	26400	33600
102KSZZ-HNCR-HYB	15	0.5906	32	1.2598	89	3.5039	0.30	0.012	5590	1260	2850	640	14000	-
103KS-HNCR-HYB	17	0.6693	35	1.3780	10	0.3937	0.30	0.012	6050	1360	3250	730	22800	28800
103KSZZ-HNCR-HYB	17	0.6693	35	1.3780	10	0.3937	0.30	0.012	6050	1360	3250	730	13000	-

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil.
For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice.
For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

MRC bearing number	Bore		Outside diameter		Width		Fillet radius[1)]		Basic radial load rating				Speed rating	
									Dynamic		Static			
	d		D		B		r_a		C[2)]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
104KS-HNCR-HYB	20	0.7874	42	1.6535	12	0.4724	0.64	0.025	9360	2100	5000	1120	20400	24000
104KSZZ-HNCR-HYB	20	0.7874	42	1.6535	12	0.4724	0.64	0.025	9360	2100	5000	1120	11000	-
105KS-HNCR-HYB	25	0.9843	47	1.8504	12	0.4724	0.64	0.025	11200	2520	6550	1470	18000	21600
105KSZZ-HNCR-HYB	25	0.9843	47	1.8504	12	0.4724	0.64	0.025	11200	2520	6550	1470	9500	-
106KS-HNCR-HYB	30	1.1811	55	2.1654	13	0.5118	1.00	0.039	13200	2970	8270	1860	14400	18000
106KSZZ-HNCR-HYB	30	1.1811	55	2.1654	13	0.5118	1.00	0.039	13200	2970	8270	1860	8000	-
38-HNCR-HYB	8	0.3150	22	0.8661	7	0.2756	0.30	0.012	3250	730	1360	306	43200	51600
38ZZ-HNCR-HYB	8	0.3150	22	0.8661	7	0.2756	0.30	0.012	3250	730	1360	306	23000	-
1900S-HNCR-HYB	10	0.3937	22	0.8661	6	0.2362	0.30	0.012	2510	565	1120	252	40800	48000
1900SZZ-HNCR-HYB	10	0.3937	22	0.8661	6	0.2362	0.30	0.012	2510	565	1120	252	19000	-
1901S-HNCR-HYB	12	0.4724	24	0.9449	6	0.2362	0.30	0.012	2890	649	1460	329	36000	43200
1901SZZ-HNCR-HYB	12	0.4724	24	0.9449	6	0.2362	0.30	0.012	2890	649	1460	329	18000	-
1902S-HNCR-HYB	15	0.5906	28	1.1024	7	0.2756	0.30	0.012	4030	906	2040	459	28800	36000
1902SZZ-HNCR-HYB	15	0.5906	28	1.1024	7	0.2756	0.30	0.012	4030	906	2040	459	16000	-
1903S-HNCR-HYB	17	0.6693	30	1.1811	7	0.2756	0.30	0.012	4360	980	2320	522	26400	33600
1903SZZ-HNCR-HYB	17	0.6693	30	1.1811	7	0.2756	0.30	0.012	4360	980	2320	522	14000	-
1904S-HNCR-HYB	20	0.7874	37	1.4567	9	0.3543	0.30	0.012	6380	1430	3680	827	21600	26400
1904SZZ-HNCR-HYB	20	0.7874	37	1.4567	9	0.3543	0.30	0.012	6380	1430	3680	827	12000	-
1905S-HNCR-HYB	25	0.9843	42	1.6535	9	0.3543	0.30	0.012	7030	1580	4530	1020	19200	22800
1905SZZ-HNCR-HYB	25	0.9843	42	1.6535	9	0.3543	0.30	0.012	7030	1580	4530	1020	10000	-

Stainless steel
single-row deep groove (SRDG) ball bearings



FFST, KSFFST, SFFST
Two shields

ZZST, KSZZST, SZZST
Two seals

MRC stainless steel (SRDG) ball bearings are used in fish, poultry and other food processing applications. Examples of popular applications include automatic filleting and sizing equipment aboard fishing trawlers, and evisceration equipment in poultry plants.

MRC stainless steel SRDG ball bearings exhibit significantly longer life than standard bearings in a wide range of demanding applications.

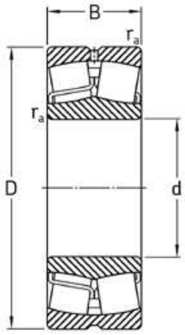
All MRC stainless steel SRDG ball bearings can also be specified with a solid lubricant pack that prevents grease washout during washdowns and helps protect against contamination in harsh environments.

Note: For equivalent load and life calculations see page 47 and 48.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[2] N	Dynamic C[2] lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
38ZZST	8.0	.3150	22.0	.8661	7.0	.2756	.30	.012	110	.17	2 600	585	1 360	306	36 000	43 000	23 000
R2ST	3.2	.1250	9.5	.3750	4.0	.1562	.30	.012	19	.03	250	56	120	27	75 000	91 000	52 000
R2FFST	3.2	.1250	9.5	.3750	4.0	.1562	.30	.012	19	.03	250	56	120	27	75 000	91 000	52 000
R3FFST	4.8	.1875	12.7	.5000	5.0	.1960	.30	.012	39	.06	765	172	490	110	57 000	69 000	40 000
R3ZZST	4.8	.1875	12.7	.5000	5.0	.1960	.30	.012	39	.06	765	172	490	110	57 000	69 000	40 000
R4FFST	6.4	.2500	15.9	.6250	5.0	.1960	.30	.012	45	.07	1 180	266	620	139	44 000	54 000	31 000
R6FFST	9.5	.3750	22.2	.8750	7.1	.2812	.41	.016	110	.17	2 660	597	1 340	301	31 000	38 000	21 000
R6ZZST	9.5	.3750	22.2	.8750	7.1	.2812	.41	.016	110	.17	2 660	597	1 340	301	31 000	38 000	21 000
R8ST	12.7	.5000	28.6	1.1250	6.4	.2500	.41	.016	181	.28	4 060	912	2 400	540	24 000	29 000	16 000
R8FFST	12.7	.5000	28.6	1.1250	7.9	.3125	.41	.016	181	.28	4 060	912	2 400	540	24 000	29 000	16 000
R8ZZST	12.7	.5000	28.6	1.1250	7.9	.3125	.41	.016	181	.28	4 060	912	2 400	540	24 000	29 000	16 000
R10ZZST	15.9	.6250	34.9	1.3750	8.7	.3438	.79	.031	226	.35	4 840	1 090	3 250	731	18 000	22 000	13 000
R12FFST	19.1	.7500	41.3	1.6250	11.1	.4375	.79	.031	361	.56	7 490	1 680	5 100	1 150	16 000	19 000	11 000
R12ZZST	19.1	.7500	41.3	1.6250	11.1	.4375	.79	.031	361	.56	7 490	1 680	5 100	1 150	16 000	19 000	11 000
101KSZZST	12.0	.4724	28.0	1.1024	8.0	.3125	.30	.012	181	.28	4 060	912	2 360	530	26 000	32 000	17 000
102KSZZST	15.0	.5906	32.0	1.2598	9.0	.3543	.30	.012	206	.32	4 470	1 010	2 850	640	22 000	28 000	14 000
103KSZZST	17.0	.6693	35.0	1.3780	10.0	.3937	.30	.012	226	.35	4 840	1 090	3 250	730	19 000	24 000	13 000
104KSZZST	20.0	.7874	42.0	1.6535	12.0	.4724	.64	.025	361	.56	7 490	1 680	5 000	1 120	17 000	20 000	11 000
105KSZZST	25.0	.9843	47.0	1.8504	12.0	.4724	.64	.025	458	.71	8 960	2 010	6 550	1 470	15 000	18 000	9 500
106KSZZST	30.0	1.1811	55.0	2.1654	13.0	.5118	1.00	.040	561	.87	9 470	2 130	7 390	1 660	12 000	15 000	8 000
200SZZST	10.0	.3937	30.0	1.1811	9.0	.3543	.64	.025	181	.28	4 060	912	2 360	531	24 000	30 000	17 000
201SST	12.0	.4724	32.0	1.2598	10.0	.3937	.64	.025	252	.39	5 510	1 240	3 100	697	22 000	28 000	15 000
201SZZST	12.0	.4724	32.0	1.2598	10.0	.3937	.64	.025	252	.39	5 510	1 240	3 100	697	22 000	28 000	15 000
202SST	15.0	.5906	35.0	1.3780	11.0	.4331	.64	.025	290	.45	6 240	1 400	3 250	843	19 000	24 000	13 000
202SFFST	15.0	.5906	35.0	1.3780	11.0	.4331	.64	.025	290	.45	6 240	1 400	3 250	843	19 000	24 000	13 000
202SZZST	15.0	.5906	35.0	1.3780	11.0	.4331	.64	.025	290	.45	6 240	1 400	3 250	843	19 000	24 000	13 000
203SFFST	17.0	.6693	40.0	1.5748	12.0	.4724	.64	.025	361	.56	7 650	1 720	4 750	1 070	17 000	20 000	12 000
203SZZST	17.0	.6693	40.0	1.5748	12.0	.4724	.64	.025	361	.56	7 650	1 720	4 750	1 070	17 000	20 000	12 000
204SST	20.0	.7874	47.0	1.8504	14.0	.5512	1.00	.040	503	.78	10 200	2 280	6 550	1 470	15 000	18 000	10 000
204SZZST	20.0	.7874	47.0	1.8504	14.0	.5512	1.00	.040	503	.78	10 200	2 280	6 550	1 470	15 000	18 000	10 000
205SFFST	25.0	.9843	52.0	2.0472	15.0	.5906	1.00	.040	568	.88	11 200	2 520	7 800	1 750	12 000	15 000	8 500
205SZZST	25.0	.9843	52.0	2.0472	15.0	.5906	1.00	.040	568	.88	11 200	2 520	7 800	1 750	12 000	15 000	8 500
206SST	30.0	1.1811	62.0	2.4409	16.0	.6299	1.00	.040	819	1.27	15 600	3 510	11 200	2 520	10 000	13 000	7 500
206SFFST	30.0	1.1811	62.0	2.4409	16.0	.6299	1.00	.040	819	1.27	15 600	3 510	11 200	2 520	10 000	13 000	7 500
206SZZST	30.0	1.1811	62.0	2.4409	16.0	.6299	1.00	.040	819	1.27	15 600	3 510	11 200	2 520	10 000	13 000	7 500
207SZZST	35.0	1.3780	72.0	2.8346	17.0	.6693	1.00	.040	1 111	1.72	20 500	4 610	15 300	3 440	9 000	11 000	6 300
304SZZST	20.0	.7874	52.0	2.0472	15.0	.5906	1.00	.040	632	.98	12 700	2 860	7 800	1 750	13 000	16 000	9 500
305SZZST	25.0	.9843	62.0	2.4409	17.0	.6693	1.00	.040	864	1.34	17 000	3 810	10 800	2 430	11 000	14 000	7 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
3) Listed values are for a pressed stainless steel cage; ABEC-1. The speed ratings have been determined through historical application and practice.

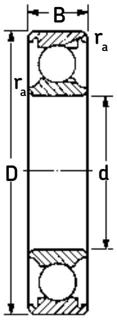
HNCR
spherical roller bearing series (SRB)



All MRC HNCR spherical roller bearings consist of double row spherical bearings for use in applications that would use the traditional spherical roller bearing, but also utilize the benefits of the HNCR material.

	Bore		Outside diameter		Width		Fillet radius[1)]		Basic radial load rating				Speed rating	
									Dynamic		Static			
MRC bearing number	d		D		B		r_a		$C^{2)}$		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
DR22313-HNCR	65	**2.5591**	140	**5.5118**	48	**1.8898**	2.00	**0.079**	340000	**76440**	360000	**80940**	3800	-
DR22314-HNCR	70	**2.7559**	150	**5.9055**	51	**2.0079**	2.00	**0.079**	400000	**89930**	430000	**96670**	3400	-
DR22315-HNCR	75	**2.9528**	160	**6.2992**	55	**2.1654**	2.00	**0.079**	440000	**98920**	475000	**106790**	3200	-
DR22316-HNCR	80	**3.1496**	170	**6.6929**	58	**2.2835**	2.00	**0.079**	490000	**110160**	540000	**121400**	3000	-
DR22317-HNCR	85	**3.3465**	180	**7.0866**	60	**2.3622**	2.50	**0.098**	550000	**123650**	620000	**139390**	2800	-
DR22318-HNCR	90	**3.5433**	190	**7.4803**	64	**2.5197**	2.50	**0.098**	495000	**111290**	635500	**142870**	2600	-
DR22320-HNCR	100	**3.9370**	215	**8.4646**	73	**2.8740**	2.50	**0.098**	815000	**183220**	950000	**213570**	2400	-
DR22322-HNCR	110	**4.3307**	240	**9.4488**	80	**3.1496**	2.50	**0.098**	950000	**213570**	1120000	**251790**	2000	-
DR23226-HNCR	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.50	**0.098**	780000	**175360**	1060000	**238300**	1900	-

“Max-type” (M-type) single-row filling-notch ball bearings



MRC’s single-row maximum M-type bearings have a single filling slot in both the inner and outer ring, enabling more balls to be added. Because of the increased ball complement, filling slot bearings have a higher radial load carrying capacity than bearings without filling slots, but their axial load carrying capacity is reduced. They can be used in applications with heavy radial loads, or a combination of radial and thrust loads, where the radial load is predominant. They are not recommended for use where only thrust loads are present.

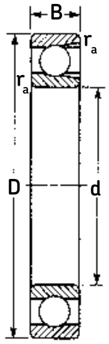
The M-type bearing is also designated as the “notched” type because it has a filling notch on one side of the inner and outer rings.

Normally furnished with ABMA CO radial clearance.

Cage types and materials

Type and material available is a two-piece, pressed steel, ball riding, stayrod cage.

100M narrow-type light series



MF
One shield

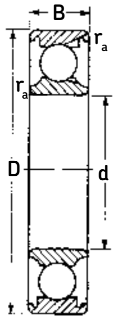
The 100M narrow-type light series consists of single-row radial filling-notch bearings having bores ranging from 50 mm to 160 mm. They can be used in applications with high radial loads, or a combination of radial and thrust loads, where the radial load is predominant. They are not recommended for use where only thrust loads are present.

Note: This series is obsoleted but is still manufactured in a few sizes for replacement parts. Please check availability before designing into equipment.

	Bore		Outside diameter		Width		Fillet radius[1]		Basic radial load rating				Speed rating[2]	
									Dynamic		Static		Open and shielded	
MRC bearing number	d		D		B		r_a		C[3]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
110M[4]	50	**1.9685**	90	**3.5433**	11	**.4331**	1.0	**.04**	18 700	**4 200**	19 600	**4 400**	5 600	6 800
113M[4]	65	**2.5591**	115	**4.5276**	14	**.5512**	1.0	**.04**	31 900	**7 170**	36 500	**8 210**	4 400	5 400
117M[4]	85	**3.3465**	145	**5.7087**	18	**.7087**	1.5	**.06**	58 300	**13 100**	68 000	**15 300**	3 400	4 200
120M	100	**3.9370**	160	**6.2992**	28	**1.1024**	2.0	**.08**	96 800	**21 800**	108 000	**24 300**	3 000	3 700
124M	120	**4.7244**	190	**7.4803**	32	**1.2598**	2.0	**.08**	123 000	**27 700**	146 000	**32 800**	2 500	3 100
126M	130	**5.1181**	205	**8.0709**	34	**1.3386**	2.0	**.08**	138 000	**31 000**	166 000	**37 300**	2 300	2 800
128M	140	**5.5118**	220	**8.6614**	36	**1.4173**	2.0	**.08**	157 000	**35 300**	190 000	**42 800**	2 100	2 600
132M	160	**6.2992**	250	**9.8425**	40	**1.5748**	2.0	**.08**	190 000	**42 700**	255 000	**57 300**	1 900	2 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

200M light series



MF
One shield

MFF
Two shields

MG
Snap-ring

MFG
Shield and snap-ring

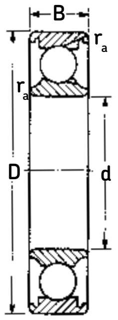
MFFG
Two shields and snap-ring

200M light series bearings are single-row maximum capacity filling-notch bearings. They are used in applications with heavy radial loads, or a combination of radial and thrust loads where the radial load is predominant. They are not to be used where only thrust loads are present.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	Basic radial load rating: Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Open and shielded: Grease rpm	Oil rpm
202M[4]	15	**.5906**	35	**1.3780**	11	**.4331**	.64	**.025**	8 250	**1 850**	5 100	**1 150**	16 000	20 000
203M[4]	17	**.6693**	40	**1.5748**	12	**.4724**	.64	**.025**	8 970	**2 020**	6 000	**1 350**	14 000	17 000
204M[4]	20	**.7874**	47	**1.8504**	14	**.5512**	1.00	**.040**	12 500	**2 810**	8 300	**1 870**	12 000	15 000
205M[4]	25	**.9843**	52	**2.0472**	15	**.5906**	1.00	**.040**	16 100	**3 620**	11 200	**2 510**	11 000	13 000
206M	30	**1.1811**	62	**2.4409**	16	**.6299**	1.00	**.040**	22 900	**5 150**	17 000	**3 820**	9 000	11 000
207M	35	**1.3780**	72	**2.8346**	17	**.6693**	1.00	**.040**	29 700	**6 680**	22 800	**5 130**	7 800	9 500
208M	40	**1.5748**	80	**3.1496**	18	**.7087**	1.00	**.040**	33 600	**7 550**	26 500	**5 960**	7 000	8 500
209M	45	**1.7717**	85	**3.3465**	19	**.7480**	1.00	**.040**	39 300	**8 840**	32 500	**7 310**	6 200	7 500
210M	50	**1.9685**	90	**3.5433**	20	**.7874**	1.00	**.040**	39 100	**8 790**	34 500	**7 760**	5 700	7 000
211M	55	**2.1654**	100	**3.9370**	21	**.8268**	1.50	**.060**	48 400	**10 900**	44 000	**9 890**	5 200	6 300
212M	60	**2.3622**	110	**4.3307**	22	**.8661**	1.50	**.060**	56 100	**12 600**	51 000	**11 500**	4 900	6 000
213M	65	**2.5591**	120	**4.7244**	23	**.9055**	1.50	**.060**	69 300	**15 600**	65 500	**14 700**	4 300	5 300
214M	70	**2.7559**	125	**4.9213**	24	**.9449**	1.50	**.060**	69 300	**15 600**	65 500	**14 700**	4 100	5 000
215M	75	**2.9528**	130	**5.1181**	25	**.9843**	1.50	**.060**	74 800	**16 800**	72 000	**16 200**	3 900	4 800
216M	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.00	**.080**	85 800	**19 300**	86 500	**19 400**	3 700	4 500
217M	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.00	**.080**	88 000	**19 800**	93 000	**20 900**	3 500	4 300
218M	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.00	**.080**	101 000	**22 700**	108 000	**24 300**	3 300	4 000
219M	95	**3.7482**	170	**6.6929**	32	**1.2598**	2.00	**.080**	111 000	**25 000**	118 000	**26 500**	3 100	3 800
220M	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.00	**.080**	127 000	**28 600**	134 000	**30 100**	2 800	3 400
221M	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.00	**.080**	142 000	**31 900**	153 000	**34 400**	2 600	3 200
222M	110	**4.3307**	215	**7.8740**	38	**1.4961**	2.00	**.080**	154 000	**34 600**	170 000	**38 200**	2 500	3 100
224M	120	**4.7244**	200	**8.4646**	40	**1.5748**	2.00	**.080**	172 000	**38 700**	200 000	**45 000**	2 300	2 800
226M	130	**5.1181**	230	**9.0551**	40	**1.5748**	2.50	**.100**	179 000	**40 300**	216 000	**48 500**	2 100	2 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

300M medium series




MF
One shield


MFF
Two shields


MG
Snap-ring


MFG
Shield and snap-ring

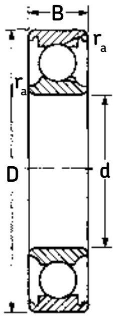

MFFG
Two shields and snap-ring

The 300M medium series consists of single-row maximum capacity filling-notch bearings with bores ranging from 17 mm to 110 mm. They are used with very heavy radial loads, or a combination of radial and thrust loads where the radial load is predominant. They are not to be used where only a thrust load is present.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating Dynamic C[3] N	Basic radial load rating Dynamic C[3] lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Speed rating[2] Open and shielded Oil rpm
303M	17	**.6693**	47	**1.8504**	14	**.5512**	1.0	**.04**	14 200	**3 200**	8 500	**1 910**	12 000	15 000
304M	20	**.7874**	52	**2.0472**	15	**.5906**	1.0	**.04**	15 900	**3 570**	10 200	**2 280**	11 000	14 000
305M	25	**.9843**	62	**2.4409**	17	**.6693**	1.0	**.04**	22 900	**5 150**	15 600	**3 510**	9 800	12 000
306M	30	**1.1811**	72	**2.8346**	19	**.7480**	1.0	**.04**	29 200	**6 560**	20 800	**4 680**	7 800	9 500
307M	35	**1.3780**	80	**3.1496**	21	**.8268**	1.5	**.06**	39 300	**8 830**	28 500	**6 410**	7 000	8 500
308M	40	**1.5748**	90	**3.5433**	23	**.9055**	1.5	**.06**	46 800	**10 500**	36 000	**8 090**	6 200	7 500
309M	45	**1.7717**	100	**3.9370**	25	**.9843**	1.5	**.06**	59 400	**13 400**	46 500	**10 500**	5 700	7 000
310M	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.0	**.08**	64 400	**14 500**	52 000	**11 700**	5 200	6 300
311M	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.0	**.08**	79 200	**17 800**	65 500	**14 700**	4 600	5 600
312M	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.0	**.08**	91 300	**20 500**	78 000	**17 500**	4 300	5 300
313M	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.08**	102 000	**22 900**	90 000	**20 200**	3 900	4 800
314M	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.0	**.08**	114 000	**25 600**	102 000	**22 900**	3 700	4 500
315M	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.0	**.08**	125 000	**28 000**	116 000	**26 000**	3 500	4 300
316M	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.0	**.08**	138 000	**31 000**	129 000	**29 000**	3 300	4 000
317M	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**.10**	147 000	**33 000**	146 000	**32 800**	3 100	3 800
318M	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.5	**.10**	157 000	**35 300**	160 000	**36 000**	2 800	3 400
319M	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.5	**.10**	168 000	**37 800**	180 000	**40 500**	2 600	3 200
320M	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**.10**	194 000	**43 600**	212 000	**47 700**	2 500	3 000
321M	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.5	**.10**	205 000	**46 100**	232 000	**52 200**	2 400	2 900
322M	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**.10**	216 000	**48 600**	250 000	**56 200**	2 200	2 700

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.

400M heavy series



MF
One shield

MFF
Two shields

MG
Snap-ring

MFG
Shield and
snap-ring

MFFG
Two shields
and snap-ring

400M heavy series bearings are single-row maximum capacity filling-notch bearings with bores ranging from 17 mm to 100 mm. They are used with extremely heavy radial loads, or a combination of radial and thrust loads where the radial load is predominant. They are not used where only thrust loads are present.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Basic radial load rating Dynamic $C^{3)}$ N	lbf	Static C_0 N	lbf	Speed rating[2)] Open and shielded Grease rpm	Oil rpm
403M	17	**.6693**	62	**2.4409**	17	**.6693**	1.0	**.04**	23 300	**5 240**	14 600	**3 280**	11 000	13 000
404M	20	**.7874**	72	**2.8346**	19	**.7480**	1.0	**.04**	29 200	**6 560**	18 600	**4 210**	9 000	11 000
405M	25	**.9843**	80	**3.1496**	21	**.8268**	1.5	**.06**	35 800	**8 050**	23 600	**5 270**	7 700	9 400
406M	30	**1.1811**	90	**3.5433**	23	**.9055**	1.5	**.06**	45 700	**10 300**	32 500	**7 310**	6 200	7 500
407M	35	**1.3780**	100	**3.9370**	25	**.9843**	1.5	**.06**	53 900	**12 100**	39 000	**8 770**	5 600	6 800
408M	40	**1.5748**	110	**4.3307**	27	**1.0630**	2.0	**.08**	68 200	**15 300**	52 000	**11 700**	5 300	6 500
409M	45	**1.7717**	120	**4.7244**	29	**1.1417**	2.0	**.08**	78 100	**17 600**	61 000	**13 700**	4 800	5 900
410M	50	**1.9685**	130	**5.1181**	31	**1.2205**	2.0	**.08**	88 000	**19 800**	71 000	**16 000**	4 400	5 400
411M	55	**2.1654**	140	**5.5118**	33	**1.2992**	2.0	**.08**	108 000	**24 200**	90 000	**20 200**	4 100	5 000
412M	60	**2.3622**	150	**5.9055**	35	**1.3780**	2.0	**.08**	117 000	**26 200**	102 000	**22 900**	3 800	4 600
413M	65	**2.5591**	160	**6.2992**	37	**1.4567**	2.0	**.08**	128 000	**28 800**	112 000	**25 200**	3 400	4 100
414M	70	**2.7559**	180	**7.0866**	42	**1.6535**	2.5	**.10**	147 000	**33 100**	140 000	**31 500**	3 200	3 900
415M	75	**2.9528**	190	**7.4803**	45	**1.7717**	2.5	**.10**	157 000	**55 300**	153 000	**34 400**	3 000	3 600
416M	80	**3.1496**	200	**7.8740**	48	**1.8898**	2.5	**.10**	176 000	**89 600**	176 000	**39 600**	2 800	3 400
417M	85	**3.3465**	210	**8.2677**	52	**2.0472**	3.0	**.12**	190 000	**42 700**	200 000	**45 000**	2 600	3 200
418M	90	**3.5433**	225	**8.8583**	54	**2.1260**	3.0	**.12**	198 000	**44 500**	212 000	**47 700**	2 500	3 000
419M	95	**3.7402**	250	**9.8425**	55	**2.1654**	3.0	**.12**	229 000	**51 500**	260 000	**58 500**	2 300	2 800
420M	100	**3.9370**	265	**10.4331**	60	**2.3622**	3.0	**.12**	251 000	**56 500**	300 000	**67 400**	2 100	2 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

Single-row filling-notch ball bearings, M-type

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R + F_A$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

When $F_A/F_R > 0.6$ or $P > 0.5\ C_0$,

a non-filling notch bearing is suggested.

C_0 = Basic static radial load rating

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic load rating

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = F_R + 0.5\ F_A$

Provided F_A/F_R is always ≤ 0.6

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Single-row filling-notch ball bearings, M-type

Dynamic equivalent radial load and life calculation examples

Bearing size: 309M
Speed = 2000 rpm
Basic dynamic load rating (C) = 13400 lbf

ABMA C0 internal clearance

Case 1

Radial load (F_R) = 1890
Equivalent load (P) = $F_R + F_A$
$P = F_R = 1890$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13400}{1890}\right)^3 = 356 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13400}{1890}\right)$$

= 2967 Hrs

Case 2

Radial load (F_R) = 1890
Thrust load (F_A) = 950
F_A / F_R = 950/1890 = 0.50
Since $F_A / F_R < 0.60$
$P = F_R + F_A = 1890 + 950 = 2840$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13400}{2840}\right)^3 = 105 \times 10^6 \text{ Rev.}$$

or

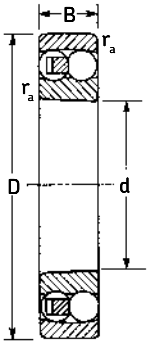
$$\text{Life (L10}_h) = \frac{10^6}{60n} = \left(\frac{13400}{2840}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13400}{2840}\right)^3$$

= 875 Hrs

Case 3

Radial load (F_R) = 1890
Thrust load (F_A) = 1250
F_A/F_R = 1250/1890 = 0.66
Since $F_A / F_R > 0.60$, use a non-filling notch bearing.

Self-aligning ball bearings



Self-aligning bearings have two rows of balls with a common sphered raceway in the outer ring. This gives the bearings their self-aligning property, permitting angular misalignment of the shaft relative to the housing. They are therefore particularly suitable for applications where misalignment can arise from errors in mounting or from shaft deflection. In addition, non-sealed self-aligning ball bearings have the lowest friction of any bearing type.

Bearing sizes having the E suffix have higher load ratings than the original standard design because of improvements in internal construction. They are supplied with a glass fiber reinforced, 6.6 polyamide cage as standard. Machined brass or pressed steel cages are supplied on other sizes.

Self-aligning ball bearings

Basic design

Self-aligning bearings of the basic design are available with both a cylindrical bore and a tapered bore with a 1:12 taper. Tapered bore bearings are furnished with adapter sleeves, including nut and lock washer, with which the bearings can be secured to smooth or stepped shafts. They are identified by suffix letter K.

Sealed bearings

Self-aligning bearings with cylindrical and tapered bores are available with contact seals on both sides, identified by the suffix 2RS1. The seals are made of oil and wear resistant synthetic rubber reinforced by a steel insert. The operating temperature range for the seals, with a suitable grease, is -40° C to 120° C (-40° F to 248° F). Sealed bearings are supplied with a lithium base grease suitable for an operating temperature range of -30° C to 110° C (-22° F to 230° F).

Sealed bearings with a tapered bore require a special adapter sleeve and lock washer identified by the suffix letter C. The lock washers have a circular beading on the side facing the bearing to prevent interference with the seal.

Extended inner ring bearings

Self-aligning bearings with an extended inner ring are used in applications employing commercial ground shafting. A special bore tolerance allows easy mounting and dismounting.

These bearings are located axially by pins or shouldered screws which engage in a slot at one side of the inner ring. The pins or screws also prevent the inner ring from turning on the shaft. When used in pairs, the slots on the inner ring must either be adjacent or at the outboard positions to provide shaft location in both directions.

Tolerances

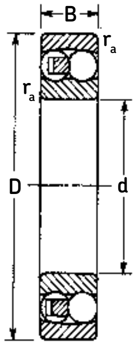
Self-aligning bearings are manufactured to ABEC-1 tolerances as shown on page 245. The exceptions are the bore and inner ring width on extended inner ring bearings, which are manufactured to the tolerances shown in the table below.

Notes:

All tolerances in ten thousandths inches (.0001) and micrometers (um).
Top figure is inch, bottom is micrometer.

Bore diameter (mm) over	Incl	Bore diameter tolerance		Bore out-of round (max)	Inner ring width
2.5	10	+3	–3	6	–130
		+8	–8	14	–330
10.0	18	+3	–3	6	–130
		+8	–8	14	–330
18.0	30	+4	–4	7	–130
		+10	–10	17	–330
30.0	50	+5	–5	8	–153
		+12	–12	21	–390
50.0	80	+6	–6	10	–181
		+15	–15	26	–460

100, 1200, 1200E series
Self-aligning ball bearings

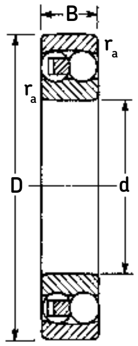


Cylindrical bore

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2)] N	lbf	Static C_0 N	lbf	Speed rating Grease rpm	Oil rpm
135	5	**.1969**	19	**.7480**	6	**.2362**	.30	**.012**	.33	1.9	3.0	2.0	2 510	**564**	480	**108**	32 000	38 000
126	6	**.2362**	19	**.7480**	6	**.2362**	.30	**.012**	.33	1.9	3.0	2.0	2 510	**564**	480	**108**	32 000	38 000
127	7	**.2756**	22	**.8661**	7	**.2756**	.30	**.012**	.33	1.9	3.0	2.0	2 650	**596**	560	**126**	30 000	36 000
108	8	**.3150**	22	**.8661**	7	**.2756**	.30	**.012**	.33	1.9	3.0	2.0	2 650	**596**	560	**126**	30 000	36 000
129	9	**.3543**	26	**1.0236**	8	**.3150**	.60	**.024**	.33	1.9	3.0	2.0	3 900	**877**	815	**183**	26 000	32 000
1200E	10	**.3937**	30	**1.1811**	9	**.3543**	.60	**.024**	.33	1.9	3.0	2.0	5 530	**1 240**	1 180	**265**	24 000	30 000
1201E	12	**.4724**	32	**1.2598**	10	**.3937**	.60	**.024**	.33	1.9	3.0	2.0	6 240	**1 400**	1 430	**321**	22 000	28 000
1202E	15	**.5906**	35	**1.3780**	11	**.4331**	.60	**.024**	.33	1.9	3.0	2.0	7 410	**1 670**	1 760	**396**	19 000	24 000
1203E	17	**.6693**	40	**1.5748**	12	**.4724**	.60	**.024**	.31	2.0	3.1	2.2	8 840	**1 990**	2 200	**495**	18 000	22 000
1204E	20	**.7874**	47	**1.8504**	14	**.5512**	1.0	**.039**	.30	2.1	3.3	2.2	12 700	**2 860**	3 400	**764**	15 000	18 000
1205E	25	**.9843**	52	**2.0472**	15	**.5906**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	13 000	16 000
1206E	30	**1.1811**	62	**2.4409**	16	**.6299**	1.0	**.039**	.25	2.5	3.9	2.5	15 600	**3 510**	4 650	**1 050**	10 000	13 000
1207E	35	**1.3780**	72	**2.8346**	17	**.6693**	1.0	**.039**	.23	2.7	4.2	2.8	19 000	**4 270**	6 000	**1 350**	9 000	11 000
1208E	40	**1.5748**	80	**3.1496**	18	**.7087**	1.0	**.039**	.22	2.9	4.5	2.8	19 900	**4 470**	6 950	**1 560**	8 500	10 000
1209E	45	**1.7717**	85	**3.3465**	19	**.7480**	1.0	**.039**	.21	3.0	4.6	3.2	22 900	**5 150**	7 800	**1 750**	7 500	9 000
1210E	50	**1.9685**	90	**3.5433**	20	**.7874**	1.0	**.039**	.21	3.0	4.6	3.2	26 500	**5 960**	9 150	**2 060**	7 000	8 500
1211E	55	**2.1654**	100	**3.9370**	21	**.8268**	1.5	**.059**	.19	3.3	5.1	3.6	27 600	**6 210**	10 600	**2 380**	6 300	7 500
1212E	60	**2.3622**	110	**4.3307**	22	**.8661**	1.5	**.059**	.19	3.3	5.1	3.6	31 200	**7 010**	12 200	**2 740**	5 600	6 700
1213E	65	**2.5591**	120	**4.7244**	23	**.9055**	1.5	**.059**	.18	3.5	5.4	3.6	35 100	**7 890**	14 000	**3 150**	5 300	6 300
1214	70	**2.7559**	125	**4.9213**	24	**.9449**	1.5	**.059**	.18	3.5	5.4	3.6	34 500	**7 760**	13 700	**3 080**	5 000	6 000
1215	75	**2.9528**	130	**5.1181**	25	**.9843**	1.5	**.059**	.17	3.7	5.7	4.0	39 000	**8 770**	15 600	**3 510**	4 800	5 600
1216	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.0	**.079**	.16	3.9	6.1	4.0	39 700	**8 930**	17 000	**3 820**	4 500	5 300
1217	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.0	**.079**	.17	3.7	5.7	4.0	48 800	**11 000**	20 800	**4 680**	4 000	4 800
1218	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.0	**.079**	.17	3.7	5.7	4.0	57 200	**12 900**	23 600	**5 310**	3 800	4 500
1219	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.0	**.079**	.17	3.7	5.7	4.0	63 700	**14 300**	27 000	**6 070**	3 600	4 300
1220	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.0	**.079**	.17	3.7	5.7	4.0	68 900	**15 500**	30 000	**6 740**	3 400	4 000
1221	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.0	**.079**	.17	3.7	5.7	4.0	74 100	**16 700**	32 500	**7 310**	3 200	3 800
1222	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.0	**.079**	.17	3.7	5.7	4.0	88 400	**19 900**	39 000	**8 770**	3 000	3 600
1224	120	**4.7244**	215	**8.4646**	42	**1.6535**	2.0	**.079**	.19	3.3	5.1	3.6	119 000	**26 800**	53 000	**11 900**	2 800	3 400
1226	130	**5.1181**	230	**9.0551**	46	**1.8110**	2.5	**.098**	.19	3.3	5.1	3.6	127 000	**28 600**	58 500	**13 200**	2 600	3 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

1300, 1300E, 1400 series self-aligning ball bearings

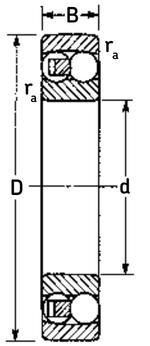


Cylindrical bore

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2] N	Dynamic C[2] lbf	Static C_0 N	Static C_0 lbf	Speed rating Grease rpm	Speed rating Oil rpm
1301E	12	**.4724**	37	**1.4567**	12	**.4724**	1.0	**.039**	.35	1.8	2.8	1.8	9 360	**2 100**	2 160	**486**	18 000	22 000
1302E	15	**.5906**	42	**1.6535**	13	**.5118**	1.0	**.039**	.31	2.0	3.1	2.2	10 800	**2 430**	2 600	**585**	17 000	20 000
1303E	17	**.6693**	47	**1.8504**	14	**.5512**	1.0	**.039**	.30	2.1	3.3	2.2	12 700	**2 860**	3 400	**764**	14 000	17 000
1304E	20	**.7874**	52	**2.0472**	15	**.5906**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	12 000	15 000
1305E	25	**.9843**	62	**2.4409**	17	**.6693**	1.0	**.039**	.28	2.2	3.5	2.5	19 000	**4 270**	5 400	**1 210**	9 500	12 000
1306E	30	**1.1811**	72	**2.8346**	19	**.7480**	1.0	**.039**	.25	2.5	3.9	2.5	22 500	**5 060**	6 800	**1 530**	9 000	11 000
1307E	35	**1.3780**	80	**3.1496**	21	**.8268**	1.5	**.059**	.25	2.5	3.9	2.5	26 500	**5 960**	8 500	**1 910**	7 500	9 000
1308E	40	**1.5748**	90	**3.5433**	23	**.9055**	1.5	**.059**	.23	2.7	4.2	2.8	33 800	**7 600**	11 200	**2 520**	6 700	8 000
1309E	45	**1.7717**	100	**3.9370**	25	**.9843**	1.5	**.059**	.23	2.7	4.2	2.8	39 000	**8 770**	13 400	**3 010**	6 300	7 500
1310E	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.0	**.079**	.24	2.6	4.1	2.8	43 600	**9 800**	14 000	**3 150**	5 600	6 700
1311E	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.0	**.079**	.23	2.7	4.2	2.8	50 700	**11 400**	18 000	**4 050**	5 000	6 000
1312E	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.0	**.079**	.23	2.7	4.2	2.8	58 500	**13 200**	22 000	**4 950**	4 500	5 300
1313E	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.079**	.22	2.9	4.5	2.8	65 000	**14 600**	25 500	**5 730**	4 300	5 000
1314	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.0	**.079**	.22	2.9	4.5	2.8	74 100	**16 700**	27 500	**6 180**	4 000	4 800
1315	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.0	**.079**	.22	2.9	4.5	2.8	79 300	**17 800**	30 000	**6 740**	3 800	4 500
1316	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.0	**.079**	.22	2.9	4.5	2.8	88 400	**19 900**	33 500	**7 530**	3 600	4 300
1317	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**.098**	.22	2.9	4.5	2.8	97 500	**21 900**	38 000	**8 540**	3 400	4 000
1318	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.5	**.098**	.22	2.9	4.5	2.8	117 000	**26 300**	44 000	**9 890**	3 200	3 800
1319	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.5	**.098**	.23	2.7	4.2	2.8	133 000	**29 900**	51 000	**11 500**	3 000	3 600
1320	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**.098**	.23	2.7	4.2	2.8	143 000	**32 200**	57 000	**12 800**	2 800	3 400
1322	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**.098**	.22	2.9	4.5	2.8	163 000	**36 600**	72 000	**16 200**	2 400	3 000
1406	30	**1.1811**	90	**3.5433**	28	**1.1024**	1.5	**.059**	.40	1.6	2.4	1.6	59 200	**13 300**	17 000	**3 820**	6 700	8 000
1407	35	**1.3780**	100	**3.9370**	30	**1.1811**	1.5	**.059**	.37	1.7	2.6	1.8	62 400	**14 000**	18 000	**4 050**	6 300	7 500
1408	40	**1.5748**	110	**4.3307**	33	**1.2992**	2.0	**.079**	.35	1.8	2.8	1.8	76 100	**17 100**	23 600	**5 310**	5 300	6 300
1409	45	**1.7717**	120	**4.7244**	35	**1.3780**	2.0	**.079**	.35	1.8	2.8	1.8	88 400	**19 900**	27 500	**6 180**	5 000	6 000
1410	50	**1.9685**	130	**5.1181**	37	**1.4567**	2.0	**.079**	.35	1.8	2.8	1.8	101 000	**22 700**	32 000	**7 190**	4 800	5 600
1411	55	**2.1654**	140	**5.5118**	40	**1.5748**	2.0	**.079**	.33	1.9	3.0	2.0	111 000	**25 000**	36 500	**8 210**	4 300	5 000
1412	60	**2.3622**	150	**5.9055**	42	**1.6535**	2.0	**.079**	.33	1.9	3.0	2.0	125 000	**28 100**	41 500	**9 330**	3 800	4 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

2200, 2200E, 2300, 2300E series self-aligning ball bearings

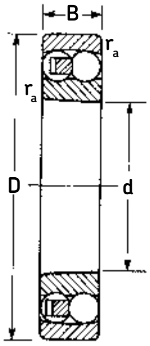


Cylindrical bore

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2] N	Dynamic C[2] lbf	Static C_0 N	Static C_0 lbf	Speed rating Grease rpm	Speed rating Oil rpm
2200E	10	.3937	30	**1.1811**	14	**.5512**	.60	**.024**	.54	1.15	1.8	1.3	8 060	**1 810**	1 730	**389**	22 000	28 000
2201E	12	.4724	32	**1.2598**	14	**.5512**	.60	**.024**	.50	1.25	2	1.3	8 520	**1 920**	1 900	**427**	20 000	26 000
2202E	15	.5906	35	**1.3780**	14	**.5512**	.60	**.024**	.43	1.50	2.3	1.6	8 710	**1 960**	2 040	**459**	18 000	22 000
2203E	17	.6693	40	**1.5748**	16	**.6299**	.60	**.024**	.43	1.50	2.3	1.6	10 600	**2 380**	2 550	**573**	17 000	20 000
2204E	20	.7874	47	**1.8504**	18	**.7087**	1.0	**.039**	.40	1.60	2.4	1.6	16 800	**3 780**	4 150	**933**	14 000	17 000
2205E	25	.9843	52	**2.0472**	18	**.7087**	1.0	**.039**	.35	1.80	2.8	1.8	16 800	**3 780**	4 400	**989**	11 000	14 000
2206E	30	**1.1811**	62	**2.4409**	20	**.7874**	1.0	**.039**	.33	1.90	3	2.0	23 800	**5 350**	6 700	**1 510**	9 500	12 000
2207E	35	**1.3780**	72	**2.8346**	23	**.9055**	1.0	**.039**	.31	2.00	3.1	2.2	30 700	**6 900**	8 800	**1 980**	8 500	10 000
2208E	40	**1.5748**	80	**3.1496**	23	**.9055**	1.0	**.039**	.28	2.20	3.5	2.5	31 900	**7 170**	10 000	**2 250**	7 500	9 000
2209E	45	**1.7717**	85	**3.3465**	23	**.9055**	1.0	**.039**	.26	2.40	3.7	2.5	32 500	**7 310**	10 600	**2 380**	7 000	8 500
2210E	50	**1.9685**	90	**3.5433**	23	**.9055**	1.0	**.039**	.23	2.70	4.2	2.8	33 800	**7 600**	11 200	**2 520**	6 300	7 500
2211E	55	**2.1654**	100	**3.9370**	25	**.9843**	1.5	**.059**	.23	2.70	4.2	2.8	39 000	**8 770**	13 400	**3 010**	6 000	7 000
2212E	60	**2.3622**	110	**4.3307**	28	**1.1024**	1.5	**.059**	.24	2.60	4.1	2.8	48 800	**11 000**	17 000	**3 820**	5 300	6 300
2213E	65	**2.5591**	120	**4.7244**	31	**1.2205**	1.5	**.059**	.24	2.60	4.1	2.8	57 200	**12 900**	20 000	**4 500**	5 000	6 000
2214	70	**2.7559**	125	**4.9213**	31	**1.2205**	1.5	**.059**	.27	2.30	3.6	2.5	44 200	**9 940**	17 000	**3 820**	4 800	5 600
2215	75	**2.9528**	130	**5.1181**	31	**1.2205**	1.5	**.059**	.25	2.50	3.9	2.5	44 200	**9 940**	18 000	**4 050**	4 500	5 300
2216E	80	**3.1496**	140	**5.5118**	33	**1.2992**	2.0	**.079**	.22	2.90	4.5	2.8	65 000	**14 600**	25 500	**5 730**	4 000	4 800
2217	85	**3.3465**	150	**5.9055**	36	**1.4173**	2.0	**.079**	.25	2.50	3.9	2.5	58 500	**13 200**	23 600	**5 310**	3 800	4 500
2218	90	**3.5433**	160	**6.2992**	40	**1.5748**	2.0	**.079**	.27	2.30	3.6	2.5	70 200	**15 800**	28 500	**6 410**	3 600	4 300
2219	95	**3.7402**	170	**6.6929**	43	**1.6929**	2.0	**.079**	.27	2.30	3.6	2.5	83 200	**18 700**	34 500	**7 760**	3 400	4 000
2220	100	**3.9370**	180	**7.0866**	46	**1.8110**	2.0	**.079**	.27	2.30	3.6	2.5	97 500	**21 900**	40 500	**9 110**	3 200	3 800
2221	105	**4.1339**	190	**7.4803**	50	**1.9685**	2.0	**.079**	.28	2.20	3.5	2.5	108 000	**24 300**	45 000	**10 100**	3 000	3 600
2222	110	**4.3307**	200	**7.8740**	53	**2.0866**	2.0	**.079**	.28	2.20	3.5	2.5	124 000	**27 900**	52 000	**11 700**	2 800	3 400
2301	12	.4724	37	**1.4567**	17	**.6693**	1.0	**.039**	.60	1.05	1.6	1.1	11 700	**2 630**	2 700	**607**	17 000	20 000
2302	15	.5906	42	**1.6535**	17	**.6693**	1.0	**.039**	.52	1.20	1.9	1.3	11 900	**2 680**	2 900	**652**	15 000	18 000
2303	17	.6693	47	**1.8504**	19	**.7480**	1.0	**.039**	.52	1.20	1.9	1.3	14 600	**3 280**	3 550	**798**	13 000	16 000
2304	20	.7874	52	**2.0472**	21	**.8268**	1.0	**.039**	.52	1.20	1.9	1.3	18 200	**4 090**	4 750	**1 070**	11 000	14 000
2305	25	.9843	62	**2.4409**	24	**.9449**	1.0	**.039**	.48	1.30	2	1.4	24 200	**5 440**	6 550	**1 470**	9 500	12 000
2306	30	**1.1811**	72	**2.8346**	27	**1.0630**	1.0	**.039**	.44	1.40	2.2	1.4	31 200	**7 010**	8 800	**1 980**	8 500	10 000
2307E	35	**1.3780**	80	**3.1496**	31	**1.2205**	1.5	**.059**	.46	1.35	2.1	1.4	39 700	**8 930**	11 200	**2 520**	7 000	8 500
2308E	40	**1.5748**	90	**3.5433**	33	**1.2992**	1.5	**.059**	.40	1.60	2.4	1.6	54 000	**12 100**	16 000	**3 600**	6 300	7 500
2309E	45	**1.7717**	100	**3.9370**	36	**1.4173**	1.5	**.059**	.33	1.90	3	2.0	63 700	**14 300**	19 300	**4 340**	5 600	6 700
2310	50	**1.9685**	110	**4.3307**	40	**1.5748**	2.0	**.079**	.43	1.50	2.3	1.6	63 700	**14 300**	20 000	**4 500**	5 300	6 300
2311	55	**2.1654**	120	**4.7244**	43	**1.6929**	2.0	**.079**	.40	1.60	2.4	1.6	76 100	**17 100**	24 000	**5 400**	4 800	5 600
2312	60	**2.3622**	130	**5.1181**	46	**1.8110**	2.0	**.079**	.33	1.90	3	2.0	87 100	**19 600**	28 500	**6 410**	4 500	5 300
2313	65	**2.5591**	140	**5.5118**	48	**1.8898**	2.0	**.079**	.37	1.70	2.6	1.8	95 600	**21 500**	32 500	**7 310**	4 000	4 800
2314	70	**2.7559**	150	**5.9055**	51	**2.0079**	2.0	**.079**	.37	1.70	2.6	1.8	111 000	**25 000**	37 500	**8 430**	3 800	4 500
2315	75	**2.9528**	160	**6.2992**	55	**2.1654**	2.0	**.079**	.37	1.70	2.6	1.8	124 000	**27 900**	43 000	**9 670**	3 400	4 000
2316	80	**3.1496**	170	**6.6929**	58	**2.2835**	2.0	**.079**	.37	1.70	2.6	1.8	135 000	**30 400**	49 000	**11 000**	3 200	3 800
2317	85	**3.3465**	180	**7.0866**	60	**2.3622**	2.5	**.098**	.37	1.70	2.6	1.8	140 000	**31 500**	51 000	**11 500**	3 000	3 600
2318	90	**3.5433**	190	**7.4803**	64	**2.5197**	2.5	**.098**	.37	1.70	2.6	1.8	153 000	**34 400**	57 000	**12 800**	2 800	3 400
2319	95	**3.7402**	200	**7.8740**	67	**2.6378**	2.5	**.098**	.37	1.70	2.6	1.8	165 000	**37 100**	64 000	**14 400**	2 600	3 200
2320	100	**3.9370**	215	**8.4646**	73	**2.8740**	2.5	**.098**	.37	1.70	2.6	1.8	190 000	**42 700**	80 000	**18 000**	2 400	3 000
2322	110	**4.3307**	240	**9.4488**	80	**3.1496**	2.5	**.098**	.37	1.70	2.6	1.8	216 000	**48 600**	95 000	**21 400**	2 200	2 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

1200K, 1200EK, 1300K, 1300EK series
self-aligning ball bearings with tapered bore

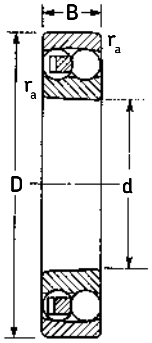


Tapered bore
taper 1:12 on diameter

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1) r_a mm	Fillet radius[1) r_a in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2) N	Dynamic C[2) lbf	Static C_0 N	Static C_0 lbf	Speed rating Grease rpm	Speed rating Oil rpm
1204EK	20	.7874	47	1.8504	14	.5512	1.0	.039	.30	2.1	3.3	2.2	12 700	2 860	3 400	764	15 000	18 000
1205EK	25	.9843	52	2.0472	15	.5906	1.0	.039	.28	2.2	3.5	2.5	14 300	3 220	4 000	899	13 000	16 000
1206EK	30	1.1811	62	2.4409	16	.6299	1.0	.039	.25	2.5	3.9	2.5	15 600	3 510	4 650	1 050	10 000	13 000
1207EK	35	1.3780	72	2.8346	17	.6693	1.0	.039	.23	2.7	4.2	2.8	19 000	4 270	6 000	1 350	9 000	11 000
1208EK	40	1.5748	80	3.1496	18	.7087	1.0	.039	.22	2.9	4.5	2.8	19 900	4 470	6 950	1 560	8 500	10 000
1209EK	45	1.7717	85	3.3465	19	.7480	1.0	.039	.21	3.0	4.6	3.2	22 900	5 150	7 800	1 750	7 500	9 000
1210EK	50	1.9685	90	3.5433	20	.7874	1.0	.039	.21	3.0	4.6	3.2	26 500	5 960	9 150	2 060	7 000	8 500
1211EK	55	2.1654	100	3.9370	21	.8268	1.5	.059	.19	3.3	5.1	3.6	27 600	6 210	10 600	2 380	6 300	7 500
1212EK	60	2.3622	110	4.3307	22	.8661	1.5	.059	.19	3.3	5.1	3.6	31 200	7 010	12 200	2 740	5 600	6 700
1213EK	65	2.5591	120	4.7244	23	.9055	1.5	.059	.18	3.5	5.4	3.6	35 100	7 890	14 000	3 150	5 300	6 300
1215K	75	2.9528	130	5.1181	25	.9843	1.5	.059	.17	3.7	5.7	4.0	39 000	8 770	15 600	3 510	4 800	5 600
1216K	80	3.1496	140	5.5118	26	1.0236	2.0	.079	.16	3.9	6.1	4.0	39 700	8 930	17 000	3 820	4 500	5 300
1217K	85	3.3465	150	5.9055	28	1.1024	2.0	.079	.17	3.7	5.7	4.0	48 800	11 000	20 800	4 680	4 000	4 800
1218K	90	3.5433	160	6.2992	30	1.1811	2.0	.079	.17	3.7	5.7	4.0	57 200	12 900	23 600	5 310	3 800	4 500
1219K	95	3.7402	170	6.6929	32	1.2598	2.0	.079	.17	3.7	5.7	4.0	63 700	14 300	27 000	6 070	3 600	4 300
1220K	100	3.9370	180	7.0866	34	1.3386	2.0	.079	.17	3.7	5.7	4.0	68 900	15 500	30 000	6 740	3 400	4 000
1221K	105	4.1339	190	7.4803	36	1.4173	2.0	.079	.17	3.7	5.7	4.0	74 100	16 700	32 500	7 310	3 200	3 800
1222K	110	4.3307	200	7.8740	38	1.4961	2.0	.079	.17	3.7	5.7	4.0	88 400	19 900	39 000	8 770	3 000	3 600
1224K	120	4.7244	215	8.4646	42	1.6535	2.0	.079	.19	3.3	5.1	3.6	11 900	26 800	53 000	11 900	2 800	3 400
1304EK	20	.7874	52	2.0472	15	.5906	1.0	.039	.28	2.2	3.5	2.5	14 300	3 220	4 000	899	12 000	15 000
1305EK	25	.9843	62	2.4409	17	.6693	1.0	.039	.28	2.2	3.5	2.5	19 000	4 270	5 400	1 210	9 500	12 000
1306EK	30	1.1811	72	2.8346	19	.7480	1.0	.039	.25	2.5	3.9	2.5	22 500	5 060	6 800	1 530	9 000	11 000
1307EK	35	1.3780	80	3.1496	21	.8268	1.5	.059	.25	2.5	3.9	2.5	26 500	5 960	8 500	1 910	7 500	9 000
1308EK	40	1.5748	90	3.5433	23	.9055	1.5	.059	.23	2.7	4.2	2.8	33 800	7 600	11 200	2 520	6 700	8 000
1309EK	45	1.7717	100	3.9370	25	.9843	1.5	.059	.23	2.7	4.2	2.8	39 000	8 770	13 400	3 010	6 300	7 500
1310EK	50	1.9685	110	4.3307	27	1.0630	2.0	.079	.24	2.6	4.1	2.8	43 600	9 800	14 000	3 150	5 600	6 700
1311EK	55	2.1654	120	4.7244	29	1.1417	2.0	.079	.23	2.7	4.2	2.8	50 700	11 400	18 000	4 050	5 000	6 000
1312EK	60	2.3622	130	5.1181	31	1.2205	2.0	.079	.23	2.7	4.2	2.8	58 500	13 200	22 000	4 950	4 500	5 300
1313EK	65	2.5591	140	5.5118	33	1.2992	2.0	.079	.22	2.9	4.5	2.8	65 000	14 600	25 500	5 730	4 300	5 000
1315K	75	2.9528	160	6.2992	37	1.4567	2.0	.079	.22	2.9	4.5	2.8	79 300	17 800	30 000	6 740	3 800	4 500
1316K	80	3.1496	170	6.6929	39	1.5354	2.0	.079	.22	2.9	4.5	2.8	88 400	19 900	33 500	7 530	3 600	4 300
1317K	85	3.3465	180	7.0866	41	1.6142	2.5	.098	.22	2.9	4.5	2.8	97 500	21 900	38 000	8 540	3 400	4 000
1318K	90	3.5433	190	7.4803	43	1.6929	2.5	.098	.22	2.9	4.5	2.8	117 000	26 300	44 000	9 890	3 200	3 800
1319K	95	3.7402	200	7.8740	45	1.7717	2.5	.098	.23	2.7	4.2	2.8	133 000	29 900	51 000	11 500	3 000	3 600
1320K	100	3.9370	215	8.4646	47	1.8504	2.5	.098	.23	2.7	4.2	2.8	143 000	32 200	57 000	12 800	2 800	3 400
1322K	110	4.3307	240	9.4488	50	1.9685	2.5	.098	.22	2.9	4.5	2.8	163 000	36 600	72 000	16 200	2 400	3 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

2200K, 2200EK, 2300K, 2300EK series
self-aligning ball bearings with tapered bore

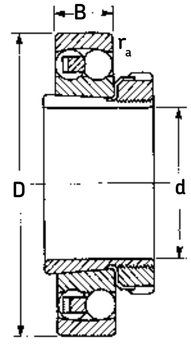


Tapered bore
taper 1:12 on diameter

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2] N	lbf	Static C_0 N	lbf	Speed rating Grease rpm	Oil rpm
2205EK	25	.9843	52	2.0472	18	.7087	1.0	.039	.35	1.8	2.8	1.8	16 800	3 780	4 400	989	11 000	14 000
2206EK	30	1.1811	62	2.4409	20	.7874	1.0	.039	.33	1.9	3.0	2.0	23 800	5 350	6 700	1 510	9 500	12 000
2207EK	35	1.3780	72	2.8346	23	.9055	1.0	.039	.31	2.0	3.1	2.2	30 700	6 900	8 800	1 980	8 500	10 000
2208EK	40	1.5748	80	3.1496	23	.9055	1.0	.039	.28	2.2	3.5	2.5	31 900	7 170	10 000	2 250	7 500	9 000
2209EK	45	1.7717	85	3.3465	23	.9055	1.0	.039	.26	2.4	3.7	2.5	32 500	7 310	10 600	2 380	7 000	8 500
2210EK	50	1.9685	90	3.5433	23	.9055	1.0	.039	.23	2.7	4.2	2.8	33 800	7 600	11 200	2 520	6 300	7 500
2211EK	55	2.1654	100	3.9370	25	.9843	1.5	.059	.23	2.7	4.2	2.8	39 000	8 770	13 400	3 010	6 000	7 000
2212EK	60	2.3622	110	4.3307	28	1.1024	1.5	.059	.24	2.6	4.1	2.8	48 800	11 000	17 000	3 820	5 300	6 300
2213EK	65	2.5591	120	4.7244	31	1.2205	1.5	.059	.24	2.6	4.1	2.8	57 200	12 900	20 000	4 500	5 000	6 000
2215K	75	2.9528	130	5.1181	31	1.2205	1.5	.059	.25	2.5	3.9	2.5	44 200	9 940	18 000	4 050	4 500	5 300
2216EK	80	3.1496	140	5.5118	33	1.2992	2.0	.079	.22	2.9	4.5	2.8	65 000	14 600	25 500	5 730	4 000	4 800
2217K	85	3.3465	150	5.9055	36	1.4173	2.0	.079	.25	2.5	3.9	2.5	58 500	13 200	23 600	5 310	3 800	4 500
2218K	90	3.5433	160	6.2992	40	1.5748	2.0	.079	.27	2.3	3.6	2.5	70 200	15 800	28 500	6 410	3 600	4 300
2219K	95	3.7402	170	6.6929	43	1.6929	2.0	.079	.27	2.3	3.6	2.5	83 200	18 700	34 500	7 760	3 400	4 000
2220K	100	3.9370	180	7.0866	46	1.8110	2.0	.079	.27	2.3	3.6	2.5	97 500	21 900	40 500	9 110	3 200	3 800
2221K	105	4.1339	190	7.4803	50	1.9685	2.0	.079	.28	2.2	3.5	2.5	108 000	24 300	45 000	10 100	3 000	3 600
2222K	110	4.3307	200	7.8740	53	2.0866	2.0	.079	.28	2.2	3.5	2.5	124 000	27 900	52 000	11 700	2 800	3 400
2305K	25	.9843	62	2.4409	24	.9449	1.0	.039	.48	1.3	2.0	1.4	24 200	5 440	6 550	1 470	9 500	12 000
2306K	30	1.1811	72	2.8346	27	1.0630	1.0	.039	.44	1.4	2.2	1.4	31 200	7 010	8 800	1 980	8 500	10 000
2307EK	35	1.3780	80	3.1496	31	1.2205	1.5	.059	.46	1.3	2.1	1.4	39 700	8 930	11 200	2 520	7 000	8 500
2308EK	40	1.5748	90	3.5433	33	1.2992	1.5	.059	.40	1.6	2.4	1.6	54 000	12 100	16 000	3 600	6 300	7 500
2309EK	45	1.7717	100	3.9370	36	1.4173	1.5	.059	.33	1.9	3.0	2.0	63 700	14 300	19 300	4 340	5 600	6 700
2310K	50	1.9685	110	4.3307	40	1.5748	2.0	.079	.43	1.5	2.3	1.6	63 700	14 300	20 000	4 500	5 300	6 300
2311K	55	2.1654	120	4.7244	43	1.6929	2.0	.079	.40	1.6	2.4	1.6	76 100	17 100	24 000	5 400	4 800	5 600
2312K	60	2.3622	130	5.1181	46	1.8110	2.0	.079	.33	1.9	3.0	2.0	87 100	19 600	28 500	6 410	4 500	5 300
2313K	65	2.5591	140	5.5118	48	1.8898	2.0	.079	.37	1.7	2.6	1.8	95 600	21 500	32 500	7 310	4 000	4 800
2315K	75	2.9528	160	6.2992	55	2.1654	2.0	.079	.37	1.7	2.6	1.8	124 000	27 900	43 000	9 670	3 400	4 000
2316K	80	3.1496	170	6.6929	58	2.2835	2.0	.079	.37	1.7	2.6	1.8	135 000	30 400	49 000	11 000	3 200	3 800
2317K	85	3.3465	180	7.0866	60	2.3622	2.5	.098	.37	1.7	2.6	1.8	140 000	31 500	51 000	11 500	3 000	3 600
2318K	90	3.5433	190	7.4803	64	2.5197	2.5	.098	.37	1.7	2.6	1.8	153 000	34 400	57 000	12 800	2 800	3 400
2319K	95	3.7402	200	7.8740	67	2.6378	2.5	.098	.37	1.7	2.6	1.8	165 000	37 100	64 000	14 400	2 600	3 200
2320K	100	3.9370	215	8.4646	73	2.8740	2.5	.098	.37	1.7	2.6	1.8	190 000	42 700	80 000	18 000	2 400	3 000
2322K	110	4.3307	240	9.4488	80	3.1496	2.5	.098	.37	1.7	2.6	1.8	216 000	48 600	95 000	21 400	2 200	2 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

1200K, 1200EK, 1300K, 1300EK series
self-aligning ball bearings with adapter sleeve

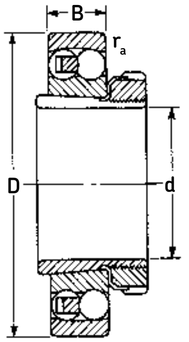


Tapered bore
taper 1:12 on diameter

MRC bearing number	Adapter sleeve	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2)] N	lbf	Static C_0 N	lbf	Speed rating Grease rpm	Oil rpm
1204EK	H204	17	**.6693**	47	**1.8504**	14	**.5512**	1.0	**.039**	.30	2.1	3.3	2.2	12 700	**2 860**	3 400	**764**	15 000	18 000
1205EK	H205	20	**.7874**	52	**2.0472**	15	**.5906**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	13 000	16 000
1206EK	H206	25	**.9843**	62	**2.4409**	16	**.6299**	1.0	**.039**	.25	2.5	3.9	2.5	15 600	**3 510**	4 650	**1 050**	10 000	13 000
1207EK	H207	30	**1.1811**	72	**2.8346**	17	**.6693**	1.0	**.039**	.23	2.7	4.2	2.8	19 000	**4 270**	6 000	**1 350**	9 000	11 000
1208EK	H208	35	**1.3780**	80	**3.1496**	18	**.7087**	1.0	**.039**	.22	2.9	4.5	2.8	19 900	**4 470**	6 950	**1 560**	8 500	10 000
1209EK	H209	40	**1.5748**	85	**3.3465**	19	**.7480**	1.0	**.039**	.21	3.0	4.6	3.2	22 900	**5 150**	7 800	**1 750**	7 500	9 000
1210EK	H210	45	**1.7717**	90	**3.5433**	20	**.7874**	1.0	**.039**	.21	3.0	4.6	3.2	26 500	**5 960**	9 150	**2 060**	7 000	8 500
1211EK	H211	50	**1.9685**	100	**3.9370**	21	**.8268**	1.5	**.059**	.19	3.3	5.1	3.6	27 600	**6 210**	10 600	**2 380**	6 300	7 500
1212EK	H212	55	**2.1654**	110	**4.3307**	22	**.8661**	1.5	**.059**	.19	3.3	5.1	3.6	31 200	**7 010**	12 200	**2 740**	5 600	6 700
1213EK	H213	60	**2.3622**	120	**4.7244**	23	**.9055**	1.5	**.059**	.18	3.5	5.4	3.6	35 100	**7 890**	14 000	**3 150**	5 300	6 300
1215K	H215	65	**2.5591**	130	**5.1181**	25	**.9843**	1.5	**.059**	.17	3.7	5.7	4.0	39 000	**8 770**	15 600	**3 510**	4 800	5 600
1216K	H216	70	**2.7559**	140	**5.5118**	26	**1.0236**	2.0	**.079**	.16	3.9	6.1	4.0	39 700	**8 930**	17 000	**3 820**	4 500	5 300
1217K	H217	75	**2.9528**	150	**5.9055**	28	**1.1024**	2.0	**.079**	.17	3.7	5.7	4.0	48 800	**11 000**	20 800	**4 680**	4 000	4 800
1218K	H218	80	**3.1496**	160	**6.2992**	30	**1.1811**	2.0	**.079**	.17	3.7	5.7	4.0	57 200	**12 900**	23 600	**5 310**	3 800	4 500
1219K	H219	85	**3.3465**	170	**6.6929**	32	**1.2598**	2.0	**.079**	.17	3.7	5.7	4.0	63 700	**14 300**	27 000	**6 070**	3 600	4 300
1220K	H220	90	**3.5433**	180	**7.0866**	34	**1.3386**	2.0	**.079**	.17	3.7	5.7	4.0	68 900	**15 500**	30 000	**6 740**	3 400	4 000
1221K	H221	95	**3.7402**	190	**7.4803**	36	**1.4173**	2.0	**.079**	.17	3.7	5.7	4.0	74 100	**16 700**	32 500	**7 310**	3 200	3 800
1222K	H222	100	**3.9370**	200	**7.8740**	38	**1.4961**	2.0	**.079**	.17	3.7	5.7	4.0	88 400	**19 900**	39 000	**8 770**	3 000	3 600
1224K	H3024	110	**4.3307**	215	**8.4646**	42	**1.6535**	2.0	**.079**	.19	3.3	5.1	3.6	119 000	**26 800**	53 000	**11 900**	2 800	3 400
1304EK	H304	17	**.6693**	52	**2.0472**	15	**.5906**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	12 000	14 000
1305EK	H305	20	**.7874**	62	**2.4409**	17	**.6693**	1.0	**.039**	.28	2.2	3.5	2.5	19 000	**4 270**	5 400	**1 210**	9 500	12 000
1306EK	H306	25	**.9843**	72	**2.8346**	19	**.7480**	1.0	**.039**	.25	2.5	3.9	2.5	22 500	**5 060**	6 800	**1 530**	9 000	11 000
1307EK	H307	30	**1.1811**	80	**3.1496**	21	**.8268**	1.5	**.059**	.25	2.5	3.9	2.5	26 500	**5 960**	8 500	**1 910**	7 500	9 000
1308EK	H308	35	**1.3780**	90	**3.5433**	23	**.9055**	1.5	**.059**	.23	2.7	4.2	2.8	33 800	**7 600**	11 200	**2 520**	6 700	8 000
1309EK	H309	40	**1.5748**	100	**3.9370**	25	**.9843**	1.5	**.059**	.23	2.7	4.2	2.8	39 000	**8 770**	13 400	**3 010**	6 300	7 500
1310EK	H310	45	**1.7717**	110	**4.3307**	27	**1.0630**	2.0	**.079**	.24	2.6	4.1	2.8	43 600	**9 800**	14 000	**3 150**	5 600	6 700
1311EK	H311	50	**1.9685**	120	**4.7244**	29	**1.1417**	2.0	**.079**	.23	2.7	4.2	2.8	50 700	**11 400**	18 000	**4 050**	5 000	6 000
1312EK	H312	55	**2.1654**	130	**5.1181**	31	**1.2205**	2.0	**.079**	.23	2.7	4.2	2.8	58 500	**13 200**	22 000	**4 950**	4 500	5 300
1313EK	H313	60	**2.3622**	140	**5.5118**	33	**1.2992**	2.0	**.079**	.22	2.9	4.5	2.8	65 000	**14 600**	25 500	**5 730**	4 300	5 000
1315K	H315	65	**2.5591**	160	**6.2992**	37	**1.4567**	2.0	**.079**	.22	2.9	4.5	2.8	79 300	**17 800**	30 000	**6 740**	3 800	4 500
1316K	H316	70	**2.7559**	170	**6.6929**	39	**1.5354**	2.0	**.079**	.22	2.9	4.5	2.8	88 400	**19 900**	33 500	**7 530**	3 600	4 300
1317K	H317	75	**2.9528**	180	**7.0866**	41	**1.6142**	2.5	**.098**	.22	2.9	4.5	2.8	97 500	**21 900**	38 000	**8 540**	3 400	4 000
1318K	H318	80	**3.1496**	190	**7.4803**	43	**1.6929**	2.5	**.098**	.22	2.9	4.5	2.8	117 000	**26 300**	44 000	**9 890**	3 200	3 800
1319K	H319	85	**3.3465**	200	**7.8740**	45	**1.7717**	2.5	**.098**	.23	2.7	4.2	2.8	133 000	**29 900**	51 000	**11 500**	3 000	3 600
1320K	H320	90	**3.5433**	215	**8.4646**	47	**1.8504**	2.5	**.098**	.23	2.7	4.2	2.8	143 000	**32 200**	57 000	**12 800**	2 800	3 400
1322K	H322	100	**3.9370**	240	**9.4488**	50	**1.9685**	2.5	**.098**	.22	2.9	4.5	2.8	163 000	**36 600**	72 000	**16 200**	2 400	3 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

2200K, 2200EK, 2300K, 2300EK series
self-aligning ball bearings with adapter sleeve

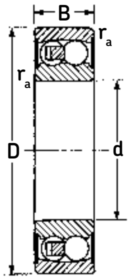


Tapered bore
taper 1:12 on diameter

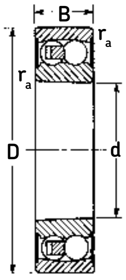
MRC bearing number	Adapter sleeve	Bore d		Outside diameter D		Width B		Fillet radius[1] r_a		Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic $C^{2)}$		Static C_0		Speed rating Grease	Oil
		mm	in.	mm	in.	mm	in.	mm	in.					N	lbf	N	lbf	rpm	rpm
2205EK	H305	20	.7874	52	2.0472	18	.7087	1.0	.039	.35	1.80	2.8	1.8	16 800	3 780	4 400	989	11 000	14 000
2206EK	H306	25	.9843	62	2.4409	20	.7874	1.0	.039	.33	1.90	3.0	2.0	23 800	5 350	6 700	1 510	9 500	12 000
2207EK	H307	30	1.1811	72	2.8346	23	.9055	1.0	.039	.31	2.00	3.1	2.2	30 700	6 900	8 800	1 980	8 500	10 000
2208EK	H308	35	1.3780	80	3.1496	23	.9055	1.0	.039	.28	2.20	3.5	2.5	31 900	7 170	10 000	2 250	7 500	9 000
2209EK	H309	40	1.5748	85	3.3465	23	.9055	1.0	.039	.26	2.40	3.7	2.5	32 500	7 310	10 600	2 380	7 000	8 500
2210EK	H310	45	1.7717	90	3.5433	23	.9055	1.0	.039	.23	2.70	4.2	2.8	33 800	7 600	11 200	2 520	6 300	7 500
2211EK	H311	50	1.9685	100	3.9370	25	.9843	1.5	.059	.23	2.70	4.2	2.8	39 000	8 770	13 400	3 010	6 000	7 000
2212EK	H312	55	2.1654	110	4.3307	28	1.1024	1.5	.059	.24	2.60	4.1	2.8	48 800	11 000	17 000	3 820	5 300	6 300
2213EK	H313	60	2.3622	120	4.7244	31	1.2205	1.5	.059	.24	2.60	4.1	2.8	57 200	12 900	20 000	4 500	5 000	6 000
2215K	H315	65	2.5591	130	5.1181	31	1.2205	1.5	.059	.25	2.50	3.9	2.5	44 200	9 940	18 000	4 050	4 500	5 300
2216EK	H316	70	2.7559	140	5.5118	33	1.2992	2.0	.079	.22	2.90	4.5	2.8	65 000	14 600	25 500	5 730	4 000	4 800
2217K	H317	75	2.9528	150	5.9055	36	1.4173	2.0	.079	.25	2.50	3.9	2.5	58 500	13 200	23 600	5 310	3 800	4 500
2218K	H318	80	3.1496	160	6.2992	40	1.5748	2.0	.079	.27	2.30	3.6	2.5	70 200	15 800	28 500	6 410	3 600	4 300
2219K	H319	85	3.3465	170	6.6929	43	1.6929	2.0	.079	.27	2.30	3.6	2.5	83 200	18 700	34 500	7 760	3 400	4 000
2220K	H320	90	3.5433	180	7.0866	46	1.8110	2.0	.079	.27	2.30	3.6	2.5	97 500	21 900	40 500	9 110	3 200	3 800
2221K	H321	95	3.7402	190	7.4803	50	1.9685	2.0	.079	.28	2.20	3.5	2.5	108 000	24 300	45 000	10 100	3 000	3 600
2222K	H322	100	3.9370	200	7.8740	53	2.0866	2.0	.079	.28	2.20	3.5	2.5	124 000	27 900	52 000	11 700	2 800	3 400
2305K	H2305	20	.7874	62	2.4409	24	.9449	1.0	.039	.48	1.30	2.0	1.4	24 200	5 440	6 550	1 470	9 500	12 000
2306K	H2306	25	.9843	72	2.8346	27	1.0630	1.0	.039	.44	1.40	2.2	1.4	31 200	7 010	8 800	1 980	8 500	10 000
2307EK	H2307	30	1.1811	80	3.1496	31	1.2205	1.5	.059	.46	1.35	2.1	1.4	39 700	8 930	11 200	2 520	7 000	8 500
2308EK	H2308	35	1.3780	90	3.5433	33	1.2992	1.5	.059	.40	1.60	2.4	1.6	54 000	12 100	16 000	3 600	6 300	7 500
2309EK	H2309	40	1.5748	100	3.9370	36	1.4173	1.5	.059	.33	1.90	3.0	2.0	63 700	14 300	19 300	4 340	5 600	6 700
2310K	H2310	45	1.7717	110	4.3307	40	1.5748	2.0	.079	.43	1.50	2.3	1.6	63 700	14 300	20 000	4 500	5 300	6 300
2311K	H2311	50	1.9685	120	4.7244	43	1.6929	2.0	.079	.40	1.60	2.4	1.6	76 100	17 100	24 000	5 400	4 800	5 600
2312K	H2312	55	2.1654	130	5.1181	46	1.8110	2.0	.079	.33	1.90	3.0	2.0	87 100	19 600	28 500	6 410	4 500	5 300
2313K	H2313	60	2.3622	140	5.5118	48	1.8898	2.0	.079	.37	1.70	2.6	1.8	95 600	21 500	32 500	7 310	4 000	4 800
2315K	H2315	65	2.5591	160	6.2992	55	2.1654	2.0	.079	.37	1.70	2.6	1.8	124 000	27 900	43 000	9 670	3 400	4 000
2316K	H2316	70	2.7559	170	6.6929	58	2.2835	2.0	.079	.37	1.70	2.6	1.8	135 000	30 400	49 000	11 000	3 200	3 800
2317K	H2317	75	2.9528	180	7.0866	60	2.3622	2.5	.098	.37	1.70	2.6	1.8	140 000	31 500	51 000	11 500	3 000	3 600
2318K	H2318	80	3.1496	190	7.4803	64	2.5197	2.5	.098	.37	1.70	2.6	1.8	153 000	34 400	57 000	12 800	2 800	3 400
2319K	H2319	85	3.3465	200	7.8740	67	2.6378	2.5	.098	.37	1.70	2.6	1.8	165 000	37 100	64 000	14 400	2 600	3 200
2320K	H2320	90	3.5433	215	8.4646	73	2.8740	2.5	.098	.37	1.70	2.6	1.8	190 000	42 700	80 000	18 000	2 400	3 000
2322K	H2322	100	3.9370	240	9.4488	80	3.1496	2.5	.098	.37	1.70	2.6	1.8	216 000	48 600	95 000	21 400	2 200	2 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

2200 and 2300 series
self-aligning ball bearings with seals, and with seals and tapered bore



Cylindrical bore

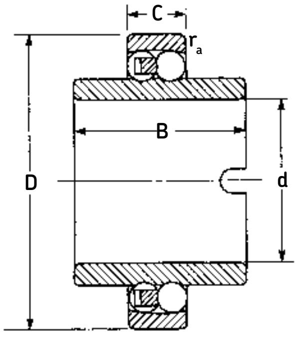


Tapered bore
taper 1:12 on diameter

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2)] N	lbf	Static C_0 N	lbf	Speed rating Grease rpm
Cylindrical bore																	
2200E2RS1	10	**.3937**	30	**1.1811**	14	**.5512**	.60	**.024**	.33	1.9	3.0	2.0	5 530	**1 240**	1 180	**265**	17 000
2201E2RS1	12	**.4724**	32	**1.2598**	14	**.5512**	.60	**.024**	.33	1.9	3.0	2.0	6 240	**1 400**	1 430	**321**	16 000
2202E2RS1	15	**.5906**	35	**1.3780**	14	**.5512**	.60	**.024**	.33	1.9	3.0	2.0	7 410	**1 670**	1 760	**396**	14 000
2203E2RS1	17	**.6693**	40	**1.5748**	16	**.6299**	.60	**.024**	.31	2.0	3.1	2.2	8 840	**1 990**	2 200	**495**	12 000
2204E2RS1	20	**.7874**	47	**1.8504**	18	**.7087**	1.0	**.039**	.30	2.1	3.3	2.2	12 700	**2 860**	3 400	**764**	10 000
2205E2RS1	25	**.9843**	52	**2.0472**	18	**.7087**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	9 000
2206E2RS1	30	**1.1811**	62	**2.4409**	20	**.7874**	1.0	**.039**	.25	2.5	3.9	2.5	15 600	**3 510**	4 650	**1 050**	7 500
2207E2RS1	35	**1.3780**	72	**2.8346**	23	**.9055**	1.0	**.039**	.23	2.7	4.2	2.8	19 000	**4 270**	6 000	**1 350**	6 300
2208E2RS1	40	**1.5748**	80	**3.1496**	23	**.9055**	1.0	**.039**	.22	2.9	4.5	2.8	19 900	**4 470**	6 950	**1 560**	5 600
2209E2RS1	45	**1.7717**	85	**3.3465**	23	**.9055**	1.0	**.039**	.21	3.0	4.6	3.2	22 900	**5 150**	7 800	**1 750**	5 300
22102RS1	50	**1.9685**	90	**3.5433**	23	**.9055**	1.0	**.039**	.20	3.2	4.9	3.2	22 900	**5 150**	8 150	**1 830**	4 800
2211E2RS1	55	**2.1654**	100	**3.9370**	25	**.9843**	1.5	**.059**	.19	3.3	5.1	3.6	27 600	**6 210**	10 600	**2 380**	4 300
2212E2RS1	60	**2.3622**	110	**4.3307**	28	**1.1024**	1.5	**.059**	.19	3.3	5.1	3.6	31 200	**7 010**	12 200	**2 740**	3 800
2213E2RS1	65	**2.5591**	120	**4.7244**	31	**1.2205**	1.5	**.059**	.18	3.5	5.4	3.6	35 100	**7 890**	14 000	**3 150**	3 600
22142RS1	70	**2.7559**	125	**4.9213**	31	**1.2205**	1.5	**.059**	.18	3.5	5.4	3.6	34 500	**7 760**	13 700	**3 080**	3 400
2302E2RS1	15	**.5906**	42	**1.6535**	17	**.6693**	1.0	**.039**	.31	2.0	3.1	2.2	10 800	**2 430**	2 600	**585**	12 000
2303E2RS1	17	**.6693**	47	**1.8504**	19	**.7480**	1.0	**.039**	.30	2.1	3.3	2.2	12 700	**2 860**	3 400	**764**	11 000
2304E2RS1	20	**.7874**	52	**2.0472**	21	**.8268**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	9 500
2305E2RS1	25	**.9843**	62	**2.4409**	24	**.9449**	1.0	**.039**	.28	2.2	3.5	2.5	19 000	**4 270**	5 400	**1 210**	7 500
2306E2RS1	30	**1.1811**	72	**2.8346**	27	**1.0630**	1.0	**.039**	.25	2.5	3.9	2.5	22 500	**5 060**	6 800	**1 530**	6 700
2307E2RS1	35	**1.3780**	80	**3.1496**	31	**1.2205**	1.5	**.059**	.25	2.5	3.9	2.5	26 500	**5 960**	8 500	**1 910**	5 600
2308E2RS1	40	**1.5748**	90	**3.5433**	33	**1.2992**	1.5	**.059**	.23	2.7	4.2	2.8	33 800	**7 600**	11 200	**2 520**	5 000
2309E2RS1	45	**1.7717**	100	**3.9370**	36	**1.4173**	1.5	**.059**	.23	2.7	4.2	2.8	39 000	**8 770**	13 400	**3 010**	4 500
2310E2RS1	50	**1.9685**	110	**4.3307**	40	**1.5748**	2.0	**.079**	.24	2.6	4.1	2.8	43 600	**9 800**	14 000	**3 150**	4 000
Tapered bore																	
2205E2RS1K	25	**.9843**	52	**2.0472**	18	**.7087**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	9 000
2206E2RS1K	30	**1.1811**	62	**2.4409**	20	**.7874**	1.0	**.039**	.25	2.5	3.9	2.5	15 600	**3 510**	4 650	**1 050**	7 500
2207E2RS1K	35	**1.3780**	72	**2.8346**	23	**.9055**	1.0	**.039**	.23	2.7	4.2	2.8	19 000	**4 270**	6 000	**1 350**	6 300
2208E2RS1K	40	**1.5748**	80	**3.1496**	23	**.9055**	1.0	**.039**	.22	2.9	4.5	2.8	19 900	**4 470**	6 950	**1 560**	5 600
2209E2RS1K	45	**1.7717**	85	**3.3465**	23	**.9055**	1.0	**.039**	.21	3.0	4.6	3.2	22 900	**5 150**	7 800	**1 750**	5 300
22102RS1K	50	**1.9685**	90	**3.5433**	23	**.9055**	1.0	**.039**	.20	3.2	4.9	3.2	22 900	**5 150**	8 150	**1 830**	4 800
2211E2RS1K	55	**2.1654**	100	**3.9370**	25	**.9843**	1.5	**.059**	.19	3.3	5.1	3.6	27 600	**6 210**	10 600	**2 380**	4 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

11200E, 11300E series
self-aligning ball bearings with extended inner ring



MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width C mm	in.	B mm	in.	Fillet radius[1) r_a mm	in.	Calculation factors e	Y_1	Y_2	Y_0	Basic radial load rating Dynamic C[2) N	lbf	Static C_0 N	lbf	Speed rating Grease or oil rpm
11204E	20	**.7874**	47	**1.8504**	14	**.5512**	40	**1.575**	1.0	**.039**	.30	2.1	3.3	2.2	12 700	**2 860**	3 400	**764**	9 000
11205E	25	**.9843**	52	**2.0472**	15	**.5906**	44	**1.732**	1.0	**.039**	.28	2.2	3.5	2.5	14 300	**3 220**	4 000	**899**	8 000
11206E	30	**1.1811**	62	**2.4409**	16	**.6299**	48	**1.890**	1.0	**.039**	.25	2.5	3.9	2.5	15 600	**3 510**	4 650	**1 050**	6 700
11207E	35	**1.3780**	72	**2.8346**	17	**.6693**	52	**2.047**	1.0	**.039**	.23	2.7	4.2	2.8	19 000	**4 270**	6 000	**1 350**	5 600
11208E	40	**1.5748**	80	**3.1496**	18	**.7087**	56	**2.205**	1.0	**.039**	.22	2.9	4.5	2.8	19 900	**4 470**	6 950	**1 560**	5 000
11209E	45	**1.7717**	85	**3.3465**	19	**.7480**	58	**2.283**	1.0	**.039**	.21	3.0	4.6	3.2	22 900	**5 150**	7 800	**1 750**	4 500
11210E	50	**1.9685**	90	**3.5433**	20	**.7874**	58	**2.283**	1.0	**.039**	.21	3.0	4.6	3.2	26 500	**5 960**	9 150	**2 060**	4 300
11212E	60	**2.3622**	110	**4.3307**	22	**.8661**	62	**2.441**	1.5	**.059**	.19	3.3	5.1	3.6	31 200	**7 010**	12 200	**2 740**	3 400
11305E	25	**.9843**	62	**2.4409**	17	**.6693**	48	**1.890**	1.0	**.039**	.28	2.2	3.5	2.5	19 000	**4 270**	5 400	**1 210**	6 700
11306E	30	**1.1811**	72	**2.8346**	19	**.7480**	52	**2.047**	1.0	**.039**	.25	2.5	3.9	2.5	22 500	**5 060**	6 800	**1 530**	5 600
11307E	35	**1.3780**	80	**3.1496**	21	**.8268**	56	**2.205**	1.5	**.059**	.25	2.5	3.9	2.5	26 500	**5 960**	8 500	**1 910**	5 000
11308E	40	**1.5748**	90	**3.5433**	23	**.9055**	58	**2.283**	1.5	**.059**	.23	2.7	4.2	2.8	33 800	**7 600**	11 200	**2 520**	4 500
11310E	50	**1.9685**	110	**4.3307**	27	**1.0630**	62	**2.441**	2.0	**.079**	.24	2.6	4.1	2.8	43 600	**9 800**	14 000	**3 150**	3 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at 33 1/3 rpm.

Radial internal clearance of self-aligning ball bearings

Bore diameter d				C2				Normal				C3				C4			
Over		Including		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.	
mm	in.	mm	in.	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Bearings with cylindrical bore																			
2.5	.0984	6	.2362	1	8	0	3	5	15	2	6	10	20	4	8	15	25	6	10
6.0	.2362	10	.3937	2	9	1	4	6	17	2	7	12	25	5	10	19	33	7	13
10.0	.3937	14	.5512	2	10	1	4	6	19	2	7	13	26	5	10	21	35	8	14
14.0	.5512	18	.7087	3	12	1	5	8	21	3	8	15	28	6	11	23	37	9	15
18.0	.7087	24	.9449	4	14	2	6	10	23	4	9	17	30	7	12	25	39	10	15
24.0	.9449	30	1.1811	5	16	2	6	11	24	4	9	19	35	7	14	29	46	11	18
30.0	1.1811	40	1.5748	6	18	2	7	13	29	5	11	23	40	9	16	34	53	13	21
40.0	1.5748	50	1.9685	6	19	2	7	14	31	6	12	25	44	10	17	37	57	15	22
50.0	1.9685	65	2.5591	7	21	3	8	16	36	6	14	30	50	12	20	45	69	18	27
65.0	2.5591	80	3.1496	8	24	3	9	18	40	7	16	35	60	14	24	54	83	21	33
80.0	3.1496	100	3.9370	9	27	4	11	22	48	9	19	42	70	17	28	64	96	25	38
100.0	3.9370	120	4.7244	10	31	4	12	25	56	10	22	50	83	20	33	75	114	30	45
120.0	4.7244	140	5.5118	10	38	4	15	30	68	12	27	60	100	24	39	90	135	35	53
Bearings with tapered bore																			
18.0	.7087	24	.9449	7	17	3	7	13	26	5	10	20	33	8	13	28	42	11	17
24.0	.9449	30	1.1811	9	20	4	8	15	28	6	11	23	39	9	15	33	50	13	20
30.0	1.1811	40	1.5748	12	24	5	9	19	35	7	14	26	46	10	18	40	59	16	23
40.0	1.5748	50	1.9685	14	27	6	11	22	39	9	15	33	52	13	20	45	65	18	26
50.0	1.9685	65	2.5591	18	32	7	13	27	47	11	19	41	61	16	24	56	80	22	31
65.0	2.5591	80	3.1496	23	39	9	15	35	57	14	22	50	75	20	30	69	98	27	39
80.0	3.1496	100	3.9370	29	47	11	19	42	68	17	27	62	90	24	35	84	116	33	46
100.0	3.9370	120	4.7244	35	56	14	22	50	81	20	32	75	108	30	43	100	139	39	75

Allowable angular misalignment of self-aligning ball bearings

Bearing series	Allowable angular misalignment degrees
108, 126, 127, 129, 1350	3.0
1200, 1200E	2.5
1300, 1300E	3.0
1400	3.0
2200, 2200E	2.5
2200ERS1	1.5
2300, 2300E	3.0
2300ERS1	1.5
11200E	2.5
11300E	3.0

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R + Y_1 F_A$, where $F_A/F_R \le e$

or

$P = 0.65 F_R + Y_2 F_A$, where $F_A/F_R > e$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Y_1 = Thrust load factor

Y_2 = Thrust load factor

e = Limiting factor for F_A/F_R

Y_1, Y_2 and e are given in bearing tables

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic load rating

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = F_R + Y_0 F_A$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Y_0 = Thrust load factor

Y_0 given in bearing tables

Dynamic equivalent radial load and life calculation examples

Bearing size: 1209E

Speed: 2000 rpm

Basic dynamic radial load rating (C) = 5150

e = 0.21

Y_1 = 3.0

Y_2 = 4.6

Case 1

Radial load (F_R) = 500

Thrust load (F_A) = 100

F_A/F_R = 100/500 = 0.20

Equivalent load (P) = $F_R + Y_1 F_A$

P = 500 + 3.0 × 100 = 800

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{5150}{800}\right)^3 = 266.8 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{5150}{800}\right)^3$$

= 2223 Hrs

Case 2

Radial load (F_R) = 500

Thrust load (F_A) = 170

F_A/F_R = 170/500 = 0.34

Equivalent load (P) = $0.65 F_R + Y_2 F_A$

P = 0.65 × 500 + 4.6 × 170 = 1107

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{5150}{1107}\right)^3 = 100.7 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{5150}{1107}\right)^3$$

= 839 Hrs

Minimum load

In order to provide satisfactory operation, self-aligning ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the balls and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the balls and raceways.

The requisite minimum load to be applied to self-aligning ball bearings can be estimated using:

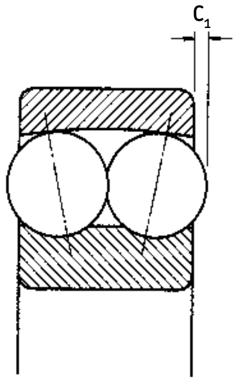
$P_m = 0.01\ C_0$

where, P_m = minimum equivalent static bearing load, lbs

C_0 = basic static load rating, lbs

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the self-aligning ball bearing must be subjected to an additional radial load, for example, by increasing belt tension or by similar means.

Self-aligning ball bearings



Ball protrusion

Self-aligning bearings in series 1400 and in some sizes in series 1200, 1200K and 1300K, have ball protrusion beyond the bearing ring faces as shown in the table below. This must be considered when designing adjacent components.

Size	Protrusion (C_1) mm	inches
1224K	1.3	.051
1226	0.7	.028
1318K	1.0	.039
1319K	1.5	.059
1320K	2.5	.098
1321K	2.6	.102
1322K	2.6	.102
1406	2.2	.087
1407	2.0	.079
1408	2.0	.079
1409	2.5	.098
1410	3.0	.118
1411	2.4	.094
1412	2.8	.110

Axial load carrying capacity of bearings mounted on adapter sleeves

The ability of self-aligning ball bearings mounted on adapter sleeves on smooth shafts to carry axial loads, depends on the friction between sleeve and shaft. The approximate permissible axial load can be determined from:

$F_{AP} = 3\ B\ d$

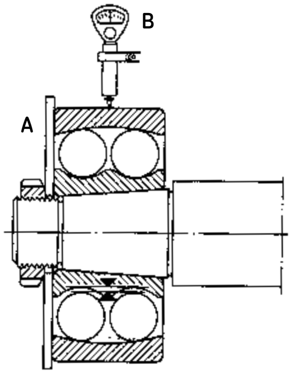
where, F_{AP} = maximum permissible axial load (N)

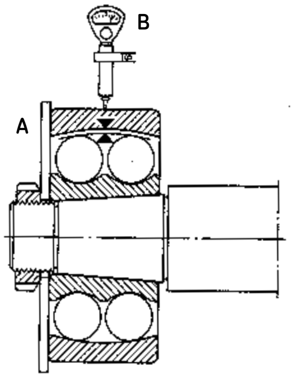
B = bearing width (mm)

d = bearing bore (mm)

To convert newtons (N) to pounds, multiply by 0.2248

Self-aligning ball bearings





Mounting bearings with tapered bore

Bearings with a tapered bore are always mounted with an interference fit on the shaft, adapter sleeve or withdrawal sleeve. As a measure of the degree of interference of the fit, either the reduction in radial internal clearance of the bearing or the axial displacement of the inner ring on the tapered bearing seating can be used. The mounting of self-aligning ball bearings with tapered bore calls for experience and skill as they have a relatively small internal clearance, and a reliable measurement of the clearance reduction is not always possible.

When mounting bearings with normal radial internal clearance it is generally sufficient to check clearance reduction during the drive-up by turning and swivelling out the outer ring. When the bearing is properly mounted the outer ring can be easily turned but there should be a slight resistance when the ring is swivelled out. The bearing will then have the requisite interference fit. In some cases, however, the residual internal clearance may be too small for the application, and a bearing with C3 radial internal clearance should be used instead.

When mounting bearings with C3 clearance, the tightening angle α or the axial displacement S can be used to measure the degree of interference. The procedures and values given in the following also apply to bearings with normal clearance.

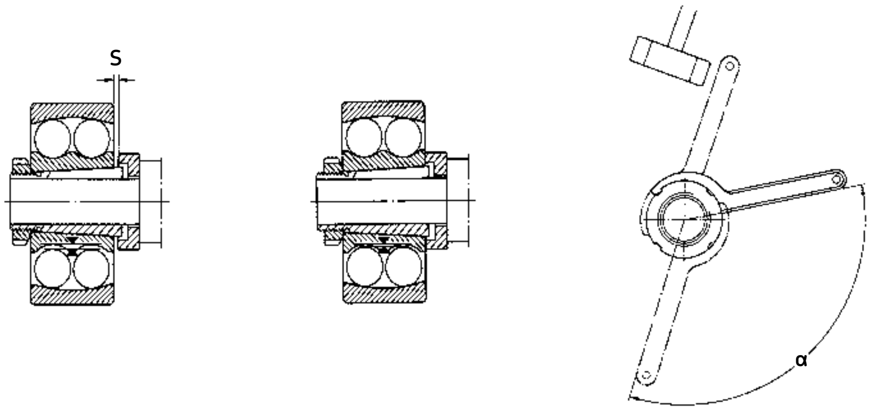
An easy method of mounting bearings on adapter sleeves is based on the tightening angle α through which the nut is turned and the procedure is described in the following. Guideline values for the tightening angle α are given in the table overleaf. Before mounting, the thread of the nut and the side face of the nut which is to abut the bearing should be smeared with a molybdenum disulphide paste or similar lubricant, and the outside diameter of the sleeve should be lightly oiled. The bearing is then pushed on to the sleeve and the nut screwed on. By turning the nut through the given angle α the bearing will be pressed up on the tapered seating of the sleeve. As the bearing has a tendency to skew when being pressed up it is advisable to reposition the hook spanner in a slot at 180° to that used for tightening and then apply a light hammer blow to the spanner. The bearing will straighten up on its seating. The nut is then removed, the locking washer inserted and the nut replaced, tightened and locked by bending down one of the tabs of the locking washer. The residual clearance of the bearing should be checked.

Another method which is often used to mount bearings with a tapered bore correctly and reliably is to measure the axial displacement S of the inner ring on the tapered seating. Guideline values for the requisite displacement S are given in the table overleaf.

When using either of the above methods, the self-aligning ball bearings should always be pushed up on to the tapered seating until the bore of the bearing is in contact with the seating on the shaft or sleeve around its whole circumference, before the final tightening procedure is begun. A sufficiently tight fit will then be obtained and the residual clearance will correspond to the mean values given in the table.

One method of measuring the internal clearance of self-aligning ball bearings is shown in the illustrations above. A washer A is inserted between the bearing and the shaft or sleeve nut to ensure correct alignment of the outer ring with respect to the inner ring. A dial gauge B placed on the bearing outer ring can be used to measure the bearing clearance. The outer ring should be pushed upwards in the direction of the shaft.

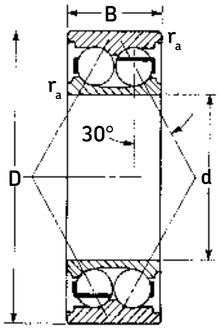
Self-aligning ball bearings



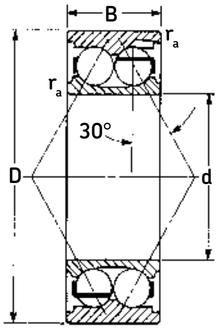
Mounting self-aligning ball bearings with tapered bore

			Axial displacement S								Mean residual clearance after mounting			
Bearing bore		Tightening angle	Bearing series								Normal		C3	
d		a	1200K		1300K		2200K		2300K		.001	.0001	.001	.0001
mm	in.	Degrees	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
20	**.7874**	70	.22	**.009**	.23	**.009**	—	**—**	—	**—**	10	**4**	20	**8**
25	**.9843**	70	.22	**.009**	.23	**.009**	.22	**.009**	.23	**.009**	10	**4**	20	**8**
30	**1.1811**	70	.22	**.009**	.23	**.009**	.22	**.009**	.23	**.009**	10	**4**	20	**8**
35	**1.3780**	70	.30	**.012**	.30	**.012**	.30	**.012**	.30	**.012**	10	**4**	20	**8**
40	**1.5748**	70	.30	**.012**	.30	**.012**	.30	**.012**	.30	**.012**	10	**4**	20	**8**
45	**1.7717**	70	.31	**.012**	.34	**.013**	.31	**.012**	.33	**.013**	15	**6**	25	**10**
50	**1.9685**	70	.31	**.012**	.34	**.013**	.31	**.012**	.33	**.013**	15	**6**	25	**10**
55	**2.1654**	90	.40	**.016**	.41	**.016**	.39	**.015**	.40	**.016**	15	**6**	30	**12**
60	**2.3622**	90	.40	**.016**	.41	**.016**	.39	**.015**	.40	**.016**	15	**6**	30	**12**
65	**2.5591**	90	.40	**.016**	.41	**.016**	.39	**.015**	.40	**.016**	15	**6**	30	**12**
75	**2.9528**	120	.45	**.018**	.47	**.019**	.43	**.017**	.46	**.018**	20	**8**	40	**16**
80	**3.1496**	120	.45	**.018**	.47	**.019**	.43	**.017**	.46	**.018**	20	**8**	40	**16**
85	**3.3465**	120	.58	**.023**	.60	**.024**	.54	**.021**	.59	**.023**	20	**8**	40	**16**
90	**3.5433**	120	.58	**.023**	.60	**.024**	.54	**.021**	.59	**.023**	20	**8**	40	**16**
95	**3.7402**	120	.58	**.023**	.60	**.024**	.54	**.021**	.59	**.023**	20	**8**	40	**16**
100	**3.9370**	120	.58	**.023**	.60	**.024**	.54	**.021**	.59	**.023**	20	**8**	40	**16**
105	**4.1339**	120	.67	**.026**	—	**—**	.66	**.026**	—	**—**	25	**10**	55	**22**
110	**4.3307**	120	.67	**.026**	.70	**.028**	.66	**.026**	.69	**.027**	25	**10**	55	**22**
120	**4.7244**	120	.67	**.026**	—	**—**	—	**—**	—	**—**	25	**10**	55	**22**

5000 series double-row angular contact ball bearings



C Plain



M Plain

MRC double-row angular contact ball bearings are manufactured in two main types: C-type (Conrad construction) and M-type (maximum capacity with filling notches). Each of the two rows has a 30° contact angle.

C-type

Conrad construction, or C-type, double-row ball bearings have contact angles that converge outside the bearing, thereby increasing resistance to misalignment. This type does not have filling notches. These bearings are recommended for applications where single-row ball bearings are inadequate, but radial loads are not so great as to suggest a filling-notch bearing. They will take heavy radial loads and axial loads equally in either direction. The C-type design fully meets the requirements of American Petroleum Institute (API) Specification 610.

Both the inner and the outer rings have closure grooves. These bearings are available with seals, shields, and snap-rings.

M-type

Maximum capacity double-row ball bearings have filling notches on one side to permit assembling the maximum number of balls into the bearing. Contact angles converge outside the bearing. All inner and outer rings have closure grooves. These bearings may be equipped with seals, shields, and snap-rings. The M-type bearing has very heavy radial capacity. It also has thrust capacity in one direction, with the ability to accommodate light thrust load in the reversing direction.

Part numbers on M-type double-row bearings are normally located on either the side face or the O.D. surface of the bearing. The side face marking is always on the side opposite the filling notch and the O.D. marking is offset from the center away from the filling notch. Therefore, double sealed or shielded bearings with the filling notch covered from view can be oriented correctly.

Ball cages and types

The cage supplied with C-type and M-type bearings is a one-piece crown-type of heat-treated pressed steel. It is snapped into place after the full quota of balls has been introduced between the inner and outer ring.

5000 series ball bearings suffix and width summary

The older MRC 5000 series double-row ball bearings were made in three series — 5200 light, 5300 medium, and 5400 heavy — each with progressively larger cross sections. These old-style 5000 type double-rows were available in the SB Conrad and maximum capacity configurations. The SB Conrad version had contact angles which diverged inwardly, thereby increasing resistance to misalignment. The maximum capacity version had contact angles which converged inwardly, giving it the capability of handling small amounts of misalignment. It also had filling notches on both sides, for the introduction of a maximum complement of balls.

Our double-row ball bearings are available in the C-type (Conrad construction) and M-type (with filling notches on one side only). Both types feature inwardly diverging contact angles, which provide greater rigidity than found in the previous double-row filling-notch type bearings. A unique manufacturing system utilizing "common parts" is employed in the manufacture of these bearings. Using a minimum number of components, the system provides greater flexibility for producing either Conrad or maximum capacity types as open bearings or with a variety of closures. Twenty-four variations of a single bearing size can be manufactured to solve your application problems.

The charts on pages 91–92 outline the suffixes and widths of MRC 5000 series bearings. The data on the charts do not represent actual availability of double-row products. These data are intended to be used as references for interchanging. Current style double-rows appear next to their old-style counterparts that are the same width.

MRC double-row suffix identification summary

Suffix	Description
B	Rigid construction, maximum capacity
BK	Rigid construction, maximum capacity, standard width
C	Conrad, rigid construction, standard width
C1	1/8 in. additional width from standard. 5205C1 and 5212C1 are 1/16 in. wider than standard
F	One shield
FF	Two shields
G	Snap-ring
HYB#1	Ceramic rolling elements
K	Standard width
M	Maximum capacity, rigid construction, standard width
M1	1/8 in. additional width from standard. 5205M1 and 5212M1 are 1/16 in. wider than standard
Plain	Maximum capacity, nonrigid construction. Narrow width in 5200 series, extra width is required with closures
S	Conrad construction (Note: always combined with additional suffix letters)
SB	Conrad, rigid construction, narrow width. Extra width is required with closures
SBK	Conrad, rigid construction, standard width
Z	One seal
ZZ	Two seals

5000 series ball bearings suffix and width summary

Basic bearing number	Old style suffix	New style suffix	Width (inches)
5200 Series			
5106	SBZZ	—	29/32
5200	SB	—	9/16
	SBKF	—	9/16
	SBKFF	—	9/16
	SBKZ	—	9/16
	SBKZZ	—	9/16
5201	SB	—	5/8
	SBFG	—	5/8
	SBKF	—	5/8
	SBKFF	—	5/8
	SBKFFG	—	5/8
	SBKFG	—	5/8
	SBKZ	—	5/8
	SBKZZ	—	5/8
5202	Plain	—	5/8
	SB	—	5/8
	SBFG	—	11/16
	SBKF	—	5/8
	SBKFF	—	5/8
	SBKFG	—	5/8
	SBKZZ	—	5/8
5203	SB	—	11/16
	SBKF	—	11/16
	SBKFF	—	11/16
	SBKFFG	—	11/16
	SBKFG	—	11/16
	SBKZ	—	11/16
	SBKZZ	—	11/16
5204	Plain	—	3/4
	K	M	13/16
	KF	MF	13/16
	SB	—	3/4
	SBK	C	13/16
	SBKF	CF	13/16
	SBKFF	CFF	13/16
	SBKFFG	CFFG	13/16
	SBKFG	CFG	13/16
	SBKG	CG	13/16
	SBKZ	CZ	13/16
5205	F	MF1	7/8
	K	M	13/16
	KG	MG	13/16
	Plain	—	3/4
	SB	—	3/4
	SBF	CF1	7/8
	SBK	C	13/16
	SBKF	CF	13/16
	SBKFF	CFF	13/16
	SBKFG	CFG	13/16
	SBKG	CG	13/16
	—	C1, M1	7/8
5206	F	MF1	1 1/16
	K	M	15/16
	KF	MF	15/16
	KFF	MFF	15/16
	KG	MG	15/16
	Plain	—	3/4
	SBF	CF1	1 1/16
	SBK	C	15/16
	SBKF	CF	15/16
	SBKFF	CFF	15/16
	SBKFFG	CFFG	15/16
	SBKFG	CFG	15/16
	SBKG	CG	15/16
	SBZZ	CZZ1	1 1/16
	SBKZZG	CZZG1	1 1/16
	—	C1, M1	1 1/16
5207	F	MF1	1 3/16
	K	M	1 1/16
	KF	MF	1 1/16
	KFF	MFF	1 1/16
	KFG	MFG	1 1/16
	KG	MG	1 1/16
	Plain	—	7/8
	SBK	C	1 1/16
	SBKF	CF	1 1/16
	SBKFF	CFF	1 1/16
	SBKFG	CFG	1 1/16
	SBKFFG	CFFG	1 1/16
	SBKG	CG	1 1/16
	—	C1, M1	1 3/16
5208	BKF	MF	1 3/16
	BKFF	MFF	1 3/16
	K	M	1 3/16
	KF	MF	1 3/16
	KFF	MFF	1 3/16
	KFG	MFG	1 3/16
	KG	MG	1 3/16
	Plain	—	1
	SBK	C	1 3/16
	SBKF	CF	1 3/16
	SBKFF	CFF	1 3/16
	SBKFG	CFG	1 3/16
	SBKG	CG	1 3/16
5209	K	M	1 3/16
	KF	MF	1 3/16
	KG	MG	1 3/16
	Plain	—	1
	SBK	C	1 3/16
	SBKF	CF	1 3/16
	SBKFF	CFF	1 3/16
5210	K	M	1 3/16
	KF	MF	1 3/16
	KFF	MFF	1 3/16
	KG	MG	1 3/16
	Plain	—	1
	—	C	1 3/16
5211	BK	M	1 5/16
	BKG	MG	1 5/16
	K	M	1 5/16
	KF	MF	1 5/16
	KFG	MFG	1 5/16
	KG	MG	1 5/16
	Plain	—	1 3/16
	—	C	1 5/16
5212	F	MF1	1 1/2
	FG	MFG1	1 1/2
	K	M	1 7/16
	KF	MF	1 7/16
	KFG	MFG	1 7/16
	KG	MG	1 7/16
	Plain	—	1 3/8
	—	C1, M1	1 1/2
	—	C	1 7/16
5213	K	M	1 1/2
	KF	MF	1 1/2
	KFG	MFG	1 1/2
	KG	MG	1 1/2
	Plain	—	1 3/8
	—	C	1 1/2
5214	K	M	1 9/16
	KF	MF	1 9/16
	KFG	MFG	1 9/16
	KG	MG	1 9/16
	Plain	—	1 7/16
	—	C	1 9/16
5215	K	M	1 5/8
	KF	MF	1 5/8
	KFF	MFF	1 5/8
	KFG	MFG	1 5/8
	KG	MG	1 5/8
	Plain	—	1 7/16
	—	C	1 5/8
5216	BFF	—	1 7/8
	K	M	1 3/4
	KF	MF	1 3/4
	KFG	MFG	1 3/4
	KG	MG	1 3/4
	Plain	—	1 5/8
	—	C	1 3/4
5217	K	M	1 15/16
	KF	MF	1 15/16
	KG	MG	1 15/16
	Plain	—	1 3/4
	—	C	1 15/16
5218	K	M	2 1/16
	KF	MF	2 1/16
	KG	MG	2 1/16
	Plain	—	2
	—	C	2 1/16
5219	G	—	2 3/16
	Plain	—	2 3/16
5220	G	—	2 3/8
	Plain	—	2 3/8
5221	Plain	—	2 9/16
5222	KF	—	2 3/4
	Plain	—	2 3/4

5000 series ball bearings suffix and width summary

Basic bearing number	Old style suffix	New style suffix	Width (inches)
5300 Series			
5300	SB	—	3/4
5301	SB	—	3/4
5302	Plain	—	3/4
	SB	—	3/4
5303	G	—	7/8
	KF	—	7/8
	KFG	—	7/8
	SB	—	7/8
	SBG	—	7/8
	SBKF	—	7/8
	SBKFF	—	7/8
	SBKFG	—	7/8
5304	F	MF1	1
	Plain	M	7/8
	SB	C	7/8
	SBF	CF1	1
	SBG	CG	7/8
	SBKF	CF	7/8
	SBKFF	CFF	7/8
	SBKFFG	CFFG	7/8
	SBKFG	CFG	7/8
	—	C1, M1	1
5305	F	—	1 1/8
	FG	—	1 1/8
	G	MG	1
	KFF	MFF	1
	Plain	M	1
	SB	C	1
	SBF	—	1 1/8
	SBFG	—	1 1/8
	SBG	CG	1
	SBKF	CF	1
	SBKFF	CFF	1
	SBKFG	CFG	1
5306	B	M	1 3/16
	BKFF	MFF	1 3/16
	F	MF1	1 5/16
	FG	MFG1	1 5/16
	G	MG	1 3/16
	KF	MF	1 3/16
	KFF	MFF	1 3/16
	KFG	MFG	1 3/16
	Plain	M	1 3/16
	—	C1, M1	1 5/16
	—	C	1 3/16
5307	BKFF	MFF	1 3/8
	F	MF1	1 1/2
	FG	MFG1	1 1/2
	G	MG	1 3/8
	KF	MF	1 3/8
	KFG	MFG	1 3/8
	Plain	M	1 3/8
	—	C1, M1	1 1/2
	—	C	1 3/8

Basic bearing number	Old style suffix	New style suffix	Width (inches)
5308	BG	MG	1 7/16
	F	MF1	1 9/16
	FG	MFG1	1 9/16
	G	MG	1 7/16
	Plain	M	1 7/16
	—	C	1 7/16
	—	C1, M1	1 9/16
5309	B	M	1 9/16
	F	MF1	1 11/16
	FG	MFG1	1 11/16
	G	MG	1 9/16
	Plain	M	1 9/16
	—	C	1 9/16
	—	C1, M1	1 11/16
5310	F	MF1	1 7/8
	FG	MFG1	1 7/8
	G	MG	1 3/4
	KF	MF	1 3/4
	KFG	MFG	1 3/4
	Plain	M	1 3/4
	—	C	1 3/4
	—	C1, M1	1 7/8
5311	F	MF1	2 1/16
	FG	MFG1	2 1/16
	G	MG	1 15/16
	Plain	M	1 15/16
	—	C	1 15/16
	—	C1, M1	2 1/16
5312	F	MF1	2 1/4
	FG	MFG1	2 1/4
	G	MG	2 1/8
	Plain	M	2 1/8
	—	C	2 1/8
	—	C1, M1	2 1/4
5313	F	MF1	2 7/16
	FG	MFG1	2 7/16
	G	MG	2 5/16
	Plain	M	2 5/16
	—	C	2 5/16
	—	C1, M1	2 7/16
5314	F	MF1	2 5/8
	G	MG	2 1/2
	KF	MF	2 1/2
	KFG	MFG	2 1/2
	Plain	M	2 1/2
	—	C	2 1/2
	—	C1, M1	2 5/8
5315	F	MF1	2 13/16
	G	MG	2 11/16
	Plain	M	2 11/16
	—	C	2 11/16
	—	C1, M1	2 13/16
5316	G	MG	2 11/16
	Plain	M	2 11/16
	—	C	2 11/16
5317	Plain		2 7/8

Basic bearing number	Old style suffix	New style suffix	Width (inches)
	—	C	2 7/8
5318	Plain	—	2 7/8
	—	C	2 7/8
5319	Plain	—	3 1/16
	—	C	3 1/16
5320	Plain	—	3 1/4
5321	Plain	—	3 7/16
5322	Plain	—	3 5/8
5400 Series			
5403	Plain	—	1 3/16
5404	Plain	—	1 3/8
5405	Plain	—	1 3/8
5406	Plain	—	1 9/16
	—	C	1 9/16
5407	G	—	1 3/4
	Plain	—	1 3/4
	—	C	1 3/4
5408	Plain	—	1 15/16
	—	C	1 15/16
5409	G	—	2 1/8
	Plain	—	2 1/8
	—	C	2 1/8
5410	F	—	2 7/16
	Plain	—	2 5/16
	—	C	2 5/16
5411	F	—	2 5/8
	G	—	2 1/2
	Plain	—	2 1/2
	—	C	2 1/2
5412	Plain	—	2 5/8
	—	C	2 5/8
5413	Plain	—	2 13/16
	—	C	2 13/16
5414	Plain	—	3 1/8
	—	C	3 1/8
5415	Plain	—	3 1/4
	—	C	3 1/4
5416	Plain	—	3 7/16
	—	C	3 7/16
5417	Plain	—	3 5/8
	—	C	3 5/8
5418	Plain	—	3 7/8
	—	C	3 7/8
5419	Plain	—	4 3/16

Interchange to C- and M-types double-row angular contact ball bearings

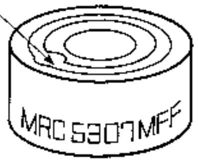
Bearing numbers of MRC double-row ball bearings produced before 1983 differ from the C- and M-types listed in this catalog. Shown below is the interchange of pre-1983 bearing numbers with the C- and M-types.

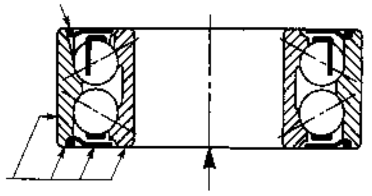
5000 series double-row bearings not listed here maintain the original bearing number and must be specified by that number when ordering.

MRC Bearing numbers	
Prior to 1983	Superseded by
5200SB	**5200C***
5200SBKF	**5200CF***
5200SBKFF	**5200CFF***
5200SBKZ	**5200CZ***
5200SBKZZ	**5200CZZ***
5201SB	**5201C***
5201SBKF	**5201CF***
5201SBKFF	**5201CFF***
5201SBKZ	**5201CZ***
5201SBKZZ	**5201CZZ***
5202SB	**5202C***
5202SBKFF	**5202CFF***
5202SBFG	**5202CFG1***
5202SBKFG	**5202CFG***
5202SBKZ	**5202CZ***
5202SBKZZ	**5202CZZ***
5203SB	**5203C***
5203SBKF	**5203CF***
5203SBKFF	**5203CFF***
5203SBKFG	**5203CFG***
5203SBKZ	**5203CZ***
5203SBKZZ	**5203CZZ***
5204SBK	**5204C**
5204SBKF	**5204CF**
5204SBKFF	**5204CFF**
5204SBKFG	**5204CFG**
5204SBKFFG	**5204CFFG**
5204SBKG	**5204CG**
5204SBKZ	**5204CZ**
5205SBK	**5205C**
5205SBF	**5205CF1**
5205SBKF	**5205CF**
5205SBKFF	**5205CFF**
5205SBKG	**5205CG**
5206SBK	**5206C**
5206SBF	**5206CF1**
5206SBKF	**5206CF**
5206SBKFF	**5206CFF**
5206SBKFG	**5206CFG**
5206SBKG	**5206CG**
5206SBZZ	**5206CZZ1**
5207F	**5207MF1**
5207SBK	**5207C**
5207SBKF	**5207CF**
5207SBKFF	**5207CFF**
5207SBKFG	**5207CFG**
5207SBKG	**5207CG**
5208SBK	**5208C**
5208SBKF	**5208CF**
5208SBKFF	**5208CFF**
5208SBKFG	**5208CFG**
5208SBKG	**5208CG**
5209K	**5209M**
5209KF	**5209MF**
5209SBFF	**5209CFF**
5209KG	**5209MG**
5210K	**5210M**
5210KF	**5210MF**
5210KFF	**5210MFF**
5210KG	**5210MG**
5211K	**5211M**
5211KF	**5211MF**
5211KFG	**5211MFG**
5211KG	**5211MG**
5212F	**5212MF1**
5212FG	**5212MFG1**
5212K	**5212M**
5212KF	**5212MF**
5212KFG	**5212MFG**
5212KG	**5212MG**
5213K	**5213M**
5213KF	**5213MF**
5213KFG	**5213MFG**
5213KG	**5213MG**
5214K	**5214M**
5214KF	**5214MF**
5214KG	**5214MG**
5215K	**5215M**
5215KF	**5215MF**
5215KFF	**5215MFF**
5215KFG	**5215MFG**
5215KG	**5215MG**
5216K	**5216M**
5216KF	**5216MF**
5216KFG	**5216MFG**
5216KG	**5216MG**
5217K	**5217M**
5217KF	**5217MF**
5217KG	**5217MG**
5218K	**5218M**
5218KF	**5218MF**
5218KG	**5218MG**
5219	**5219**
5219G	**5219G**
5220	**5220**
5220G	**5220G**
5221	**5221**
5222	**5222**
5222KF	**5222KF**
5300SB	**5300C***
5301SB	**5301C***
5302SB	**5302C***
5303SB	**5303C***
5303SBG	**5303CG***
5303SBKF	**5303CF***
5303SBKFF	**5303CFF***
5303SBKFG	**5303CFG***
5304SB	**5304C**
5304SBF	**5304CF1**
5304SBKF	**5304CF**
5304SBKFF	**5304CFF**
5305SB	**5305C**
5305SBG	**5305CG**
5305SBKF	**5305CF**
5305SBKFF	**5305CFF**
5305SBKFG	**5305CFG**
5306	**5306M**
5306F	**5306MF1**
5306FG	**5306MFG1**
5306G	**5306MG**
5306KF	**5306MF**
5306KFF	**5306MFF**
5306KFG	**5306MFG**
5307	**5307M**
5307F	**5307MF1**
5307FG	**5307MFG1**
5307G	**5307MG**
5307KF	**5307MF**
5307KFG	**5307MFG**
5308	**5308M**
5308F	**5308MF1**
5308FG	**5308MFG1**
5308G	**5308MG**
5309	**5309M**
5309B	**5309M**
5309F	**5309MF1**
5309FG	**5309MFG1**
5309G	**5309MG**
5310	**5310**
5310F	**5310MF1**
5310FG	**5310MFG1**
5310G	**5310MG**
5310KF	**5310MF**
5310KFG	**5310MFG**
5311	**5311M**
5311F	**5311MF1**
5311FG	**5311MFG1**
5311G	**5311MG**
5312	**5312M**
5312F	**5312MF1**
5312FG	**5312MFG1**
5312G	**5312MG**
5313	**5313M**
5313F	**5313MF1**
5313FG	**5313MFG1**
5313G	**5313MG**
5314	**5314M**
5314F	**5314MF1**
5314G	**5314MG**
5314KF	**5314MF**
5315	**5315M**
5315F	**5315MF1**
5315G	**5315MG**
5316	**5316M**
5316G	**5316MG**
5317	**5317**
5318	**5318**
5319	**5319**
5320	**5320**
5321	**5321**
5322	**5322**

*Listed for information only. Not currently in production. Use SB types.

Filling notch location on 5000MFF and 5000MZZ series





Since the filling notch row is not visible on 5000MFF and 5000MZZ bearings, it is necessary to identify which row of balls has the notch in those cases where the bearing will be subjected to axial load. Axial load should be carried on the non-filling notch row. A moderate reversing axial load is permissible on the filling notch row.

The filling notch is oriented in relation to the identification marking on the bearing, which will be found in one of the following locations:

- Side face of the outer ring
- Side face of the inner ring
- O.D. surface of the outer ring
- Face of the closure

In each case the marking will occur on the side of the bearing opposite the filling notch as illustrated above.

A typical application of a 5000MFF or 5000MZZ bearing is shown above in which it is subjected to an axial load in an upward direction. The bearing should be mounted with the filling notch up so that the axial load is taken by the bottom, non-filling notch row.

5000 series axial and radial internal clearance

5200 and 5300 series

Bore diameter d				Axial internal clearance															
				C2				Normal C0				C3				C4			
Over		Including		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.	
mm	in.	mm	in.	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
		10	.3937	1	11	**0**	**4**	5	21	**2**	**8**	12	28	**5**	**11**	25	45	**10**	**18**
10	.3937	18	.7087	1	12	**0**	**5**	6	23	**2**	**9**	13	31	**5**	**12**	27	47	**11**	**19**
18	.7087	24	.9449	2	14	**1**	**6**	7	25	**3**	**10**	16	34	**6**	**13**	28	48	**11**	**19**
24	.9449	30	**1.1811**	2	15	**1**	**6**	8	27	**3**	**11**	18	37	**7**	**15**	30	50	**12**	**20**
30	**1.1811**	40	**1.5748**	2	16	**1**	**6**	9	29	**4**	**11**	21	40	**8**	**16**	33	54	**13**	**21**
40	**1.5748**	50	**1.9685**	2	18	**1**	**7**	11	33	**4**	**13**	23	44	**9**	**17**	36	58	**14**	**23**
50	**1.9685**	65	**2.5591**	3	22	**1**	**9**	13	36	**5**	**14**	26	48	**10**	**19**	40	63	**16**	**25**
65	**2.5591**	80	**3.1496**	3	24	**1**	**9**	15	40	**6**	**16**	30	54	**12**	**21**	46	71	**18**	**28**
80	**3.1496**	100	**3.9370**	3	26	**1**	**10**	18	46	**7**	**18**	35	63	**14**	**25**	55	83	**22**	**33**
100	**3.9370**	110	**4.3307**	4	30	**2**	**12**	22	53	**9**	**21**	42	73	**17**	**29**	65	96	**26**	**38**

Bore diameter d				Radial internal clearance															
				C2				Normal C0				C3				C4			
Over		Including		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.	
mm	in.	mm	in.	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
		10	.3937	0.6	7	**0.0**	**2.4**	3.0	13	**1.2**	**5**	8	18	**3**	**7**	15	27	**6**	**11**
10	.3937	18	.7087	0.6	7	**0.0**	**3.0**	3.6	14	**1.2**	**5**	8	18	**3**	**7**	18	27	**7**	**11**
18	.7087	24	.9449	1.2	8	**0.6**	**3.6**	4.0	15	**1.8**	**6**	11	21	**4**	**8**	18	27	**7**	**11**
24	.9449	30	**1.1811**	1.2	9	**0.6**	**3.6**	5.0	16	**1.8**	**7**	11	23	**4**	**9**	18	31	**7**	**12**
30	**1.1811**	40	**1.5748**	1.2	10	**0.6**	**3.6**	5.0	17	**2.4**	**7**	12	25	**5**	**10**	21	33	**8**	**13**
40	**1.5748**	50	**1.9685**	1.2	11	**0.6**	**4.0**	7.0	20	**2.4**	**8**	12	25	**5**	**10**	21	36	**8**	**14**
50	**1.9685**	65	**2.5591**	1.8	13	**0.6**	**5.0**	8.0	22	**3.0**	**8**	15	27	**6**	**11**	25	38	**10**	**15**
65	**2.5591**	80	**3.1496**	1.8	14	**0.6**	**5.0**	9.0	24	**3.6**	**10**	18	33	**7**	**13**	27	44	**11**	**17**
80	**3.1496**	100	**3.9370**	1.8	16	**0.6**	**6.0**	11.0	28	**4.0**	**11**	21	38	**8**	**15**	33	50	**13**	**20**
100	**3.9370**	110	**4.3307**	2.4	18	**1.2**	**7.0**	13.0	32	**5.0**	**13**	25	44	**10**	**17**	40	58	**16**	**23**

5400 series

Bore diameter d				Radial internal clearance															
				C2				Normal C0				C3				C4			
Over		Including		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.		.001 mm		.0001 in.	
mm	in.	mm	in.	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
		30	**1.1811**	1	8	**0.4**	**3**	2	13	**1**	**5**	13	23	**5**	**9**	20	38	**8**	**15**
30	**1.1811**	40	**1.5748**	1	8	**0.5**	**3**	6	13	**2**	**5**	15	23	**6**	**9**	23	41	**9**	**16**
40	**1.5748**	50	**1.9685**	1	8	**0.5**	**3**	6	15	**2**	**6**	15	25	**6**	**10**	23	44	**9**	**17**
50	**1.9685**	65	**2.5591**	1	11	**0.5**	**4**	6	15	**2**	**6**	15	28	**6**	**11**	25	45	**10**	**18**
65	**2.5591**	70	**2.7559**	1	11	**0.5**	**4**	6	18	**2**	**7**	18	31	**7**	**12**	28	48	**11**	**19**
70	**2.7559**	80	**3.1496**	0	6	**0.0**	**2**	6	18	**2**	**7**	18	33	**7**	**13**	33	48	**13**	**19**
80	**3.1496**	90	**3.5433**	0	7	**0.0**	**3**	7	23	**3**	**9**	23	44	**9**	**17**	44	65	**17**	**26**

Thrust rating of 5000 series double-row angular contact ball bearings

Dynamic rating

To obtain dynamic thrust rating multiply dynamic radial rating C by the factor shown below.

Size	Factor
5200SB-5203SB 5300SB-5303SB 5403C-5414C	0.71
5204C and M-5218C and M 5304C and M-5319C and M	0.81

Example:

Bearing size: 5307C

Basic dynamic radial load rating (C) = 11100 lbf

Thrust rating factor = 0.81

Thrust rating = 0.81 × 11100 = 8991 lbf

Sizes 5415C–5419C have 0° contact angles and are not included in the above tables. When thrust load is present, the equivalent radial load should be used to determine life.

Static rating

To obtain static thrust rating multiply static radial rating C_0 by the factor shown below.

Size	Factor
5200SB-5203SB 5300SB-5303SB 5204C and M-5206C and M 5403C-5414C	0.57
5207C and M-5218C and M 5304C and M-5319C and M	0.66

Example:

Bearing size: 5214M

Basic static radial load rating (C_0) = 28100 lbf

Thrust rating factor = 0.66

Thrust rating = 0.66 × 28100 = 18546 lbf

5000 series extra wide double-row angular contact ball bearings

Double-row angular contact ball bearings with non-standard extra wide width are currently available as a retrofit kit. These replacement units consist of a standard width double-row angular contact ball bearing and two specially designed spacers packaged together in a single carton.

Spacers

The extra width double-row angular contact ball bearing retrofit kit is simple to use. When used with bearings without snap-rings, place both spacers on the same side, as shown in Figure 1.

With snap-ring bearings, the inner ring spacer must be installed on the side opposite the snap-ring, as shown in Figure 2. The outer spacer is not needed in applications where the bearing's snap-ring controls the axial location of the outer ring in the housing.

The spacers accommodate slight variations in the shaft and housing seat width. The inner ring and spacer can be secured to the shaft with a retaining ring or threaded lock nut. If a lock nut is used, the amount of clamping force can be regulated to make slight adjustments in the shaft's axial location. The spacer rings yield slightly when an axial clamping force is applied. The spacer rings also exert a reaction force, which helps maintain the initial clamping force and helps prevent the inner ring from becoming loose on the shaft. The same circumstances apply to the outer ring spacers when an end cap is used to clamp the bearing's outer ring against a housing shoulder.

Because the spacer rings are designed to yield slightly when axial clamping forces are applied, the spacer rings should always be replaced with new spacer rings anytime the bearing is removed, replaced or reinstalled.

Materials for rings, balls and spacers

High-carbon chromium vacuum-processed steel (SAE 52100) is used for all balls and rings. Machined and roll formed spacer rings are fabricated from 1018 carbon steel and 304 stainless steel.

Mounting instructions without snap-ring

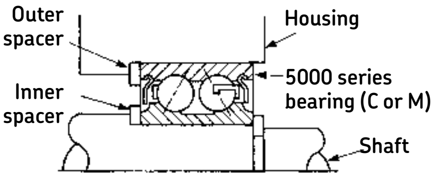


Figure 1

1 Install inner and outer ring spacers onto the shaft and into the housing bore respectively.
2 Install bearing in accordance with normal mounting instructions.
3 If any locking devices such as snap-rings or lock nuts are normally used to secure the bearing on the shaft or in the housing, be sure they are properly installed.
4 These inner and outer ring spacers are adjusted to proper width prior to installation. During bearing installation their width may be slightly altered to accommodate variations in shaft and housing shoulder distances. As a consequence, when a new extra width retrofit bearing kit is installed, the new spacer rings supplied with the kit should always be used and the old spacers discarded.

Mounting instructions with snap-ring

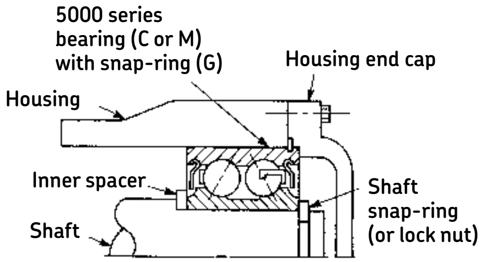


Figure 2

1 Install the inner ring spacer onto the shaft. The outer ring spacer is not used with a snap-ring bearing and may be discarded.
2 Install bearing in accordance with normal mounting instructions.
3 If any locking devices such as snap-rings, lock nuts or end caps are normally used to secure the bearing on the shaft or in the housing, be sure they are properly installed.
4 These inner and outer ring spacers are adjusted to proper width prior to installation. During bearing installation their width may be slightly altered to accommodate variations in shaft and housing shoulder distances. As a consequence, when a new extra width retrofit bearing kit is installed, the new spacer rings supplied with the kit should always be used and the old spacers discarded.

Extra wide 5000 series part numbers

A listing of available part numbers appears below. This listing may change with sizes being added or deleted based on demand.

MRC part number	Width including spacers		
	in.		mm
5205CF1	7/8	.8750	22.23
5205MF1	7/8	.8750	22.23
5206CF1	1 1/16	1.0625	26.99
5206MF1	1 1/16	1.0625	26.99
5206SBZZ*	1 1/16	1.0625	26.99
5212MF1	1 1/2	1.5000	38.10
5304CF1	1	1.0000	25.40
5304MF1	1	1.0000	25.40
5305CF1	1 1/8	1.1250	28.58
5305MFG1	1 1/8	1.1250	28.58
5306MFG1	1 5/16	1.3125	33.34
5306MF1	1 5/16	1.3125	33.34
5307MF1	1 1/2	1.5000	38.10
5307MFG1	1 1/2	1.5000	38.10
5308MFG1	1 9/16	1.5625	39.69
5308MF1	1 9/16	1.5625	39.69
5309MFG1	1 11/16	1.6875	42.86
5309MF1	1 11/16	1.6875	42.86
5310MFG1	1 7/8	1.8750	47.63
5310MF1	1 7/8	1.8750	47.63
5311MFG1	2 1/16	2.0625	52.39
5311MF1	2 1/16	2.0625	52.39
5312MFG1	2 1/4	2.2500	57.15
5312MF1	2 1/4	2.2500	57.15
5313MFG1	2 7/16	2.4375	61.91
5313MF1	2 7/16	2.4375	61.91
5315MF1	2 13/16	2.8125	71.44

*Currently stocked. No spacer needed.

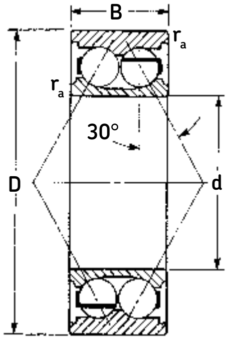
Nomenclature

5 3 09 M F G 1

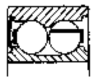
- Double-row angular contact type ball bearing — 5
- Series (200, 300, 400) — 3
- Bore diameter code — 09
- C or M (Conrad or max type) — M
- F or Z (shield or seal) — F
- Snap-ring — G
- Extra width (spacer ring kit supplied) — 1

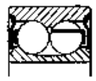
5200C, 5200SB light series

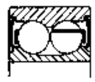
5200C bearings are used with moderate to heavy radial loads, two-directional thrust loads, or a combination of both.



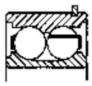

CF/SBKF
One shield


CZ/SBKZ
One seal

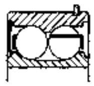

CFF/SBKFF
Two shields


CZZ/SBKZZ
Two seals

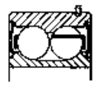

CFZ/SBKFZ
Shield and seal

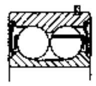

CG/SBKG
Snap-ring


CFG/SBKFG
One shield
and snap-ring


CZG
One seal
and snap-ring


CFFG/SBKFFG
Two shields
and snap-ring

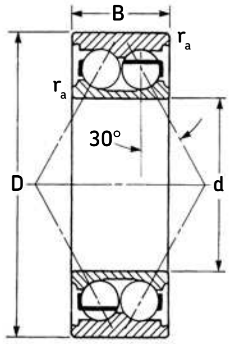

CZZG
Two seals
and snap-ring


CFZG
Shield, seal
and snap-ring

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating Dynamic C[3] N	Dynamic C[3] lbf	Static C_0 N	Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed grease rpm
5200SB	10	**.3937**	30	**1.1811**	14.00	**.5625**	.64	**.025**	7 610	**1 710**	4 300	**967**	16 000	22 000	16 000
5201SB	12	**.4724**	32	**1.2598**	15.88	**.6250**	.64	**.025**	10 400	**2 340**	5 600	**1 260**	15 000	20 000	15 000
5202SB	15	**.5906**	35	**1.3780**	15.88	**.6250**	.64	**.025**	11 400	**2 560**	6 800	**1 530**	12 000	17 000	12 000
5203SB	17	**.6693**	40	**1.5748**	17.47	**.6876**	.64	**.025**	14 300	**3 210**	8 800	**1 980**	10 000	15 000	10 000
5204C	20	**.7874**	47	**1.8504**	20.64	**.8125**	1.00	**.040**	19 000	**4 270**	12 000	**2 700**	9 000	13 000	9 000
5205C	25	**.9843**	52	**2.0472**	20.64	**.8125**	1.00	**.040**	20 800	**4 680**	14 000	**3 150**	8 000	11 000	8 000
5205C1	25	**.9843**	52	**2.0472**	22.23	**.8750**	1.00	**.040**	20 800	**4 680**	14 000	**3 150**	8 000	11 000	8 000
5206C	30	**1.1811**	62	**2.4409**	23.81	**.9375**	1.00	**.040**	28 600	**6 430**	20 400	**4 590**	7 000	9 500	7 000
5206C1	30	**1.1811**	62	**2.4409**	26.99	**1.0625**	1.00	**.040**	28 600	**6 430**	20 400	**4 590**	7 000	9 500	7 000
5207C	35	**1.3780**	72	**2.8346**	26.99	**1.0625**	1.00	**.040**	37 700	**8 480**	27 500	**6 180**	6 000	8 000	6 000
5207C1	35	**1.3780**	72	**2.8346**	30.16	**1.1875**	1.00	**.040**	37 700	**8 480**	27 500	**6 180**	6 000	8 000	6 000
5208C	40	**1.5748**	80	**3.1496**	30.16	**1.1875**	1.00	**.040**	44 900	**10 100**	34 000	**7 640**	5 600	7 500	5 600
5209C	45	**1.7717**	85	**3.3465**	30.16	**1.1875**	1.00	**.040**	48 800	**11 000**	39 000	**8 770**	5 000	6 700	5 000
5210C	50	**1.9685**	90	**3.5433**	30.16	**1.1875**	1.00	**.040**	48 800	**11 000**	39 000	**8 770**	4 800	6 300	4 800
5211C	55	**2.1654**	100	**3.9370**	33.34	**1.3125**	1.50	**.060**	57 200	**12 900**	47 500	**10 700**	4 300	5 600	4 300
5212C	60	**2.3622**	110	**4.3307**	36.51	**1.4375**	1.50	**.060**	70 200	**15 800**	58 500	**13 200**	3 800	5 000	3 800
5212C1	60	**2.3622**	110	**4.3307**	38.10	**1.5000**	1.50	**.060**	70 200	**15 800**	58 500	**13 200**	3 800	5 000	3 800
5213C	65	**2.5591**	120	**4.7244**	38.10	**1.5000**	1.50	**.060**	80 600	**18 100**	73 500	**16 500**	3 600	4 800	3 600
5214C	70	**2.7559**	125	**4.9213**	39.69	**1.5625**	1.50	**.060**	88 400	**19 900**	80 000	**18 000**	3 200	4 300	3 200
5215C	75	**2.9528**	130	**5.1181**	41.28	**1.6250**	1.50	**.060**	95 600	**21 500**	88 000	**19 800**	3 200	4 300	3 200
5216C	80	**3.1496**	140	**5.5118**	44.45	**1.7500**	2.00	**.080**	106 000	**23 900**	95 000	**21 400**	2 800	3 800	2 800
5217C	85	**3.3465**	150	**5.9055**	49.21	**1.9375**	2.00	**.080**	124 000	**27 900**	110 000	**24 700**	2 600	3 600	2 600
5218C	90	**3.5433**	160	**6.2992**	52.39	**2.0625**	2.00	**.080**	130 000	**29 300**	120 000	**27 000**	2 400	3 400	2 400
5219C	95	**3.7402**	170	**6.6929**	55.56	**2.1875**	2.00	**.080**	159 000	**35 700**	146 000	**32 800**	2 200	3 200	2 200
5220C	100	**3.9370**	180	**7.0866**	60.33	**2.3750**	2.00	**.080**	178 000	**40 000**	166 000	**37 300**	2 000	3 000	2 000
5221C	105	**4.1339**	190	**7.4803**	65.09	**2.5625**	2.00	**.080**	186 000	**41 800**	180 000	**40 500**	1 800	2 800	1 800
5222C	110	**4.3307**	200	**7.8740**	69.85	**2.7500**	2.00	**.080**	203 000	**45 600**	200 000	**45 000**	1 600	2 600	1 600

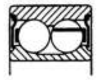
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
Note: Extra width bearings identified by the suffix C1 are supplied with a retrofit kit described on pages 97, 98.

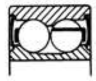
5300C, 5300SB medium series

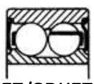


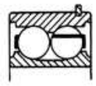

CF/SBKF
One shield


CZ/SBKZ
One seal


CFF/SBKFF
Two shields


CZZ/SBKZZ
Two seals


CFZ/SBKFZ
Shield and seal


CG/SBKG
Snap-ring


CFG/SBKFG
One shield
and snap-ring


CZG
One seal
and snap-ring


CFFG/SBKFFG
Two shields
and snap-ring


CZZG
Two seals
and snap-ring

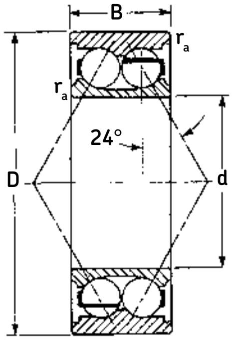

CFZG
Shield, seal
and snap-ring

5300C bearings are used with moderate to heavy radial loads, two-directional thrust loads, or a combination of both.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating: Dynamic C[3] N	Dynamic C[3] lbf	Static C_0 N	Static C_0 lbf	Speed rating[2]: Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
5300SB	10	.3937	35	**1.3780**	19.05	**.7500**	.64	**.025**	10 600	**2 380**	6 100	**1 370**	15 000	20 000	15 000
5301SB	12	.4724	37	**1.4567**	19.05	**.7500**	1.00	**.040**	11 700	**2 630**	6 800	**1 530**	14 000	18 000	14 000
5302SB	15	.5906	42	**1.6535**	19.05	**.7500**	1.00	**.040**	15 100	**3 390**	9 300	**2 090**	11 000	15 000	11 000
5303SB	17	.6693	47	**1.8504**	22.23	**.8750**	1.00	**.040**	21 600	**4 860**	12 700	**2 860**	11 000	14 000	11 000
5304C	20	.7874	52	**2.0472**	22.23	**.8750**	1.00	**.040**	22 500	**5 060**	14 600	**3 280**	8 500	12 000	8 500
5304C1	20	.7874	52	**2.0472**	25.40	**1.0000**	1.00	**.040**	22 500	**5 060**	14 600	**3 280**	8 500	12 000	8 500
5305C	25	.9843	62	**2.4409**	25.40	**1.0000**	1.00	**.040**	30 700	**6 910**	20 400	**4 590**	7 500	10 000	7 500
5306C	30	**1.1811**	72	**2.8346**	30.16	**1.1875**	1.00	**.040**	41 600	**9 360**	29 000	**6 520**	6 300	8 500	6 300
5306C1	30	**1.1811**	72	**2.8346**	33.34	**1.3125**	1.00	**.040**	41 600	**9 360**	29 000	**6 520**	6 300	8 500	6 300
5307C	35	**1.3780**	80	**3.1496**	34.93	**1.3750**	1.50	**.060**	49 400	**11 100**	34 500	**7 760**	5 600	7 500	5 600
5307C1	35	**1.3780**	80	**3.1496**	38.10	**1.5000**	1.50	**.060**	49 400	**11 100**	34 500	**7 760**	5 600	7 500	5 600
5308C	40	**1.5748**	90	**3.5433**	36.51	**1.4375**	1.50	**.060**	60 500	**13 600**	43 000	**9 760**	5 000	6 700	5 000
5308C1	40	**1.5748**	90	**3.5433**	39.69	**1.5625**	1.50	**.060**	60 500	**13 600**	43 000	**9 760**	5 000	6 700	5 000
5309C	45	**1.7717**	100	**3.9370**	39.69	**1.5625**	1.50	**.060**	72 800	**16 400**	53 000	**11 900**	4 500	6 000	4 500
5309C1	45	**1.7717**	100	**3.9370**	42.86	**1.6875**	1.50	**.060**	72 800	**16 400**	53 000	**11 900**	4 500	6 000	4 500
5310C	50	**1.9685**	110	**4.3307**	44.45	**1.7500**	2.00	**.080**	85 200	**19 200**	64 000	**14 400**	4 000	5 300	4 000
5310C1	50	**1.9685**	110	**4.3307**	47.63	**1.8750**	2.00	**.080**	85 200	**19 200**	64 000	**14 400**	4 000	5 300	4 000
5311C	55	**2.1654**	120	**4.7244**	49.21	**1.9375**	2.00	**.080**	106 000	**23 900**	81 500	**18 300**	3 800	5 000	3 800
5311C1	55	**2.1654**	120	**4.7244**	52.39	**2.0625**	2.00	**.080**	106 000	**23 900**	81 500	**18 300**	3 800	5 000	3 800
5312C	60	**2.3622**	130	**5.1181**	53.98	**2.1250**	2.00	**.080**	121 000	**27 200**	95 000	**21 400**	3 400	4 500	3 400
5312C1	60	**2.3622**	130	**5.1181**	57.15	**2.2500**	2.00	**.080**	121 000	**27 200**	95 000	**21 400**	3 400	4 500	3 400
5313C	65	**2.5591**	140	**5.5118**	58.74	**2.3125**	2.00	**.080**	138 000	**31 100**	108 000	**24 300**	3 200	4 300	3 200
5313C1	65	**2.5591**	140	**5.5118**	61.91	**2.4375**	2.00	**.080**	138 000	**31 100**	108 000	**24 300**	3 200	4 300	3 200
5314C	70	**2.7559**	150	**5.9055**	63.50	**2.5000**	2.00	**.080**	153 000	**34 400**	125 000	**28 100**	2 800	3 800	2 800
5314C1	70	**2.7559**	150	**5.9055**	66.68	**2.6250**	2.00	**.080**	153 000	**34 400**	125 000	**28 100**	2 800	3 800	2 800
5315C	75	**2.9528**	160	**6.2992**	68.26	**2.6875**	2.00	**.080**	168 000	**37 800**	140 000	**31 500**	2 600	3 600	2 600
5315C1	75	**2.9528**	160	**6.2992**	71.44	**2.8125**	2.00	**.080**	168 000	**37 800**	140 000	**31 500**	2 600	3 600	2 600
5316C	80	**3.1496**	170	**6.6929**	68.26	**2.6875**	2.00	**.080**	182 000	**41 000**	156 000	**35 100**	2 400	3 400	2 400
5317C	85	**3.3465**	180	**7.0866**	73.03	**2.8750**	2.50	**.100**	195 000	**43 900**	176 000	**39 600**	2 200	3 200	2 200
5318C	90	**3.5433**	190	**7.4803**	73.03	**2.8750**	2.50	**.100**	212 000	**47 700**	196 000	**44 100**	2 000	3 000	2 000
5319C	95	**3.7402**	200	**7.8740**	77.79	**3.0625**	2.50	**.100**	234 000	**52 700**	224 000	**50 400**	1 900	2 800	1 900
5320C	100	**3.9370**	215	**8.4646**	82.55	**3.2500**	2.50	**.100**	255 000	**57 300**	255 000	**57 300**	1 800	2 600	1 800
5322C	110	**4.3307**	240	**9.4488**	92.08	**3.6250**	2.50	**.100**	291 000	**65 400**	305 000	**68 600**	1 700	2 400	1 700

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
Note: Extra width bearings identified by the suffix C1 are supplied with a retrofit kit described on pages 97, 98.

5400C heavy series



5400 series bearings are used with extremely heavy radial loads, two-directional thrust loads, or a combination of both.

Notes:

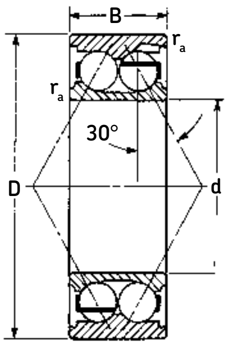
5406-5414 have a 24° contact angle per row.

5415-5418 have a 0° contact angle.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	Fillet radius[1)] r_a in.	Basic radial load rating Dynamic C[3)] N	Basic radial load rating Dynamic C[3)] lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating[2)] Grease rpm	Speed rating[2)] Oil rpm
5406C	30	**1.1811**	90	**3.5433**	39.69	**1.5625**	1.5	**.06**	67 600	**15 200**	45 000	**10 100**	5 300	7 000
5407C	35	**1.3780**	100	**3.9370**	44.45	**1.7500**	1.5	**.06**	76 100	**17 000**	49 000	**11 000**	4 800	6 300
5408C	40	**1.5748**	110	**4.3307**	49.21	**1.9375**	2.0	**.08**	88 400	**19 900**	57 000	**12 800**	4 300	5 600
5409C	45	**1.7717**	120	**4.7244**	53.98	**2.1250**	2.0	**.08**	112 000	**25 200**	78 000	**17 600**	4 000	5 300
5410C	50	**1.9685**	130	**5.1181**	58.74	**2.3125**	2.0	**.08**	143 000	**32 200**	102 000	**23 000**	3 600	4 800
5411C	55	**2.1654**	140	**5.5118**	63.50	**2.5000**	2.0	**.08**	146 000	**32 900**	102 000	**23 000**	3 200	4 300
5412C	60	**2.3622**	150	**5.9055**	66.68	**2.6250**	2.0	**.08**	159 000	**35 800**	114 000	**25 700**	3 000	4 000
5413C	65	**2.5591**	160	**6.2992**	71.44	**2.8125**	2.0	**.08**	195 000	**43 900**	156 000	**35 100**	2 800	3 800
5414C	70	**2.7559**	180	**7.0866**	79.38	**3.1250**	2.5	**.10**	199 000	**44 800**	156 000	**35 100**	2 400	3 400
5415C	75	**2.9528**	190	**7.4803**	82.55	**3.2500**	2.5	**.10**	212 000	**47 700**	200 000	**45 000**	2 200	3 200
5416C	80	**3.1496**	200	**7.8740**	87.31	**3.4375**	2.5	**.10**	229 000	**51 500**	216 000	**48 600**	2 000	3 000
5417C	85	**3.3465**	210	**8.2677**	92.08	**3.6250**	3.0	**.12**	255 000	**57 300**	255 000	**57 300**	1 900	2 800
5418C	90	**3.5433**	225	**8.8583**	98.43	**3.8750**	3.0	**.12**	281 000	**63 200**	300 000	**67 400**	1 800	2 600

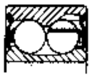
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

5200M light series



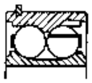

MF
One shield


MZ
One seal

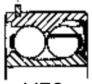

MFF
Two shields


MZZ
Two seals


MFZ
Shield and seal

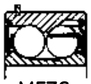

MG
Snap-ring


MFG
One shield
and snap-ring


MZG
One seal
and snap-ring


MFFG
Two shields
and snap-ring


MZZG
Two seals
and snap-ring

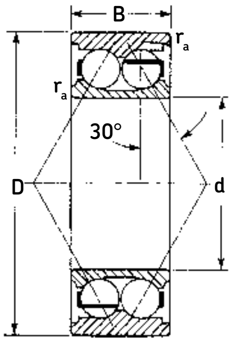

MFZG
Shield, seal
and snap-ring

5200M bearings are used with heavy radial loads, two-directional thrust loads, or a combination of both. Thrust load should be carried on the non-filling notch row. Moderate thrust load is permissible on the filling notch row.

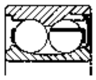
MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating Dynamic $C^{3)}$ N	Dynamic $C^{3)}$ lbf	Static C_0 N	Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Open and shielded Oil rpm	Single and double sealed Grease rpm
5204M	20	**.7874**	47	**1.8504**	20.64	**.8125**	1.0	**.04**	20 500	**4 610**	17 000	**3 820**	9 000	13 000	9 000
5205M	25	**.9843**	52	**2.0472**	20.64	**.8125**	1.0	**.04**	22 900	**5 150**	21 200	**4 770**	8 000	11 000	8 000
5205M1	25	**.9843**	52	**2.0472**	22.23	**.8750**	1.0	**.04**	22 900	**5 150**	21 200	**4 770**	8 000	11 000	8 000
5206M	30	**1.1811**	62	**2.4409**	23.81	**.9375**	1.0	**.04**	30 300	**6 820**	28 000	**6 290**	7 000	9 500	7 000
5206M1	30	**1.1811**	62	**2.4409**	26.99	**1.0625**	1.0	**.04**	30 300	**6 820**	28 000	**6 290**	7 000	9 500	7 000
5207M	35	**1.3780**	72	**2.8346**	26.99	**1.0625**	1.0	**.04**	39 100	**8 800**	36 500	**8 210**	6 000	8 000	6 000
5207M1	35	**1.3780**	72	**2.8346**	30.16	**1.1875**	1.0	**.04**	39 100	**8 800**	36 500	**8 210**	6 000	8 000	6 000
5208M	40	**1.5748**	80	**3.1496**	30.16	**1.1875**	1.0	**.04**	49 500	**11 100**	49 000	**11 000**	5 600	7 500	5 600
5209M	45	**1.7717**	85	**3.3465**	30.16	**1.1875**	1.0	**.04**	51 200	**11 500**	54 000	**12 100**	5 000	6 700	5 000
5210M	50	**1.9685**	90	**3.5433**	30.16	**1.1875**	1.0	**.04**	53 900	**12 100**	58 500	**13 200**	4 800	6 300	4 800
5211M	55	**2.1654**	100	**3.9370**	33.34	**1.3125**	1.5	**.06**	66 000	**14 900**	76 500	**17 200**	4 300	5 600	4 300
5212M	60	**2.3622**	110	**4.3307**	36.51	**1.4375**	1.5	**.06**	78 100	**17 600**	88 000	**19 800**	3 800	5 000	3 800
5212M1	60	**2.3622**	110	**4.3307**	38.10	**1.5000**	1.5	**.06**	78 100	**17 600**	88 000	**19 800**	3 800	5 000	3 800
5213M	65	**2.5591**	120	**4.7244**	38.10	**1.5000**	1.5	**.06**	88 000	**19 800**	106 000	**23 800**	3 600	4 800	3 600
5214M	70	**2.7559**	125	**4.9213**	39.69	**1.5625**	1.5	**.06**	101 000	**22 700**	125 000	**28 100**	3 200	4 300	3 200
5215M	75	**2.9528**	130	**5.1181**	41.28	**1.6250**	1.5	**.06**	108 000	**24 300**	137 000	**30 800**	3 200	4 300	3 200
5216M	80	**3.1496**	140	**5.5118**	44.45	**1.7500**	2.0	**.08**	128 000	**28 800**	160 000	**36 000**	2 800	3 800	2 800
5217M	85	**3.3465**	150	**5.9055**	49.21	**1.9375**	2.0	**.08**	142 000	**32 000**	176 000	**39 600**	2 600	3 600	2 600
5218M	90	**3.5433**	160	**6.2992**	52.39	**2.0625**	2.0	**.08**	151 000	**34 000**	193 000	**43 400**	2 400	3 400	2 400

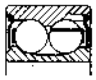
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
Note: Extra width bearings identified by the suffix M1 are supplied with a retrofit kit described on pages 97, 98.

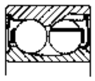
5300M medium series

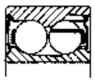


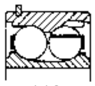

MF
One shield

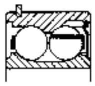

MZ
One seal

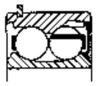

MFF
Two shields

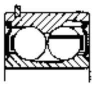

MZZ
Two seals

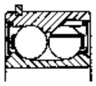

MFZ
Shield and seal

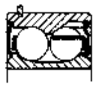

MG
Snap-ring


MFG
One shield
and snap-ring


MZG
One seal
and snap-ring


MFFG
Two shields
and snap-ring


MZZG
Two seals
and snap-ring

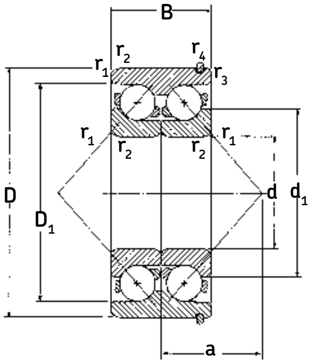

MFZG
Shield, seal
and snap-ring

5300M bearings are used with heavy radial loads, two-directional thrust loads, or a combination of both. Thrust load should be carried on the non-filling notch row. Moderate thrust load is permissible on the filling notch row.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating Dynamic $C^{3)}$ N	Basic radial load rating Dynamic $C^{3)}$ lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating[2] Open and shielded Grease rpm	Speed rating[2] Open and shielded Oil rpm	Speed rating[2] Single and double sealed Grease rpm
5304M	20	**.7874**	52	**2.0472**	22.23	**.8750**	1.0	**.04**	23 800	**5 360**	20 000	**4 500**	8 500	12 000	8 500
5304M1	20	**.7874**	52	**2.0472**	25.40	**1.0000**	1.0	**.04**	23 800	**5 360**	20 000	**4 500**	8 500	12 000	8 500
5305M	25	**.9843**	62	**2.4409**	25.40	**1.0000**	1.0	**.04**	34 100	**7 670**	30 500	**6 860**	7 500	10 000	7 500
5306M	30	**1.1811**	72	**2.8346**	30.16	**1.1875**	1.0	**.04**	46 800	**10 500**	43 000	**9 670**	6 300	8 500	6 300
5306M1	30	**1.1811**	72	**2.8346**	33.34	**1.3125**	1.0	**.04**	46 800	**10 500**	43 000	**9 670**	6 300	8 500	6 300
5307M	35	**1.3780**	80	**3.1496**	34.93	**1.3750**	1.5	**.06**	52 300	**11 800**	48 000	**10 800**	5 600	7 500	5 600
5307M1	35	**1.3780**	80	**3.1496**	38.10	**1.5000**	1.5	**.06**	52 300	**11 800**	48 000	**10 800**	5 600	7 500	5 600
5308M	40	**1.5748**	90	**3.5433**	36.51	**1.4375**	1.5	**.06**	67 100	**15 100**	65 500	**14 700**	5 000	6 700	5 000
5308M1	40	**1.5748**	90	**3.5433**	39.69	**1.5625**	1.5	**.06**	67 100	**15 100**	65 500	**14 700**	5 000	6 700	5 000
5309M	45	**1.7717**	100	**3.9370**	39.69	**1.5625**	1.5	**.06**	80 900	**18 200**	80 000	**18 000**	4 500	6 000	4 500
5309M1	45	**1.7717**	100	**3.9370**	42.86	**1.6875**	1.5	**.06**	80 900	**18 200**	80 000	**18 000**	4 500	6 000	4 500
5310M	50	**1.9685**	110	**4.3307**	44.45	**1.7500**	2.0	**.08**	95 200	**21 400**	95 000	**21 400**	4 000	5 300	4 000
5310M1	50	**1.9685**	110	**4.3307**	47.63	**1.8750**	2.0	**.08**	95 200	**21 400**	95 000	**21 400**	4 000	5 300	4 000
5311M	55	**2.1654**	120	**4.7244**	49.21	**1.9375**	2.0	**.08**	119 000	**26 800**	122 000	**27 400**	3 800	5 000	3 800
5311M1	55	**2.1654**	120	**4.7244**	52.39	**2.0625**	2.0	**.08**	119 000	**26 800**	122 000	**27 400**	3 800	5 000	3 800
5312M	60	**2.3622**	130	**5.1181**	53.98	**2.1250**	2.0	**.08**	134 000	**30 200**	143 000	**32 100**	3 400	4 500	3 400
5312M1	60	**2.3622**	130	**5.1181**	57.15	**2.2500**	2.0	**.08**	134 000	**30 200**	143 000	**32 100**	3 400	4 500	3 400
5313M	65	**2.5591**	140	**5.5118**	58.74	**2.3125**	2.0	**.08**	154 000	**34 700**	163 000	**36 600**	3 200	4 300	3 200
5313M1	65	**2.5591**	140	**5.5118**	61.91	**2.4375**	2.0	**.08**	154 000	**34 700**	163 000	**36 600**	3 200	4 300	3 200
5314M	70	**2.7559**	150	**5.9055**	63.50	**2.5000**	2.0	**.08**	172 000	**38 700**	186 000	**41 800**	2 800	3 800	2 800
5314M1	70	**2.7559**	150	**5.9055**	66.68	**2.6250**	2.0	**.08**	172 000	**38 700**	186 000	**41 800**	2 800	3 800	2 800
5315M	75	**2.9528**	160	**6.2992**	68.26	**2.6875**	2.0	**.08**	187 000	**42 000**	208 000	**46 800**	2 600	3 600	2 600
5315M1	75	**2.9528**	160	**6.2992**	71.44	**2.8125**	2.0	**.08**	187 000	**42 000**	208 000	**46 800**	2 600	3 600	2 600
5316M	80	**3.1496**	170	**6.6929**	68.26	**2.6875**	2.0	**.08**	201 000	**45 200**	236 000	**53 100**	2 400	3 400	2 400
5317	85	**3.3465**	180	**7.0866**	73.03	**2.8750**	2.5	**.10**	198 000	**44 500**	245 000	**55 100**	2 200	3 200	2 200
5318	90	**3.5433**	190	**7.4803**	73.03	**2.8750**	2.5	**.10**	224 000	**50 400**	290 000	**65 200**	2 000	3 000	2 000
5319	95	**3.7402**	200	**7.8740**	77.79	**3.0625**	2.5	**.10**	242 000	**54 400**	315 000	**70 800**	1 900	2 800	1 900

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.
Note: Extra width bearings identified by the suffix M1 are supplied with a retrofit kit described on pages 97, 98.

5300UPG series double-row angular contact ball bearings



5300UPG series bearings are a specialized double-row angular contact design developed specifically for pump applications. The bearings are capable of carrying axial loads in either direction, radial loads, or a combination of both. Machined brass cages, ABEC-3 tolerances, 40° contact angle and reduced ("CB") endplay are standard features selected to improve performance for these bearings.

The 5300UPG series is "The Pump Bearing".

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	Fillet radius r_a in.	Basic radial load rating Dynamic C[2)] N	Dynamic lbf	Static C_0 N	Static lbf	Speed rating Grease rpm	Speed rating Oil rpm
5308UPG	40	**1.5748**	90	**3.5433**	36.51	**1.4375**	1.5	**0.06**	49 400	**11 110**	41 500	**9 330**	5 000	6 700
5309UPG	45	**1.7717**	100	**3.9370**	39.69	**1.5625**	1.5	**0.06**	61 800	**13 890**	52 000	**11 690**	4 500	6 000
5310UPG	50	**1.9685**	110	**4.3307**	44.45	**1.7500**	2.0	**0.08**	81 900	**18 410**	69 500	**15 620**	4 000	5 300
5311UPG	55	**2.1654**	120	**4.7244**	49.21	**1.9375**	2.0	**0.08**	95 600	**21 490**	83 000	**18 660**	3 800	5 000
5313UPG	65	**2.5591**	140	**5.5118**	58.74	**2.3125**	2.1	**0.08**	138 000	**31 000**	122 000	**27 400**	3 200	4 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^{1}/3$ rpm.

5000 series double-row angular contact ball bearings

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = XF_R + YF_A$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

X = Radial load factor

Y = Thrust load factor

C_0 = Basic static radial load rating

e = Limiting factor for F_A/F_R

Size	e	$F_A/F_R \leq e$		$F_A/F_R > e$	
		X	Y	X	Y
5200SB–5206C and M 5300SB–5303SB 5403C–5414C	0.66	1.0	0.92	0.67	1.41
5207C and M–5218C and M 5304C and M–5319C and M	0.80	1.0	0.78	0.63	1.24
5308UPG–5313UPG	1.14	1.0	0	0.35	0.57

Size	F_A/C_0	Normal clearance (ST Fit)			C3 clearance (LO Fit)		
		e	X	Y	e	X	Y
5415C–5419C	0.025	0.22	0.56	2.0	0.25	0.52	1.80
	0.040	0.24	0.56	1.8	0.28	0.52	1.65
	0.070	0.27	0.56	1.6	0.30	0.52	1.50
	0.130	0.31	0.56	1.4	0.34	0.52	1.33
	0.250	0.37	0.56	1.2	0.40	0.52	1.17
	0.500	0.44	0.56	1.0	0.48	0.52	1.00

Values of Y and e for loads not shown are obtained by linear interpolation.

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic load rating

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = X_0F_R + Y_0F_A$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

X_0 = Radial load factor

Y_0 = Thrust load factor

Size	X_0	Y_0	
5200SB–5206C and M 5300SB–5303SB 5403C–5414C	1.00	0.76	
5207C and M–5218C and M 5304C and M–5319C and M	1.00	0.66	
5308–5313UPG	0.50	0.26	
5415C–5419C	0.60	0.50	P_0 is always ≥ F_R

Minimum radial load

To insure satisfactory operation of double-row, angular contact ball bearings, they must be subjected to a minimum radial load. This is especially true at high speeds where inertia forces of the balls and cage, and the friction in the lubricant, can cause skidding to occur between the balls and raceway.

The required minimum radial load can be estimated from:

$$F_{rm} = K_r \left(\frac{vn}{1000}\right)^{2/3}\left(\frac{d_m}{100}\right)^2$$

F_{rm} = Minimum radial load (N)

K_r = Minimum load factor

Series	K_r
5200SB and C	60
5200M	90
5300SB and C	70
5300M	110
5400C	70

v = Oil viscosity at operating temperature (cSt)

n = Speed in rpm

d_m = Mean bearing diameter = $\left(\frac{D+d}{2}\right)$, (mm)

D = Bearing outside diameter (mm)

d = Bearing inside diameter (mm)

5000 series double-row angular contact ball bearings

Dynamic equivalent radial load and life calculation examples

Bearing size: 5210M
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 12100

Case 1

Radial load (F_R) = 1750

F_A/F_R = 0/1750 = 0

Equivalent load (P) = X F_R + Y F_A

Since F_A/F_R < e, equivalent load

(P) = 1.0 F_R + 0.78 F_A = 1.0 x 1750 = 1750

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{12100}{1750}\right)^3 = 331 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{12100}{1750}\right)^3$$

= 2755 Hrs

Case 2

Radial load (F_R) = 1750

Thrust load (F_A) = 1300

F_A/F_R = 1300/1750 = 0.74

Equivalent load (P) = X F_R + Y F_A

Since F_A/F_R < e, equivalent load

(P) = 1.0 F_R + 0.78 F_A = 1.0 x 1750 + 0.78 x 1300 = 2764

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{12100}{2764}\right)^3 = 83.9 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{12100}{2764}\right)^3$$

= 699 Hrs

Case 3

Radial load (F_R) = 1750

Thrust load (F_A) = 1500

F_A/F_R = 1500/1750 = 0.86

Equivalent load (P) = X F_R + Y F_A

Since F_A/F_R > e, equivalent load

(P) = 0.63 F_R + 1.24 F_A

= 0.63 x 1750 +1.24 x 1500 = 2963

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{12100}{2963}\right)^3 = 68.1 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{12100}{2963}\right)^3$$

= 568 Hrs

Case 4

Thrust load (F_A) = 1500

F_A/F_R = 1500/0 = ∞

Equivalent load (P) = X F_R + Y F_A

Since F_A/F_R > e, equivalent load

(P) = 0.63 F_R + 1.24 F_A = 1.24 x 1500 = 1860

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{12100}{1860}\right)^3 = 275 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{12100}{1860}\right)^3$$

= 2294 Hrs

5000 series double-row angular contact ball bearings

Dynamic equivalent radial load and life calculation examples

Bearing size: 5203SB
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 3210

Case 1

Radial load (F_R) = 500
$F_A/F_R = 0/500 = 0$
Equivalent load (P) = $X\,F_R + Y\,F_A$
Since $F_A/F_R < e$, equivalent load
(P) = $1.0\,F_R + 0.92\,F_A = 1.0 \times 500 = 500$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{3210}{500}\right)^3 = 265 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{3210}{500}\right)^3$$

= 2205 Hrs

Case 2

Radial load (F_R) = 500
Thrust load (F_A) = 325
$F_A/F_R = 325/500 = 0.65$
Equivalent load (P) = $X\,F_R + Y\,F_A$
Since $F_A/F_R < e$, equivalent load
(P) = $1.0\,F_R + 0.92\,F_A = 1.0 \times 500 + 0.92 \times 325 = 799$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{3210}{799}\right)^3 = 64.8 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{3210}{799}\right)^3$$

= 540 Hrs

Case 3

Radial load (F_R) = 500
Thrust load (F_A) = 375
$F_A/F_R = 375/500 = 0.75$
Equivalent load (P) = $X\,F_R + Y\,F_A$
Since $F_A/F_R > e$, equivalent load
(P) = $0.67\,F_R + 1.41\,F_A$
= $0.67 \times 500 + 1.41 \times 375 = 864$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{3210}{864}\right)^3 = 51.3 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{3210}{864}\right)^3$$

= 427 Hrs

Case 4

Thrust load (F_A) = 375
$F_A/F_R = 375/0 = \infty$
Equivalent load (P) = $X\,F_R + Y\,F_A$
Since $F_A/F_R > e$, equivalent load
(P) = $0.67\,F_R + 1.41\,F_A = 1.41 \times 375 = 529$

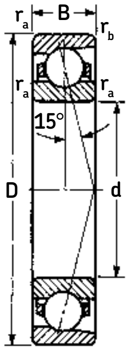
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{3210}{529}\right)^3 = 223 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{3210}{529}\right)^3$$

= 1862 Hrs

R-type single-row 15° angular contact ball bearings



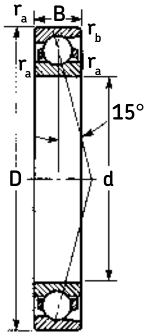
R-type bearings are single-row 15° angular contact ball bearings with one heavy race shoulder and one counterbored race shoulder on the outer ring. Because of this construction, it is possible to incorporate a greater number of balls than in the deep-groove nonfilling notch bearing. R-type bearings have ample radial capacity and moderate thrust capacity in order to accommodate those applications involving heavy radial loads; some thrust load; or a combination of both.

Note: Normally furnished with ABMA C3 radial clearance.

Cage types and materials

Cage types and materials available are: two-piece pressed steel, ball-riding, bent prong cages; one-piece machined brass, inner ring-riding cages; and one-piece phenolic (Bakelite), inner ring-riding cages.

1900R extremely light series single ball bearings

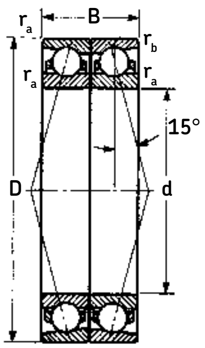


1900R extremely light series bearings are made with bores ranging from 10 mm to 200 mm. The extremely light section on the 1900R bearing permits the use of these bearings in applications where there are space and weight limitations. These bearings can accommodate light radial loads and one directional thrust loads, or a combination of both. Use duplex bearings for two-directional thrust loads. 1900R bearings can be furnished duplex ground for installation in pairs.

	Bore		Outside diameter		Width		Fillet radius[1]						Basic radial load rating				Speed rating[2]	
													Dynamic		Static			
MRC bearing number	d		D		B		r_a		r_b		ZD^2		C[3]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
1900R	10	**.3937**	22	**.8661**	6	**.2362**	.30	**.012**	.10	**.004**	110	**.17**	3 120	**701**	1 560	**351**	33 000	40 000
1901R	12	**.4724**	24	**.9449**	6	**.2362**	.30	**.012**	.10	**.004**	123	**.19**	3 250	**731**	1 800	**405**	30 000	36 000
1902R	15	**.5906**	28	**1.1024**	7	**.2756**	.30	**.012**	.10	**.004**	187	**.29**	4 880	**1 100**	2 700	**607**	24 000	30 000
1903R	17	**.6693**	30	**1.1811**	7	**.2756**	.30	**.012**	.10	**.004**	206	**.32**	5 400	**1 210**	3 000	**674**	22 000	28 000
1904R	20	**.7874**	37	**1.4567**	9	**.3543**	.30	**.012**	.15	**.006**	400	**.62**	9 360	**2 100**	5 850	**1 320**	18 000	22 000
1905R	25	**.9843**	42	**1.6535**	9	**.3543**	.30	**.012**	.15	**.006**	342	**.53**	7 610	**1 710**	5 300	**1 190**	16 000	19 000
1906R	30	**1.1811**	47	**1.8504**	9	**.3543**	.30	**.012**	.15	**.006**	452	**.70**	9 750	**2 190**	7 100	**1 600**	14 000	17 000
1907R	35	**1.3780**	55	**2.1654**	10	**.3937**	.64	**.025**	.15	**.006**	555	**.86**	11 200	**2 520**	9 000	**2 020**	11 000	14 000
1908R	40	**1.5748**	62	**2.4409**	12	**.4724**	.64	**.025**	.15	**.006**	722	**1.12**	14 300	**3 210**	11 600	**2 600**	10 000	15 000
1909R	45	**1.7717**	68	**2.6772**	12	**.4724**	.64	**.025**	.15	**.006**	806	**1.25**	15 100	**3 400**	13 400	**3 010**	9 000	11 000
1910R	50	**1.9685**	72	**2.8346**	12	**.4724**	.64	**.025**	.15	**.006**	1 070	**1.66**	19 500	**4 380**	17 300	**3 900**	8 500	10 000
1911R	55	**2.1654**	80	**3.1496**	13	**.5118**	1.00	**.040**	.30	**.012**	1 260	**1.95**	22 900	**5 150**	20 400	**4 590**	8 000	9 500
1912R	60	**2.3622**	85	**3.3465**	13	**.5118**	1.00	**.040**	.30	**.012**	1 390	**2.15**	24 200	**5 440**	22 800	**5 130**	7 500	9 000
1913R	65	**2.5591**	90	**3.5433**	13	**.5118**	1.00	**.040**	.30	**.012**	1 450	**2.25**	24 700	**5 550**	24 000	**5 400**	6 700	8 000
1914R	70	**2.7559**	100	**3.9370**	16	**.6299**	1.00	**.040**	.30	**.012**	1 990	**3.09**	33 200	**7 460**	32 500	**7 300**	6 300	7 500
1915R	75	**2.9528**	105	**4.1339**	16	**.6299**	1.00	**.040**	.30	**.012**	2 080	**3.23**	34 500	**7 760**	34 500	**7 760**	6 000	7 000
1916R	80	**3.1496**	110	**4.3307**	16	**.6299**	1.00	**.040**	.30	**.012**	2 180	**3.38**	34 500	**7 760**	36 000	**8 100**	5 600	6 700
1917R	85	**3.3465**	120	**4.7244**	18	**.7087**	1.00	**.040**	.60	**.024**	2 840	**4.40**	44 900	**10 100**	46 500	**10 500**	5 300	6 300
1918R	90	**3.5433**	125	**4.9213**	18	**.7087**	1.00	**.040**	.60	**.024**	3 400	**5.27**	52 700	**11 800**	56 000	**12 600**	5 000	6 000
1919R	95	**3.7402**	130	**5.1181**	18	**.7087**	1.00	**.040**	.60	**.024**	3 090	**4.79**	47 500	**10 700**	52 000	**11 700**	4 800	5 600
1920R	100	**3.9370**	140	**5.5118**	20	**.7874**	1.00	**.040**	.60	**.024**	3 870	**6.00**	58 500	**13 200**	64 000	**14 400**	4 500	5 300
1921R	105	**4.1339**	145	**5.7087**	20	**.7874**	1.00	**.040**	.60	**.024**	4 030	**6.25**	60 500	**13 600**	67 000	**15 100**	4 300	5 000
1922R	110	**4.3307**	150	**5.9055**	20	**.7874**	1.00	**.040**	.60	**.024**	3 820	**5.93**	55 300	**12 400**	64 000	**14 400**	4 000	4 800
1924R	120	**4.7244**	165	**6.4961**	22	**.8661**	1.00	**.040**	.60	**.024**	5 100	**7.91**	74 100	**16 700**	85 000	**19 100**	3 600	4 300
1926R	130	**5.1181**	180	**7.0866**	24	**.9449**	1.50	**.060**	.60	**.024**	6 300	**9.77**	90 400	**20 500**	106 000	**23 800**	3 400	4 000
1928R	140	**5.5118**	190	**7.4803**	24	**.9449**	1.50	**.060**	.60	**.024**	6 580	**10.20**	95 600	**21 400**	110 000	**24 700**	3 200	3 800
1930R	150	**5.9055**	210	**8.2677**	28	**1.1024**	2.00	**.080**	1.00	**.040**	9 090	**14.10**	125 000	**28 200**	150 000	**33 700**	2 800	3 400
1932R	160	**6.2992**	220	**8.6614**	28	**1.1024**	2.00	**.080**	1.00	**.040**	9 420	**14.60**	127 000	**28 600**	156 000	**35 100**	2 600	3 200
1934R	170	**6.6929**	230	**9.0551**	28	**1.1024**	2.00	**.080**	1.00	**.040**	10 200	**15.80**	133 000	**29 800**	170 000	**38 300**	2 400	3 000
1936R	180	**7.0866**	250	**9.8425**	33	**1.2992**	2.00	**.080**	1.00	**.040**	12 800	**19.90**	168 000	**36 000**	212 000	**47 800**	2 200	2 800
1938R	190	**7.4803**	260	**10.2362**	33	**1.2992**	2.00	**.080**	1.00	**.040**	13 400	**20.70**	174 000	**39 100**	224 000	**50 400**	2 200	2 800
1940R	200	**7.8740**	280	**11.0236**	38	**1.4961**	2.00	**.080**	1.00	**.040**	16 800	**26.00**	216 100	**48 600**	275 000	**61 800**	2 000	2 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

1900RD extremely light series duplex ball bearings



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

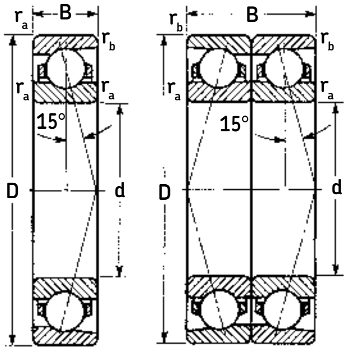
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	r_a in.	r_b mm	r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3)] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[2)] Grease rpm	Oil rpm
1900RD	10	**.3937**	22	**.8661**	12	**.4724**	.30	**.012**	.10	**.004**	110	**.17**	5 070	**1 140**	3 100	**697**	26 000	32 000
1901RD	12	**.4724**	24	**.9449**	12	**.4724**	.30	**.012**	.10	**.004**	123	**.19**	5 270	**1 180**	3 550	**798**	24 000	29 000
1902RD	15	**.5906**	28	**1.1024**	14	**.5512**	.30	**.012**	.10	**.004**	187	**.29**	7 930	**1 780**	5 400	**1 210**	19 000	24 000
1903RD	17	**.6693**	30	**1.1811**	14	**.5512**	.30	**.012**	.10	**.004**	206	**.32**	8 710	**1 960**	6 100	**1 370**	18 000	22 000
1904RD	20	**.7874**	37	**1.4567**	18	**.7087**	.30	**.012**	.15	**.006**	400	**.62**	15 300	**3 440**	11 600	**2 600**	14 000	18 000
1905RD	25	**.9843**	42	**1.6535**	18	**.7087**	.30	**.012**	.15	**.006**	342	**.53**	12 400	**2 790**	10 800	**2 430**	13 000	15 000
1906RD	30	**1.1811**	47	**1.8504**	18	**.7087**	.30	**.012**	.15	**.006**	452	**.70**	15 900	**3 580**	14 300	**3 210**	11 000	14 000
1907RD	35	**1.3780**	55	**2.1654**	20	**.7874**	.64	**.025**	.15	**.006**	555	**.86**	18 200	**4 090**	18 000	**4 050**	8 800	11 000
1908RD	40	**1.5748**	62	**2.4409**	24	**.9449**	.64	**.025**	.15	**.006**	722	**1.12**	22 900	**5 150**	23 200	**5 220**	8 000	10 000
1909RD	45	**1.7717**	68	**2.6772**	24	**.9449**	.64	**.025**	.15	**.006**	806	**1.25**	24 700	**5 550**	26 500	**5 960**	7 200	8 800
1910RD	50	**1.9685**	72	**2.8346**	24	**.9449**	.64	**.025**	.15	**.006**	1 070	**1.66**	31 900	**7 170**	34 500	**7 760**	6 800	8 000
1911RD	55	**2.1654**	80	**3.1496**	26	**1.0236**	1.00	**.040**	.30	**.012**	1 260	**1.95**	37 100	**8 340**	40 500	**9 100**	6 400	7 600
1912RD	60	**2.3622**	85	**3.3465**	26	**1.0236**	1.00	**.040**	.30	**.012**	1 390	**2.15**	39 000	**8 770**	45 500	**10 200**	6 000	7 200
1913RD	65	**2.5591**	90	**3.5433**	26	**1.0236**	1.00	**.040**	.30	**.012**	1 450	**2.25**	39 700	**8 920**	48 000	**10 800**	5 400	6 400
1914RD	70	**2.7559**	100	**3.9370**	32	**1.2598**	1.00	**.040**	.30	**.012**	1 990	**3.09**	54 000	**12 100**	65 500	**14 700**	5 000	6 000
1915RD	75	**2.9528**	105	**4.1339**	32	**1.2598**	1.00	**.040**	.30	**.012**	2 080	**3.23**	55 900	**12 600**	68 000	**15 300**	4 800	5 600
1916RD	80	**3.1496**	110	**4.3307**	32	**1.2598**	1.00	**.040**	.30	**.012**	2 180	**3.38**	57 200	**12 900**	72 000	**16 200**	4 500	5 400
1917RD	85	**3.3465**	120	**4.7244**	36	**1.4173**	1.00	**.040**	.60	**.024**	2 840	**4.40**	74 100	**16 700**	93 000	**20 900**	4 200	5 000
1918RD	90	**3.5433**	125	**4.9213**	36	**1.4173**	1.00	**.040**	.60	**.024**	3 400	**5.27**	85 200	**19 200**	112 000	**25 200**	4 000	4 800
1919RD	95	**3.7402**	130	**5.1181**	36	**1.4173**	1.00	**.040**	.60	**.024**	3 090	**4.79**	76 100	**17 100**	104 000	**23 400**	3 800	4 500
1920RD	100	**3.9370**	140	**5.5118**	40	**1.5748**	1.00	**.040**	.60	**.024**	3 870	**6.00**	95 600	**21 500**	127 000	**28 600**	3 600	4 200
1921RD	105	**4.1339**	145	**5.7087**	40	**1.5748**	1.00	**.040**	.60	**.024**	4 030	**6.25**	97 500	**21 900**	134 000	**30 100**	3 400	4 000
1922RD	110	**4.3307**	150	**5.9055**	40	**1.5748**	1.00	**.040**	.60	**.024**	3 820	**5.93**	90 400	**20 300**	129 000	**29 000**	3 200	3 800
1924RD	120	**4.7244**	165	**6.4961**	44	**1.7323**	1.00	**.040**	.60	**.024**	5 100	**7.91**	121 000	**27 200**	170 000	**38 200**	2 900	3 400
1926RD	130	**5.1181**	180	**7.0866**	48	**1.8898**	1.50	**.060**	.60	**.024**	6 300	**9.77**	146 000	**32 800**	208 000	**46 800**	2 700	3 200
1928RD	140	**5.5118**	190	**7.4803**	48	**1.8898**	1.50	**.060**	.60	**.024**	6 580	**10.20**	156 000	**35 100**	220 000	**49 500**	2 600	3 000
1930RD	150	**5.9055**	210	**8.2677**	56	**2.2047**	2.00	**.080**	1.00	**.040**	9 090	**14.10**	203 000	**45 600**	300 000	**67 400**	2 200	2 700
1932RD	160	**6.2992**	220	**8.6614**	56	**2.2047**	2.00	**.080**	1.00	**.040**	9 420	**14.60**	208 000	**46 800**	315 000	**70 800**	2 100	2 600
1934RD	170	**6.6929**	230	**9.0551**	56	**2.2047**	2.00	**.080**	1.00	**.040**	10 200	**15.80**	216 000	**48 600**	340 000	**76 400**	1 900	2 400
1936RD	180	**7.0866**	250	**9.8425**	66	**2.5984**	2.00	**.080**	1.00	**.040**	12 800	**19.90**	276 000	**62 000**	425 000	**95 600**	1 800	2 200
1938RD	190	**7.4803**	260	**10.2362**	66	**2.5984**	2.00	**.080**	1.00	**.040**	13 400	**20.70**	281 000	**63 200**	440 000	**98 900**	1 800	2 200
1940RD	200	**7.8740**	280	**11.0236**	76	**2.9921**	2.00	**.080**	1.00	**.040**	16 800	**26.00**	351 000	**78 900**	550 000	**124 000**	1 600	2 100

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

100R and 100RD extra large series



100R extra large series bearings are available in bore diameters ranging from 100 mm to 320 mm. They are used with light to moderate radial loads, one-directional thrust loads, or a combination of both. Duplex bearings should be used for two-directional thrust loads.

Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex.

See pages 240 and 241 for suffix description.

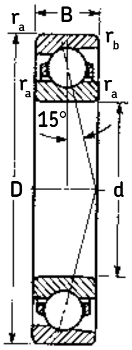
Values for RD bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Grease rpm	Oil rpm
100R																		
120R	100	**3.9370**	160	**6.2992**	28	**1.1024**	2.0	**.08**	1.0	**.040**	6 100	**9.45**	95 600	**21 500**	95 000	**21 400**	3 900	4 800
122R	110	**4.3307**	175	**6.8898**	30	**1.1811**	2.0	**.08**	1.0	**.040**	7 290	**11.30**	114 000	**25 600**	114 000	**25 600**	3 600	4 400
124R	120	**4.7244**	190	**7.4803**	32	**1.2598**	2.0	**.08**	1.0	**.040**	8 970	**13.90**	134 000	**30 100**	140 000	**31 500**	3 300	4 000
126R	130	**5.1181**	205	**8.0709**	34	**1.3386**	2.0	**.08**	1.0	**.040**	9 350	**14.50**	138 000	**31 000**	150 000	**33 700**	3 000	3 700
128R	140	**5.5118**	220	**8.6614**	36	**1.4173**	2.0	**.08**	1.0	**.040**	10 800	**16.80**	157 000	**35 300**	173 000	**38 900**	2 800	3 400
130R	150	**5.9055**	235	**9.2520**	38	**1.4961**	2.0	**.08**	1.0	**.040**	12 400	**19.30**	176 000	**39 600**	200 000	**45 000**	2 600	3 200
132R	160	**6.2992**	250	**9.8425**	40	**1.5748**	2.0	**.08**	1.0	**.040**	14 200	**22.00**	183 000	**41 100**	228 000	**51 300**	2 500	3 000
134R	170	**6.6929**	265	**10.4331**	42	**1.6535**	2.5	**.10**	1.0	**.040**	16 000	**24.80**	216 000	**48 600**	255 000	**57 300**	2 300	2 800
136R	180	**7.0866**	280	**11.0236**	44	**1.7323**	2.5	**.10**	1.0	**.040**	17 900	**27.80**	233 000	**52 400**	285 000	**64 100**	2 100	2 600
138R	190	**7.4803**	300	**11.8110**	46	**1.8110**	2.5	**.10**	1.0	**.040**	22 200	**34.40**	275 000	**61 800**	355 000	**79 800**	2 100	2 500
140R	200	**7.8740**	320	**12.5984**	48	**1.8898**	2.5	**.10**	1.0	**.040**	24 400	**37.90**	292 000	**65 600**	390 000	**87 700**	1 900	2 300
142R	210	**8.2677**	340	**13.3858**	50	**1.9685**	2.5	**.10**	1.0	**.040**	28 000	**43.40**	319 000	**71 700**	440 000	**98 900**	1 800	2 200
144R	220	**8.6614**	350	**13.7795**	51	**2.0079**	2.5	**.10**	1.0	**.040**	29 300	**45.50**	336 000	**75 500**	465 000	**105 000**	1 700	2 100
146R	230	**9.0551**	370	**14.5669**	53	**2.0866**	3.0	**.12**	1.0	**.040**	31 900	**49.50**	352 000	**79 100**	510 000	**115 000**	1 600	2 000
148R	240	**9.4488**	390	**15.3543**	55	**2.1654**	3.0	**.12**	1.0	**.040**	34 600	**53.70**	374 000	**84 100**	550 000	**124 000**	1 600	1 900
150R	250	**9.8425**	410	**16.1417**	57	**2.2441**	3.0	**.12**	1.0	**.040**	37 500	**58.10**	393 000	**88 400**	600 000	**135 000**	1 500	1 800
152R	260	**10.2362**	430	**16.9291**	59	**2.3228**	3.0	**.12**	1.0	**.040**	40 400	**62.70**	413 000	**92 800**	655 000	**147 000**	1 400	1 700
156R	280	**11.0236**	460	**18.1102**	63	**2.4803**	3.0	**.12**	1.0	**.040**	46 600	**72.30**	457 000	**103 000**	750 000	**169 000**	1 300	1 600
164R	320	**12.5984**	500	**19.6850**	71	**2.7953**	3.0	**.12**	1.0	**.040**	56 800	**88.00**	523 000	**118 000**	900 000	**202 000**	1 100	1 400
100RD																		
120RD	100	**3.9370**	160	**6.2992**	56	**2.2047**	2.0	**.08**	1.0	**.040**	6 100	**9.450**	156 000	**35 100**	190 000	**42 700**	3 100	3 800
122RD	110	**4.3307**	175	**6.8898**	60	**2.3622**	2.0	**.08**	1.0	**.040**	7 290	**11.30**	185 000	**41 800**	228 000	**51 300**	2 900	3 500
124RD	120	**4.7244**	190	**7.4803**	64	**2.5197**	2.0	**.08**	1.0	**.040**	8 970	**13.90**	221 000	**49 700**	280 000	**62 900**	2 600	3 200
126RD	130	**5.1181**	205	**8.0709**	68	**2.6772**	2.0	**.08**	1.0	**.040**	9 350	**14.50**	221 000	**49 700**	300 000	**67 400**	2 400	3 000
128RD	140	**5.5118**	220	**8.6614**	72	**2.8346**	2.0	**.08**	1.0	**.040**	10 800	**16.80**	255 000	**57 300**	345 000	**77 600**	2 200	2 700
130RD	150	**5.9055**	235	**9.2520**	76	**2.9921**	2.0	**.08**	1.0	**.040**	12 400	**19.30**	286 000	**64 300**	400 000	**89 900**	2 100	2 600
132RD	160	**6.2992**	250	**9.8425**	80	**3.1496**	2.0	**.08**	1.0	**.040**	14 200	**22.00**	296 000	**66 500**	455 000	**102 000**	2 000	2 400
134RD	170	**6.6929**	265	**10.4331**	84	**3.3071**	2.5	**.10**	1.0	**.040**	16 000	**24.80**	351 000	**78 900**	510 000	**115 000**	1 800	2 200
136RD	180	**7.0866**	280	**11.0236**	88	**3.4646**	2.5	**.10**	1.0	**.040**	17 900	**27.80**	377 000	**84 800**	570 000	**128 000**	1 700	2 100
138RD	190	**7.4803**	300	**11.8110**	92	**3.6220**	2.5	**.10**	1.0	**.040**	22 200	**34.40**	442 000	**99 400**	710 000	**160 000**	1 700	2 000
140RD	200	**7.8740**	320	**12.5984**	96	**3.7795**	2.5	**.10**	1.0	**.040**	24 400	**37.90**	475 000	**107 000**	780 000	**175 000**	1 500	1 800
142RD	210	**8.2677**	340	**13.3858**	100	**3.9370**	2.5	**.10**	1.0	**.040**	28 000	**43.40**	527 000	**118 000**	880 000	**198 000**	1 400	1 800
144RD	220	**8.6614**	350	**13.7795**	102	**4.0157**	2.5	**.10**	1.0	**.040**	29 300	**45.50**	540 000	**121 000**	930 000	**209 000**	1 400	1 700
146RD	230	**9.0551**	370	**14.5669**	106	**4.1732**	3.0	**.12**	1.0	**.040**	31 900	**49.50**	572 000	**129 000**	1 020 000	**229 000**	1 300	1 600
148RD	240	**9.4488**	390	**15.3543**	110	**4.3307**	3.0	**.12**	1.0	**.040**	34 600	**53.70**	605 000	**136 000**	1 100 000	**247 000**	1 300	1 500
150RD	250	**9.8425**	410	**16.1417**	114	**4.4882**	3.0	**.12**	1.0	**.040**	37 500	**58.10**	637 000	**143 000**	1 200 000	**270 000**	1 200	1 400
152RD	260	**10.2362**	430	**16.9291**	118	**4.6457**	3.0	**.12**	1.0	**.040**	40 400	**62.70**	676 000	**152 000**	1 290 000	**290 000**	1 100	1 400
156RD	280	**11.0236**	460	**18.1102**	126	**4.9606**	3.0	**.12**	1.0	**.040**	46 600	**72.30**	741 000	**167 000**	1 500 000	**337 000**	1 000	1 300
164RD	320	**12.5984**	500	**19.6850**	142	**5.5906**	3.0	**.12**	1.0	**.040**	56 800	**88.00**	852 000	**192 000**	1 800 000	**405 000**	880	1 100

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

100KR extra light series single ball bearings

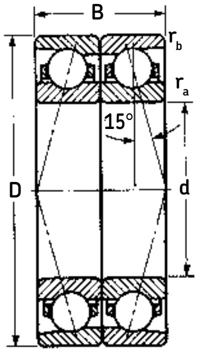


100KR extra light series bearings are made with bores ranging from 10 mm to 320 mm. 100KR bearings can accommodate light to moderate radial loads or one-directional thrust loads, or a combination of both where space is somewhat limited. They can be furnished duplex-ground for mounting in pairs. Duplex bearings should be used for two-directional thrust loads.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Grease rpm	Oil rpm
100KR	10	**.3937**	26	**1.0236**	8	**.3150**	.30	**.012**	.10	**.004**	181	**.28**	4 940	**1 110**	2 280	**513**	30 000	36 000
101KR	12	**.4724**	28	**1.1024**	8	**.3150**	.30	**.012**	.10	**.004**	206	**.32**	5 530	**1 240**	2 650	**596**	26 000	32 000
102KR	15	**.5906**	32	**1.2598**	9	**.3543**	.30	**.012**	.10	**.004**	226	**.35**	6 050	**1 350**	3 150	**708**	22 000	28 000
103KR	17	**.6693**	35	**1.3780**	10	**.3937**	.30	**.012**	.10	**.004**	342	**.53**	8 520	**1 920**	4 650	**1 050**	19 000	24 000
104KR	20	**.7874**	42	**1.6535**	12	**.4724**	.64	**.025**	.30	**.012**	445	**.69**	10 800	**2 420**	6 200	**1 390**	17 000	20 000
105KR	25	**.9843**	47	**1.8504**	12	**.4724**	.64	**.025**	.30	**.012**	522	**.81**	12 100	**2 720**	7 650	**1 720**	15 000	18 000
106KR	30	**1.1811**	55	**2.1654**	13	**.5118**	1.00	**.040**	.30	**.012**	716	**1.11**	15 600	**3 500**	10 600	**2 380**	12 000	15 000
107KR	35	**1.3780**	62	**2.4409**	14	**.5512**	1.00	**.040**	.30	**.012**	884	**1.37**	18 600	**4 180**	13 200	**2 970**	10 000	13 000
108KR	40	**1.5748**	68	**2.6772**	15	**.5906**	1.00	**.040**	.30	**.012**	942	**1.46**	19 500	**4 380**	14 600	**3 280**	9 500	12 000
109KR	45	**1.7717**	75	**2.9528**	16	**.6299**	1.00	**.040**	.30	**.012**	1 220	**1.89**	24 200	**5 440**	19 000	**4 270**	9 000	11 000
110KR	50	**1.9685**	80	**3.1496**	16	**.6299**	1.00	**.040**	.30	**.012**	1 300	**2.01**	25 100	**5 640**	20 400	**4 590**	8 500	10 000
111KR	55	**2.1654**	90	**3.5433**	18	**.7087**	1.00	**.040**	.60	**.024**	1 810	**2.81**	33 800	**7 600**	28 000	**6 290**	7 500	9 000
112KR	60	**2.3622**	95	**3.7402**	18	**.7087**	1.00	**.040**	.60	**.024**	1 920	**2.97**	35 100	**7 890**	30 000	**6 740**	6 700	8 000
113KR	65	**2.5591**	100	**3.9370**	18	**.7087**	1.00	**.040**	.60	**.024**	2 030	**3.14**	35 800	**8 050**	32 500	**7 310**	6 300	7 500
114KR	70	**2.7559**	110	**4.3307**	20	**.7874**	1.00	**.040**	.60	**.024**	2 470	**3.83**	42 300	**9 510**	40 000	**8 990**	6 000	7 000
115KR	75	**2.9528**	115	**4.5276**	20	**.7874**	1.00	**.040**	.60	**.024**	2 590	**4.02**	43 600	**9 800**	42 500	**9 550**	5 600	6 770
116KR	80	**3.1496**	125	**4.9213**	22	**.8661**	1.00	**.040**	.60	**.024**	3 390	**5.25**	55 900	**12 600**	54 000	**12 100**	5 300	6 300
117KR	85	**3.3465**	130	**5.1181**	22	**.8661**	1.00	**.040**	.60	**.024**	3 550	**5.50**	57 200	**12 900**	57 000	**12 800**	5 000	6 000
118KR	90	**3.5433**	140	**5.5118**	24	**.9449**	1.50	**.060**	.60	**.024**	4 280	**6.64**	68 900	**15 500**	68 000	**15 300**	4 800	5 600
119KR	95	**3.7402**	145	**5.7087**	24	**.9449**	1.50	**.060**	.60	**.024**	5 040	**7.81**	83 200	**18 700**	80 000	**18 000**	4 500	5 300
120KR	100	**3.9370**	150	**5.9055**	24	**.9449**	1.50	**.060**	.60	**.024**	4 700	**7.28**	71 500	**16 100**	76 500	**17 200**	4 300	5 000
121KR	105	**4.1339**	160	**6.2992**	26	**1.0236**	2.00	**.080**	1.00	**.040**	5 540	**8.59**	85 200	**19 200**	90 000	**20 200**	4 000	4 800
122KR	110	**4.3307**	170	**6.6929**	28	**1.1024**	2.00	**.080**	1.00	**.040**	6 400	**9.93**	99 500	**22 400**	102 000	**23 000**	3 800	4 500
124KR	120	**4.7244**	180	**7.0866**	28	**1.1024**	2.00	**.080**	1.00	**.040**	6 710	**10.40**	101 000	**22 600**	110 000	**24 700**	3 400	4 000
126KR	130	**5.1181**	200	**7.8740**	33	**1.2992**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	138 000	**31 000**	150 000	**33 700**	3 200	3 800
128KR	140	**5.5118**	210	**8.2677**	33	**1.2992**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	135 000	**30 300**	153 000	**34 400**	3 000	3 600
130KR	150	**5.9055**	225	**8.8583**	35	**1.3780**	2.00	**.080**	1.00	**.040**	10 800	**16.80**	156 000	**35 000**	176 000	**39 600**	2 600	3 200
132KR	160	**6.2992**	240	**9.4488**	38	**1.4961**	2.00	**.080**	1.00	**.040**	12 400	**19.30**	178 000	**40 000**	204 000	**45 900**	2 400	3 000
134KR	170	**6.6929**	260	**10.2362**	42	**1.6535**	2.00	**.080**	1.00	**.040**	15 300	**23.70**	212 000	**47 700**	245 000	**55 100**	2 200	2 800
136KR	180	**7.0866**	280	**11.0236**	46	**1.8110**	2.00	**.080**	1.00	**.040**	17 900	**27.80**	234 000	**52 600**	290 000	**65 200**	2 000	2 600
138KR	190	**7.4803**	290	**11.4173**	46	**1.8110**	2.00	**.080**	1.00	**.040**	18 800	**29.10**	242 000	**54 400**	305 000	**68 600**	2 000	2 600
140KR	200	**7.8740**	310	**12.2047**	51	**2.0079**	2.00	**.080**	1.00	**.040**	22 200	**34.40**	276 000	**62 000**	355 000	**79 800**	1 900	2 400
144KR	220	**8.6614**	340	**13.3858**	56	**2.2047**	2.50	**.100**	1.00	**.040**	30 400	**47.20**	345 000	**77 600**	480 000	**108 000**	1 800	2 200
148KR	240	**9.4488**	360	**14.1732**	56	**2.2047**	2.50	**.100**	1.00	**.040**	31 900	**49.50**	351 000	**78 900**	510 000	**115 000**	1 700	2 000
152KR	260	**10.2362**	400	**15.7480**	65	**2.5591**	3.00	**.120**	1.50	**.060**	41 500	**64.30**	423 000	**95 100**	655 000	**147 000**	1 500	1 800
156KR	280	**11.0236**	420	**16.5354**	65	**2.5591**	3.00	**.120**	1.50	**.060**	43 500	**67.40**	436 000	**98 000**	695 000	**156 000**	1 400	1 700
160KR	300	**11.8110**	460	**18.1102**	74	**2.9134**	3.00	**.120**	1.50	**.060**	54 200	**84.00**	520 000	**117 000**	850 000	**191 000**	1 200	1 500
164KR	320	**12.5984**	480	**18.8976**	74	**2.9134**	3.00	**.120**	1.50	**.060**	56 800	**88.00**	527 000	**118 000**	900 000	**202 000**	1 100	1 400

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

100KRD extra light series duplex ball bearings



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

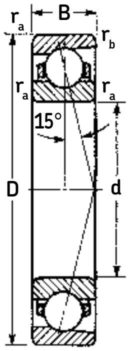
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	r_a in.	r_b mm	r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic $C^{3)}$ N	Dynamic lbf	Static C_0 N	Static lbf	Speed rating[2)] Grease rpm	Oil rpm
100KRD	10	**.3937**	26	**1.0236**	16	**.6299**	.30	**.012**	.10	**.004**	181	**.28**	8 060	**1 810**	4 550	**1 020**	24 000	29 000
101KRD	12	**.4724**	28	**1.1024**	16	**.6299**	.30	**.012**	.10	**.004**	206	**.32**	8 840	**1 990**	5 300	**1 190**	21 000	26 000
102KRD	15	**.5906**	32	**1.2598**	18	**.7087**	.30	**.012**	.10	**.004**	226	**.35**	9 750	**2 190**	6 300	**1 420**	18 000	22 000
103KRD	17	**.6693**	35	**1.3780**	20	**.7874**	.30	**.012**	.10	**.004**	342	**.53**	13 800	**3 100**	9 300	**2 090**	15 000	19 000
104KRD	20	**.7874**	42	**1.6535**	24	**.9449**	.64	**.025**	.30	**.012**	445	**.69**	17 400	**3 910**	12 500	**2 810**	14 000	16 000
105KRD	25	**.9843**	47	**1.8504**	24	**.9449**	.64	**.025**	.30	**.012**	522	**.81**	19 500	**4 380**	15 300	**3 440**	12 000	14 000
106KRD	30	**1.1811**	55	**2.1654**	26	**1.0236**	1.00	**.040**	.30	**.012**	716	**1.11**	25 500	**5 730**	21 200	**4 760**	9 600	12 000
107KRD	35	**1.3780**	62	**2.4409**	28	**1.1024**	1.00	**.040**	.30	**.012**	884	**1.37**	30 200	**6 790**	26 500	**5 960**	8 000	10 000
108KRD	40	**1.5748**	68	**2.6772**	30	**1.1811**	1.00	**.040**	.30	**.012**	942	**1.46**	31 900	**7 170**	29 000	**6 520**	7 600	9 600
109KRD	45	**1.7717**	75	**2.9528**	32	**1.2598**	1.00	**.040**	.30	**.012**	1 220	**1.89**	39 000	**8 770**	37 500	**8 430**	7 200	8 800
110KRD	50	**1.9685**	80	**3.1496**	32	**1.2598**	1.00	**.040**	.30	**.012**	1 300	**2.01**	40 300	**9 060**	40 500	**9 100**	6 800	8 000
111KRD	55	**2.1654**	90	**3.5433**	36	**1.4173**	1.00	**.040**	.60	**.024**	1 810	**2.81**	55 300	**12 400**	56 000	**12 600**	6 000	7 200
112KRD	60	**2.3622**	95	**3.7402**	36	**1.4173**	1.00	**.040**	.60	**.024**	1 920	**2.97**	55 900	**12 600**	61 000	**13 700**	5 400	6 400
113KRD	65	**2.5591**	100	**3.9370**	36	**1.4173**	1.00	**.040**	.60	**.024**	2 030	**3.14**	58 500	**13 200**	64 000	**14 400**	5 000	6 000
114KRD	70	**2.7559**	110	**4.3307**	40	**1.5748**	1.00	**.040**	.60	**.024**	2 470	**3.83**	68 900	**15 500**	80 000	**18 000**	4 800	5 600
115KRD	75	**2.9528**	115	**4.5276**	40	**1.5748**	1.00	**.040**	.60	**.024**	2 590	**4.02**	70 200	**15 800**	85 000	**19 100**	4 500	5 400
116KRD	80	**3.1496**	125	**4.9213**	44	**1.7323**	1.00	**.040**	.60	**.024**	3 390	**5.25**	90 400	**20 300**	110 000	**24 700**	4 200	5 000
117KRD	85	**3.3465**	130	**5.1181**	44	**1.7323**	1.00	**.040**	.60	**.024**	3 550	**5.50**	92 300	**20 700**	116 000	**26 100**	4 000	4 800
118KRD	90	**3.5433**	140	**5.5118**	48	**1.8898**	1.50	**.060**	.60	**.024**	4 280	**6.64**	111 000	**25 000**	137 000	**30 800**	3 800	4 500
119KRD	95	**3.7402**	145	**5.7087**	48	**1.8898**	1.50	**.060**	.60	**.024**	5 040	**7.81**	135 000	**30 300**	160 000	**36 000**	3 600	4 200
120KRD	100	**3.9370**	150	**5.9055**	48	**1.8898**	1.50	**.060**	.60	**.024**	4 700	**7.28**	117 000	**26 300**	153 000	**34 400**	3 400	4 000
121KRD	105	**4.1339**	160	**6.2992**	52	**2.0472**	2.00	**.080**	1.00	**.040**	5 540	**8.59**	138 000	**31 000**	180 000	**40 500**	3 200	3 800
122KRD	110	**4.3307**	170	**6.6929**	56	**2.2047**	2.00	**.080**	1.00	**.040**	6 400	**9.93**	163 000	**36 600**	204 000	**45 900**	3 000	3 600
124KRD	120	**4.7244**	180	**7.0866**	56	**2.2047**	2.00	**.080**	1.00	**.040**	6 710	**10.40**	163 000	**36 600**	220 000	**49 500**	2 700	3 200
126KRD	130	**5.1181**	200	**7.8740**	66	**2.5984**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	225 000	**50 000**	300 000	**67 400**	2 600	3 000
128KRD	140	**5.5118**	210	**8.2677**	66	**2.5984**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	221 000	**49 700**	305 000	**68 600**	2 400	2 900
130KRD	150	**5.9055**	225	**8.8583**	70	**2.7559**	2.00	**.080**	1.00	**.040**	10 800	**16.80**	255 000	**57 300**	355 000	**79 800**	2 100	2 600
132KRD	160	**6.2992**	240	**9.4488**	76	**2.9921**	2.00	**.080**	1.00	**.040**	12 400	**19.30**	286 000	**64 300**	405 000	**91 000**	1 900	2 400
134KRD	170	**6.6929**	260	**10.2362**	84	**3.3071**	2.00	**.080**	1.00	**.040**	15 300	**23.70**	345 000	**77 600**	490 000	**110 000**	1 800	2 200
136KRD	180	**7.0866**	280	**11.0236**	92	**3.6220**	2.00	**.080**	1.00	**.040**	17 900	**27.80**	377 000	**84 800**	570 000	**128 000**	1 600	2 100
138KRD	190	**7.4803**	290	**11.4173**	92	**3.6220**	2.00	**.080**	1.00	**.040**	18 800	**29.10**	390 000	**87 700**	610 000	**137 000**	1 600	2 100
140KRD	200	**7.8740**	310	**12.2047**	102	**4.0157**	2.00	**.080**	1.00	**.040**	22 200	**34.40**	442 000	**99 400**	710 000	**160 000**	1 500	1 900
144KRD	220	**8.6614**	340	**13.3858**	112	**4.4094**	2.50	**.100**	1.00	**.040**	30 400	**47.20**	559 000	**126 000**	965 000	**217 000**	1 400	1 800
148KRD	240	**9.4488**	360	**14.1732**	112	**4.4094**	2.50	**.100**	1.00	**.040**	31 900	**49.50**	572 000	**129 000**	1 020 000	**228 000**	1 400	1 600
152KRD	260	**10.2362**	400	**15.7480**	130	**5.1181**	3.00	**.120**	1.50	**.060**	41 500	**64.30**	702 000	**158 000**	1 320 000	**297 000**	1 200	1 400
156KRD	280	**11.0236**	420	**16.5354**	130	**5.1181**	3.00	**.120**	1.50	**.060**	43 500	**67.40**	715 000	**161 000**	1 400 000	**315 000**	1 100	1 400
160KRD	300	**11.8110**	460	**18.1102**	148	**5.8268**	3.00	**.120**	1.50	**.060**	54 200	**84.00**	832 000	**187 000**	1 700 000	**382 000**	960	1 200
164KRD	320	**12.5984**	480	**18.8976**	148	**5.8268**	3.00	**.120**	1.50	**.060**	56 800	**88.00**	852 000	**192 000**	1 810 000	**406 000**	880	1 100

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

200R light series single ball bearings

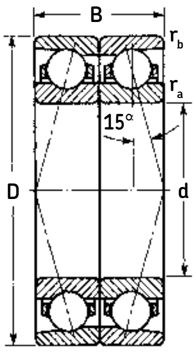


200R light series bearings are made with bore diameters ranging from 10 mm to 320 mm. These bearings are recommended for moderate to heavy radial loads, one-directional thrust loads, or for combinations of both. Duplex bearings should be used for two-directional thrust loads.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Fillet radius[1] r_b mm	Fillet radius[1] r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3] N	Basic radial load rating Dynamic C[3] lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating[2] Grease rpm	Speed rating[2] Oil rpm
200R	10	.3937	30	1.1811	9	.3543	.64	.025	.30	.012	284	.44	7 280	1 640	3 200	719	24 000	30 000
201R	12	.4724	32	1.2598	10	.3937	.64	.025	.30	.012	323	.50	8 190	1 840	3 900	877	22 000	28 000
202R	15	.5906	35	1.3780	11	.4331	.64	.025	.30	.012	406	.63	9 750	2 190	5 100	1 150	19 000	24 000
203R	17	.6693	40	1.5748	12	.4724	.64	.025	.30	.012	510	.79	12 100	2 720	6 550	1 470	17 000	20 000
204R	20	.7874	47	1.8504	14	.5512	1.00	.040	.60	.024	613	.95	14 000	3 150	8 500	1 910	15 000	18 000
205R	25	.9843	52	2.0472	15	.5906	1.00	.040	.60	.024	755	1.17	16 800	3 780	10 600	2 380	12 000	15 000
206R	30	1.1811	62	2.4409	16	.6299	1.00	.040	.60	.024	884	1.37	19 000	4 270	12 900	2 910	10 000	13 000
207R	35	1.3780	72	2.8346	17	.6693	1.00	.040	.60	.024	1 270	1.97	26 000	5 850	18 600	4 180	9 000	11 000
208R	40	1.5748	80	3.1496	18	.7087	1.00	.040	.60	.024	1 730	2.68	34 500	7 760	25 000	5 620	8 500	10 000
209R	45	1.7717	85	3.3465	19	.7480	1.00	.040	.60	.024	1 730	2.68	34 500	7 760	25 500	5 730	7 500	9 000
210R	50	1.9685	90	3.5433	20	.7874	1.00	.040	.60	.024	1 970	3.06	37 700	8 480	30 000	6 740	7 000	8 500
211R	55	2.1654	100	3.9370	21	.8268	1.50	.060	1.00	.040	2 860	4.43	54 000	12 100	41 500	9 330	6 300	7 500
212R	60	2.3622	110	4.3307	22	.8661	1.50	.060	1.00	.040	3 260	5.06	59 200	13 300	49 000	11 000	6 000	7 000
213R	65	2.5591	120	4.7244	23	.9055	1.50	.060	1.00	.040	4 030	6.25	60 500	13 600	58 500	13 200	5 300	6 300
214R	70	2.7559	125	4.9213	24	.9449	1.50	.060	1.00	.040	4 530	7.03	78 000	17 500	68 000	15 300	5 000	6 000
215R	75	2.9528	130	5.1181	25	.9843	1.50	.060	1.00	.040	5 190	8.04	88 400	19 900	76 500	17 200	4 800	5 600
216R	80	3.1496	140	5.5118	26	1.0236	2.00	.080	1.00	.040	4 880	7.56	85 200	19 200	73 500	16 500	4 500	5 300
217R	85	3.3465	150	5.9055	28	1.1024	2.00	.080	1.00	.040	6 170	9.56	104 000	23 400	93 000	20 900	4 300	5 000
218R	90	3.5433	160	6.2992	30	1.1811	2.00	.080	1.00	.040	7 870	12.20	130 000	29 200	116 000	26 100	3 800	4 500
219R	95	3.7402	170	6.6929	32	1.2598	2.00	.080	1.00	.040	8 390	13.00	138 000	31 000	125 000	28 000	3 600	4 300
220R	100	3.9370	180	7.0866	34	1.3386	2.00	.080	1.00	.040	9 610	14.90	153 000	34 000	143 000	32 100	3 400	4 000
221R	105	4.1339	190	7.4803	36	1.4173	2.00	.080	1.00	.040	10 300	16.00	168 000	37 800	153 000	34 400	3 200	3 800
222R	110	4.3307	200	7.8740	38	1.4961	2.00	.080	1.00	.040	11 700	18.10	182 000	40 900	170 000	38 200	3 000	3 600
224R	120	4.7244	215	8.4646	40	1.5748	2.00	.080	1.00	.040	13 000	20.20	199 000	44 700	193 000	43 300	2 800	3 400
226R	130	5.1181	230	9.0551	40	1.5748	2.50	.100	1.00	.040	15 500	24.00	221 000	49 600	232 000	52 200	2 600	3 200
228R	140	5.5118	250	9.8425	42	1.6535	2.50	.100	1.00	.040	17 200	26.60	238 000	53 500	260 000	58 500	2 400	2 900
230R	150	5.9055	270	10.6299	45	1.7717	2.50	.100	1.00	.040	20 700	32.10	270 000	60 700	310 000	69 700	2 200	2 700
232R	160	6.2992	290	11.4173	48	1.8898	2.50	.100	1.00	.040	24 600	38.20	307 000	69 000	365 000	82 100	2 100	2 500
234R	170	6.6929	310	12.2047	52	2.0472	3.00	.120	1.00	.040	27 200	42.20	332 000	74 600	400 000	89 900	1 900	2 300
236R	180	7.0866	320	12.5984	52	2.0472	3.00	.120	1.00	.040	29 000	44.90	345 000	77 600	430 000	96 700	1 800	2 200
238R	190	7.4803	340	13.3858	55	2.1654	3.00	.120	1.00	.040	33 100	51.30	377 000	84 800	500 000	112 000	1 700	2 100
240R	200	7.8740	360	14.1732	58	2.2835	3.00	.120	1.00	.040	35 500	55.10	390 000	87 700	540 000	121 000	1 600	2 000
242R	210	8.2677	380	14.9606	61	2.4016	3.00	.120	1.00	.040	40 800	63.30	436 000	98 000	610 000	137 000	1 600	1 900
244R	220	8.6614	400	15.7480	65	2.5591	3.00	.120	1.00	.040	43 900	68.00	462 000	104 000	655 000	147 000	1 500	1 800
246R	230	9.0551	420	16.5354	68	2.6772	3.00	.120	1.00	.040	49 500	76.80	494 000	111 000	735 000	165 000	1 400	1 700
248R	240	9.4488	440	17.3228	72	2.8346	3.00	.120	1.00	.040	55 500	86.10	540 000	121 000	830 000	187 000	1 300	1 600
250R	250	9.8425	460	18.1102	76	2.9921	4.00	.160	1.50	.060	61 900	95.90	585 000	132 000	915 000	206 000	1 200	1 500
252R	260	10.2362	480	18.8976	80	3.1496	4.00	.160	1.50	.060	68 400	106.00	624 000	140 000	1 020 000	229 000	1 100	1 400
256R	280	11.0236	500	19.6850	80	3.1496	4.00	.160	1.50	.060	72 200	112.00	650 000	146 000	1 100 000	247 000	1 100	1 400
260R	300	11.8110	540	21.2598	85	3.3465	4.00	.160	1.50	.060	80 000	124.00	689 000	155 000	1 220 000	274 000	1 100	1 300
264R	320	12.5984	580	22.8346	92	3.6220	4.00	.160	1.50	.060	87 700	136.00	741 000	167 000	1 340 000	301 000	980	1 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

200RD light series duplex bearings



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex See pages 240 and 241 for suffix description.

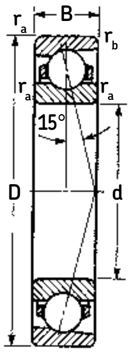
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3] N	Dynamic lbf	Static C_0 N	Static lbf	Speed rating[2] Grease rpm	Oil rpm
200RD	10	**.3937**	30	**1.1811**	18	**.7087**	.64	**.025**	.30	**.012**	284	**.44**	11 900	**2 680**	6 400	**1 440**	19 000	24 000
201RD	12	**.4724**	32	**1.2598**	20	**.7874**	.64	**.025**	.30	**.012**	323	**.50**	13 300	**2 990**	7 800	**1 750**	18 000	22 000
202RD	15	**.5906**	35	**1.3780**	22	**.8661**	.64	**.025**	.30	**.012**	406	**.63**	15 900	**3 570**	10 200	**2 290**	15 000	19 000
203RD	17	**.6693**	40	**1.5748**	24	**.9449**	.64	**.025**	.30	**.012**	510	**.79**	19 900	**4 470**	13 200	**2 970**	14 000	16 000
204RD	20	**.7874**	47	**1.8504**	28	**1.1024**	1.00	**.040**	.60	**.024**	613	**.95**	22 900	**5 140**	17 000	**3 820**	12 000	14 000
205RD	25	**.9843**	52	**2.0472**	30	**1.1811**	1.00	**.040**	.60	**.024**	755	**1.17**	27 600	**6 200**	21 200	**4 770**	9 600	12 000
206RD	30	**1.1811**	62	**2.4409**	32	**1.2598**	1.00	**.040**	.60	**.024**	884	**1.37**	30 700	**6 900**	26 000	**5 850**	8 000	10 000
207RD	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.00	**.040**	.60	**.024**	1 207	**1.97**	42 300	**9 510**	37 500	**8 430**	7 200	8 800
208RD	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.00	**.040**	.60	**.024**	1 730	**2.68**	55 900	**12 600**	50 000	**11 200**	6 800	8 000
209RD	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.00	**.040**	.60	**.024**	1 730	**2.68**	55 900	**12 600**	51 000	**11 500**	6 000	7 200
210RD	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.00	**.040**	.60	**.024**	1 970	**3.06**	60 500	**13 600**	60 000	**13 500**	5 600	6 800
211RD	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.50	**.060**	1.00	**.040**	2 860	**4.43**	87 100	**19 600**	83 000	**18 700**	5 000	6 000
212RD	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.50	**.060**	1.00	**.040**	3 260	**5.06**	95 600	**21 500**	98 000	**22 000**	4 800	5 600
213RD	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.50	**.060**	1.00	**.040**	4 030	**6.25**	97 500	**21 900**	118 000	**26 500**	4 200	5 000
214RD	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.50	**.060**	1.00	**.040**	4 530	**7.03**	125 000	**28 200**	137 000	**30 800**	4 000	4 800
215RD	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.50	**.060**	1.00	**.040**	5 190	**8.04**	143 000	**32 100**	153 000	**34 400**	3 800	4 500
216RD	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.00	**.080**	1.00	**.040**	4 880	**7.56**	138 000	**31 000**	140 000	**31 500**	3 600	4 200
217RD	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.00	**.080**	1.00	**.040**	6 170	**9.56**	168 000	**37 800**	186 000	**41 800**	3 400	4 000
218RD	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.00	**.080**	1.00	**.040**	7 870	**12.20**	212 000	**47 700**	232 000	**52 200**	3 000	3 600
219RD	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.00	**.080**	1.00	**.040**	8 390	**13.00**	221 000	**49 700**	250 000	**56 200**	2 900	3 400
220RD	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.00	**.080**	1.00	**.040**	9610	**14.90**	251 000	**56 400**	285 000	**64 100**	2 700	3 200
221RD	105	**4.1339**	190	**7.4803**	72	**2.8346**	2.00	**.080**	1.00	**.040**	10 300	**16.00**	270 000	**60 700**	305 000	**68 600**	2 600	3 000
222RD	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.00	**.080**	1.00	**.040**	11 700	**18.10**	296 000	**66 500**	340 000	**76 400**	2 400	2 900
224RD	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.00	**.080**	1.00	**.040**	13 000	**20.20**	325 000	**73 100**	390 000	**87 700**	2 200	2 700
226RD	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.50	**.100**	1.00	**.040**	15 500	**24.00**	358 000	**80 500**	465 000	**105 000**	2 100	2 600
228RD	140	**5.5118**	250	**9.8425**	84	**3.3071**	2.50	**.100**	1.00	**.040**	17 200	**26.60**	390 000	**87 700**	510 000	**115 000**	1 900	2 300
230RD	150	**5.9055**	270	**10.6299**	90	**3.5433**	2.50	**.100**	1.00	**.040**	20 700	**32.10**	442 000	**99 400**	620 000	**139 000**	1 800	2 200
232RD	160	**6.2992**	290	**11.4173**	96	**3.7795**	2.50	**.100**	1.00	**.040**	24 600	**38.20**	494 000	**111 000**	735 000	**165 000**	1 700	2 000
234RD	170	**6.6929**	310	**12.2047**	104	**4.0945**	3.00	**.120**	1.00	**.040**	27 200	**42.20**	527 000	**118 000**	800 000	**180 000**	1 500	1 800
236RD	180	**7.0866**	320	**12.5984**	104	**4.0945**	3.00	**.120**	1.00	**.040**	29 000	**44.90**	559 000	**126 000**	865 000	**194 000**	1 400	1 800
238RD	190	**7.4803**	340	**13.3858**	110	**4.3307**	3.00	**.120**	1.00	**.040**	33 100	**51.30**	605 000	**136 000**	1 000 000	**225 000**	1 400	1 700
240RD	200	**7.8740**	360	**14.1732**	116	**4.5669**	3.00	**.120**	1.00	**.040**	35 500	**55.10**	637 000	**143 000**	1 080 000	**243 000**	1 300	1 600
242RD	210	**8.2677**	380	**14.9606**	122	**4.8031**	3.00	**.120**	1.00	**.040**	40 800	**63.30**	702 000	**158 000**	1 220 000	**274 000**	1 300	1 500
244RD	220	**8.6614**	400	**15.7480**	130	**5.1181**	3.00	**.120**	1.00	**.040**	43 900	**68.00**	741 000	**167 000**	1 320 000	**297 000**	1 200	1 400
246RD	230	**9.0551**	420	**16.5354**	136	**5.3543**	3.00	**.120**	1.00	**.040**	49 500	**76.80**	806 000	**181 000**	1 500 000	**337 000**	1 100	1 400
248RD	240	**9.4488**	440	**17.3228**	144	**5.6693**	3.00	**.120**	1.00	**.040**	55 500	**86.10**	871 000	**196 000**	1 660 000	**373 000**	1 000	1 300
250RD	250	**9.8425**	460	**18.1102**	152	**5.9843**	4.00	**.160**	1.50	**.060**	61 900	**95.90**	956 000	**215 000**	1 830 000	**411 000**	960	1 200
252RD	260	**10.2362**	480	**18.8976**	160	**6.2992**	4.00	**.160**	1.50	**.060**	68 400	**106.00**	1 010 000	**227 000**	2 040 000	**459 000**	880	1 100
256RD	280	**11.0236**	500	**19.6850**	160	**6.2992**	4.00	**.160**	1.50	**.060**	72 200	**112.00**	1 060 000	**238 000**	2 200 000	**495 000**	880	1 100
260RD	300	**11.8110**	540	**21.2598**	170	**6.6929**	4.00	**.160**	1.50	**.060**	80 000	**124.00**	1 140 000	**256 000**	2 400 000	**540 000**	880	1 000
264RD	320	**12.5984**	580	**22.8346**	184	**7.2441**	4.00	**.160**	1.50	**.060**	87 700	**136.00**	1 210 000	**272 000**	2 700 000	**607 000**	780	960

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

300R medium series single ball bearings

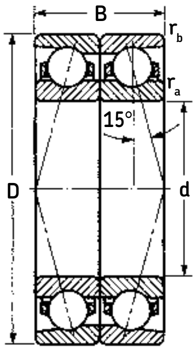


300R medium series bearing bores range in diameter from 12 mm to 280 mm. They are used with heavy radial loads, one-directional thrust loads, or a combination of both. They can be furnished duplex ground for mounting in pairs with two-directional thrust loads.

MRC bearing number	Bore d		Outside diameter D		Width B		Fillet radius[1] r_a		r_b		ZD^2		Basic radial load rating Dynamic C[3]		Static C_0		Speed rating[2] Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
301R	12	**.4724**	37	**1.4567**	12	**.4724**	1.0	**.04**	.60	**.024**	439	**.68**	10 600	**2 380**	4 900	**1 100**	19 000	24 000
302R	15	**.5906**	42	**1.6535**	13	**.5118**	1.0	**.04**	.60	**.024**	510	**.79**	12 100	**2 720**	6 550	**1 470**	17 000	20 000
303R	17	**.6693**	47	**1.8504**	14	**.5512**	1.0	**.04**	.60	**.024**	632	**.98**	14 800	**3 330**	8 150	**1 830**	16 000	19 000
304R	20	**.7874**	52	**2.0472**	15	**.5906**	1.0	**.04**	.60	**.024**	909	**1.41**	20 300	**4 560**	11 400	**2 560**	13 000	16 000
305R	25	**.9843**	62	**2.4409**	17	**.6693**	1.0	**.04**	.60	**.024**	1 090	**1.69**	23 400	**5 260**	15 300	**3 440**	11 000	14 000
306R	30	**1.1811**	72	**2.8346**	19	**.7480**	1.0	**.04**	.60	**.024**	1 480	**2.30**	31 200	**7 010**	20 000	**4 500**	9 000	11 000
307R	35	**1.3780**	80	**3.1496**	21	**.8268**	1.5	**.06**	1.00	**.040**	1 940	**3.00**	39 700	**8 920**	26 000	**5 850**	8 500	10 000
308R	40	**1.5748**	90	**3.5433**	23	**.9055**	1.5	**.06**	1.00	**.040**	2 450	**3.80**	48 800	**11 000**	33 500	**7 530**	7 500	9 000
309R	45	**1.7717**	100	**3.9370**	25	**.9843**	1.5	**.06**	1.00	**.040**	3 030	**4.69**	58 500	**13 200**	40 500	**9 100**	6 700	8 000
310R	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.0	**.08**	1.00	**.040**	4 350	**6.75**	80 600	**18 100**	57 000	**12 800**	6 300	7 500
311R	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.0	**.08**	1.00	**.040**	5 110	**7.92**	93 600	**21 000**	67 000	**15 100**	5 600	6 700
312R	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.0	**.08**	1.00	**.040**	5 930	**9.19**	108 000	**24 300**	78 000	**17 500**	5 000	6 000
313R	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.08**	1.00	**.040**	6 900	**10.70**	121 000	**27 200**	93 000	**20 900**	4 800	5 600
314R	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.0	**.08**	1.00	**.040**	6 770	**10.50**	121 000	**27 200**	93 000	**20 900**	4 500	5 300
315R	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.0	**.08**	1.00	**.040**	9 030	**14.00**	153 000	**34 400**	122 000	**27 400**	4 300	5 000
316R	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.0	**.08**	1.00	**.040**	9 480	**14.70**	159 000	**35 700**	129 000	**29 000**	3 800	4 500
317R	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**.10**	1.00	**.040**	11 400	**17.70**	182 000	**40 900**	156 000	**35 100**	3 600	4 300
318R	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.5	**.10**	1.00	**.040**	11 800	**18.30**	186 000	**41 800**	160 000	**36 000**	3 400	4 000
319R	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.5	**.10**	1.00	**.040**	13 100	**20.30**	199 000	**44 700**	180 000	**40 500**	3 200	3 800
320R	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**.10**	1.00	**.040**	14 400	**22.40**	212 000	**47 700**	200 000	**45 000**	3 000	3 600
321R	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.5	**.10**	1.00	**.040**	15 900	**24.60**	229 000	**51 500**	204 000	**45 900**	2 800	3 400
322R	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**.10**	1.00	**.040**	18 800	**29.20**	255 000	**57 300**	255 000	**57 300**	2 600	3 200
324R	120	**4.7244**	260	**10.2362**	55	**2.1654**	2.5	**.10**	1.00	**.040**	22 100	**34.30**	265 000	**59 600**	300 000	**67 400**	2 500	3 000
326R	130	**5.1181**	280	**11.0236**	58	**2.2835**	3.0	**.12**	1.00	**.040**	25 700	**39.80**	296 000	**66 500**	345 000	**77 600**	2 300	2 800
328R	140	**5.5118**	300	**11.8110**	62	**2.4409**	3.0	**.12**	1.00	**.040**	29 500	**45.70**	351 000	**78 900**	400 000	**89 900**	2 100	2 600
330R	150	**5.9055**	320	**12.5984**	65	**2.5591**	3.0	**.12**	1.00	**.040**	33 900	**52.60**	390 000	**87 700**	475 000	**107 000**	2 000	2 400
332R	160	**6.2992**	340	**13.3858**	68	**2.6772**	3.0	**.12**	1.00	**.040**	38 400	**59.60**	423 000	**95 100**	530 000	**119 000**	1 800	2 200
334R	170	**6.6929**	360	**14.1732**	72	**2.8346**	3.0	**.12**	1.00	**.040**	40 800	**63.20**	436 000	**98 000**	570 000	**128 000**	1 700	2 100
336R	180	**7.0866**	380	**14.9606**	75	**2.9528**	3.0	**.12**	1.00	**.040**	45 700	**70.90**	475 000	**107 000**	640 000	**144 000**	1 600	2 000
338R	190	**7.4803**	400	**15.7480**	78	**3.0709**	4.0	**.16**	1.50	**.060**	51 000	**79.00**	507 000	**114 000**	710 000	**160 000**	1 600	1 900
340R	200	**7.8740**	420	**16.5354**	80	**3.1496**	4.0	**.16**	1.50	**.060**	56 400	**87.50**	553 000	**124 000**	780 000	**175 000**	1 500	1 800
342R	210	**8.2677**	440	**17.3228**	84	**3.3071**	4.0	**.16**	1.50	**.060**	62 200	**96.50**	592 000	**133 000**	865 000	**194 000**	1 400	1 700
344R	220	**8.6614**	460	**18.1102**	88	**3.4646**	4.0	**.16**	1.50	**.060**	68 400	**106.00**	637 000	**143 000**	950 000	**214 000**	1 300	1 600
348R	240	**9.4488**	500	**19.6850**	95	**3.7402**	4.0	**.16**	1.50	**.060**	74 800	**116.00**	676 000	**152 000**	1 060 000	**238 000**	1 100	1 400
352R	260	**10.2362**	540	**21.2598**	102	**4.0157**	5.0	**.20**	2.00	**.080**	87 100	**135.00**	741 000	**167 000**	1 250 000	**281 000**	1 100	1 300
356R	280	**11.0236**	580	**22.8346**	108	**4.2520**	5.0	**.20**	2.00	**.080**	102 000	**158.00**	832 000	**187 000**	1 460 000	**328 000**	980	1 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

300RD medium series duplex



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

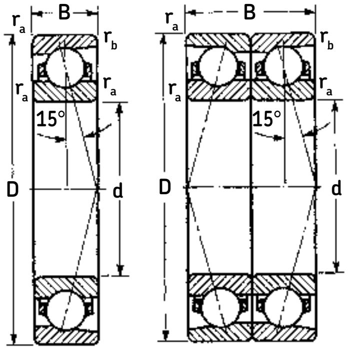
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

	Bore		Outside diameter		Width		Fillet radius[1]						Basic radial load rating				Speed rating[2]	
													Dynamic		Static			
MRC bearing number	d mm	in.	D mm	in.	B mm	in.	r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	$C^{3)}$ N	lbf	C_0 N	lbf	Grease rpm	Oil rpm
301RD	12	**.4724**	37	**1.4567**	24	**.9449**	1.0	**.04**	.60	**.024**	439	**.68**	17 200	**3 870**	9 800	**2 200**	15 000	19 000
302RD	15	**.5906**	42	**1.6535**	26	**1.0236**	1.0	**.04**	.60	**.024**	510	**.79**	19 900	**4 470**	13 200	**2 970**	14 000	16 000
303RD	17	**.6693**	47	**1.8504**	28	**1.1024**	1.0	**.04**	.60	**.024**	632	**.98**	24 200	**5 440**	16 300	**3 660**	13 000	15 000
304RD	20	**.7874**	52	**2.0472**	30	**1.1811**	1.0	**.04**	.60	**.024**	909	**1.41**	33 200	**7 460**	22 800	**5 130**	10 000	13 000
305RD	25	**.9843**	62	**2.4409**	34	**1.3386**	1.0	**.04**	.60	**.024**	1 090	**1.69**	37 700	**8 480**	30 500	**6 860**	8 800	11 000
306RD	30	**1.1811**	72	**2.8346**	38	**1.4961**	1.0	**.04**	.60	**.024**	1 480	**2.30**	50 700	**11 400**	40 000	**8 990**	7 200	8 800
307RD	35	**1.3780**	80	**3.1496**	42	**1.6535**	1.5	**.06**	1.00	**.040**	1 940	**3.00**	65 000	**14 600**	52 000	**11 700**	6 800	8 000
308RD	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.00	**.040**	2 450	**3.80**	79 300	**17 800**	67 000	**15 100**	6 000	7 200
309RD	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.00	**.040**	3 030	**4.69**	95 600	**21 500**	81 500	**18 300**	5 400	6 400
310RD	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.00	**.040**	4 350	**6.75**	133 000	**29 900**	114 000	**25 600**	5 000	6 000
311RD	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.00	**.040**	5 110	**7.92**	153 000	**34 400**	134 000	**30 100**	4 500	5 400
312RD	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.00	**.040**	5 930	**9.19**	174 000	**39 100**	156 000	**35 100**	4 000	4 800
313RD	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.00	**.040**	6 900	**10.70**	195 000	**43 800**	190 000	**42 700**	3 800	4 500
314RD	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.00	**.040**	6 770	**10.50**	195 000	**43 800**	186 000	**41 800**	3 600	4 200
315RD	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.00	**.040**	9 030	**14.00**	247 000	**55 500**	245 000	**55 100**	3 400	4 000
316RD	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.0	**.08**	1.00	**.040**	9 480	**14.70**	260 000	**58 500**	260 000	**58 500**	3 000	3 600
317RD	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.5	**.10**	1.00	**.040**	11 400	**17.70**	291 000	**65 400**	310 000	**67 400**	2 900	3 400
318RD	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.5	**.10**	1.00	**.040**	11 800	**18.30**	302 000	**67 900**	320 000	**71 900**	2 700	3 200
319RD	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.5	**.10**	1.00	**.040**	13 100	**20.30**	325 000	**73 100**	360 000	**80 900**	2 600	3 000
320RD	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.5	**.10**	1.00	**.040**	14 400	**22.40**	345 000	**77 600**	400 000	**89 900**	2 400	2 900
321RD	105	**4.1339**	225	**8.8583**	98	**3.8583**	2.5	**.10**	1.00	**.040**	15 900	**24.60**	371 000	**83 400**	405 000	**91 000**	2 200	2 700
322RD	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.5	**.10**	1.00	**.040**	18 800	**29.20**	416 000	**93 500**	510 000	**115 000**	2 100	2 600
324RD	120	**4.7244**	260	**10.2362**	110	**4.3307**	2.5	**.10**	1.00	**.040**	22 100	**34.30**	436 000	**98 000**	600 000	**135 000**	2 000	2 400
326RD	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.0	**.12**	1.00	**.040**	25 700	**39.80**	475 000	**107 000**	695 000	**156 000**	1 800	2 200
328RD	140	**5.5118**	300	**11.8110**	124	**4.8819**	3.0	**.12**	1.00	**.040**	29 500	**45.70**	572 000	**129 000**	800 000	**180 000**	1 700	2 100
330RD	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.0	**.12**	1.00	**.040**	33 900	**52.60**	624 000	**140 000**	950 000	**214 000**	1 600	1 900
332RD	160	**6.2992**	340	**13.3858**	136	**5.3543**	3.0	**.12**	1.00	**.040**	38 400	**59.60**	689 000	**155 000**	1 080 000	**243 000**	1 400	1 800
334RD	170	**6.6929**	360	**14.1732**	144	**5.6693**	3.0	**.12**	1.00	**.040**	40 800	**63.20**	715 000	**161 000**	1 140 000	**256 000**	1 400	1 700
336RD	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.0	**.12**	1.00	**.040**	45 700	**70.90**	780 000	**175 000**	1 270 000	**286 000**	1 300	1 600
338RD	190	**7.4803**	400	**15.7480**	156	**6.1417**	4.0	**.16**	1.50	**.060**	51 000	**79.00**	832 000	**187 000**	1 430 000	**321 000**	1 300	1 500
340RD	200	**7.8740**	420	**16.5354**	160	**6.2992**	4.0	**.16**	1.50	**.060**	56 400	**87.50**	904 000	**203 000**	1 560 000	**351 000**	1 200	1 400
342RD	210	**8.2677**	440	**17.3228**	168	**6.6142**	4.0	**.16**	1.50	**.060**	62 200	**96.50**	956 000	**215 000**	1 730 000	**389 000**	1 100	1 400
344RD	220	**8.6614**	460	**18.1102**	176	**6.9291**	4.0	**.16**	1.50	**.060**	68 400	**106.00**	1 040 000	**234 000**	1 900 000	**427 000**	1 000	1 300
348RD	240	**9.4488**	500	**19.6850**	190	**7.4803**	4.0	**.16**	1.50	**.060**	74 800	**116.00**	1 080 000	**243 000**	2 120 000	**477 000**	880	1 100
352RD	260	**10.2362**	540	**21.2598**	204	**8.0315**	5.0	**.20**	2.00	**.080**	87 100	**135.00**	1 210 000	**272 000**	2 500 000	**562 000**	880	1 000
356RD	280	**11.0236**	580	**22.8346**	216	**8.5039**	5.0	**.20**	2.00	**.080**	102 000	**158.00**	1 350 000	**303 000**	2 900 000	**652 000**	780	960

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

400R and 400RD heavy series



400R and RD heavy series bearings are available in bores from 17 mm to 110 mm. They can handle very heavy radial loads, one-directional thrust loads, or a combination of both. Use duplex bearings for two-directional thrust loads.

Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

Values for RD bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

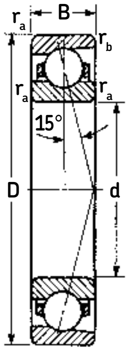
ABEC-1 and -3 are stocked as half-pairs where available.

This series is obsoleted and is for reference only. Minimum quantities required for future manufacturing.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[3] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[2] Grease rpm	Oil rpm
403R	17	.6693	62	2.4409	17	.6693	1.0	.04	.60	.024	1 290	2.00	23 400	5 260	14 600	3 280	12 000	15 000
404R	20	.7874	72	2.8346	19	.7480	1.0	.04	.60	.024	1 840	2.85	37 100	8 340	21 200	4 770	10 000	13 000
405R	25	.9843	80	3.1496	21	.8268	1.5	.06	1.00	.040	2 270	3.52	44 900	10 100	26 500	5 960	9 000	11 000
406R	30	1.1811	90	3.5433	23	.9055	1.5	.06	1.00	.040	3 050	4.73	49 400	11 100	36 000	8 090	8 500	10 000
407R	35	1.3780	100	3.9370	25	.9843	1.5	.06	1.00	.040	3 620	5.62	58 500	13 200	44 000	9 890	7 000	8 500
408R	40	1.5748	110	4.3307	27	1.0630	2.0	.08	1.00	.040	4 260	6.60	67 600	15 200	52 000	11 700	6 700	8 000
409R	45	1.7717	120	4.7244	29	1.1417	2.0	.08	1.00	.040	4 940	7.66	78 000	17 500	61 000	13 700	6 000	7 000
410R	50	1.9685	130	5.1181	31	1.2205	2.0	.08	1.00	.040	6 240	9.67	95 600	21 500	78 000	17 500	5 300	6 300
411R	55	2.1654	140	5.5118	33	1.2992	2.0	.08	1.00	.040	7 100	11.0	108 000	24 300	90 000	20 200	5 000	6 000
412R	60	2.3622	150	5.9055	35	1.3780	2.0	.08	1.00	.040	8 000	12.4	117 000	26 300	102 000	22 900	4 800	5 600
413R	65	2.5591	160	6.2992	37	1.4567	2.0	.08	1.00	.040	8 970	13.9	127 000	28 600	112 000	25 200	4 500	5 300
414R	70	2.7559	180	7.0866	42	1.6535	2.5	.10	1.00	.040	12 200	18.9	156 000	35 100	150 000	33 700	3 800	4 500
415R	75	2.9528	190	7.4803	45	1.7717	2.5	.10	1.00	.040	13 400	20.8	168 000	37 800	166 000	37 300	3 600	4 300
416R	80	3.1496	200	7.8740	48	1.8898	2.5	.10	1.00	.040	14 600	22.7	178 000	40 000	183 000	41 100	3 400	4 000
417R	85	3.3465	210	8.2677	52	2.0472	3.0	.12	1.00	.040	16 000	24.8	190 000	42 700	200 000	45 000	3 200	3 800
418R	90	3.5433	225	8.8583	54	2.1260	3.0	.12	1.00	.040	18 700	29.0	212 000	47 700	236 000	53 100	3 000	3 600
419R	95	3.7402	250	9.8425	55	2.1654	3.0	.12	1.00	.040	21 700	33.7	234 000	52 600	275 000	60 700	2 700	3 300
420R	100	3.9370	265	10.4331	60	2.3622	3.0	.12	1.00	.040	25 000	38.7	260 000	58 500	305 000	68 600	2 500	3 100
421R	105	4.1339	290	11.4173	65	2.5591	3.0	.12	1.00	.040	29 200	45.2	286 000	64 300	355 000	79 800	2 400	2 900
422R	110	4.3307	320	12.5984	70	2.7559	3.0	.12	1.00	.040	34 500	53.5	319 000	71 700	425 000	95 500	2 100	2 600
400RD																		
403RD	17	.6693	62	2.4409	34	1.3386	1.0	.04	.60	.024	1 290	2.00	37 700	8 480	29 000	6 520	9 600	12 000
404RD	20	.7874	72	2.8346	38	1.4961	1.0	.04	.60	.024	1 840	2.85	60 500	13 600	42 500	9 550	8 000	10 000
405RD	25	.9843	80	3.1496	42	1.6535	1.5	.06	1.00	.040	2 270	3.52	74 100	16 700	53 000	11 900	7 200	8 800
406RD	30	1.1811	90	3.5433	46	1.8110	1.5	.06	1.00	.040	3 050	4.73	80 600	18 100	72 000	16 200	6 800	8 000
407RD	35	1.3780	100	3.9370	50	1.9685	1.5	.06	1.00	.040	3 620	5.62	95 600	21 500	86 500	19 400	5 600	6 800
408RD	40	1.5748	110	4.3307	54	2.1260	2.0	.08	1.00	.040	4 260	6.60	111 000	25 000	104 000	23 400	5 400	6 400
409RD	45	1.7717	120	4.7244	58	2.2835	2.0	.08	1.00	.040	4 940	7.66	127 000	28 600	122 000	27 400	4 800	5 600
410RD	50	1.9685	130	5.1181	62	2.4409	2.0	.08	1.00	.040	6 240	9.67	153 000	34 400	156 000	35 100	4 200	5 000
411RD	55	2.1654	140	5.5118	66	2.5984	2.0	.08	1.00	.040	7 100	11.0	174 000	39 100	180 000	40 500	4 000	4 800
412RD	60	2.3622	150	5.9055	70	2.7559	2.0	.08	1.00	.040	8 000	12.4	190 000	42 700	204 000	45 900	3 800	4 500
413RD	65	2.5591	160	6.2992	74	2.9134	2.0	.08	1.00	.040	8 970	13.9	208 000	46 800	224 000	50 400	3 600	4 200
414RD	70	2.7559	180	7.0866	84	3.3071	2.5	.10	1.00	.040	12 200	18.9	255 000	57 300	300 000	67 400	3 000	3 600
415RD	75	2.9528	190	7.4803	90	3.5433	2.5	.10	1.00	.040	13 400	20.8	270 000	60 700	335 000	75 300	2 900	3 400
416RD	80	3.1496	200	7.8740	96	3.7795	2.5	.10	1.00	.040	14 600	22.7	286 000	64 300	365 000	82 100	2 700	3 200
417RD	85	3.3465	210	8.2677	104	4.0945	3.0	.12	1.00	.040	16 000	24.8	307 000	69 000	400 000	89 900	2 600	3 000
418RD	90	3.5433	225	8.8583	108	4.2520	3.0	.12	1.00	.040	18 700	29.0	345 000	77 600	465 000	105 000	2 400	2 900
419RD	95	3.7402	250	9.8425	110	4.3307	3.0	.12	1.00	.040	21 700	33.7	377 000	84 800	550 000	124 000	2 200	2 600
420RD	100	3.9370	265	10.4331	120	4.7244	3.0	.12	1.00	.040	25 000	38.7	416 000	93 500	610 000	137 000	2 000	2 500
421RD	105	4.1339	290	11.4173	130	5.1181	3.0	.12	1.00	.040	29 200	45.2	462 000	104 000	710 000	160 000	1 900	2 300
422RD	110	4.3307	320	12.5984	140	5.5118	3.0	.12	1.00	.040	34 500	53.5	520 000	117 000	850 000	191 000	1 700	2 100

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

XLS type single-row inch size 15° angular contact ball bearings



XLS series bearings are single-row 15° angular contact ball bearings made to inch dimensions. They are similar to R-type bearings. The XLS series bearing is made with one heavy race shoulder and one counter-bored race shoulder on the outer ring.

XLS series bearings have ample radial and thrust capacity for the majority of applications involving light radial loads, light thrust loads in one direction, or combinations of both. They are used in such applications where space limitations exist.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Grease rpm	Oil rpm
XLS-1 3/8	34.9	1.3750	65.1	2.5625	14.3	.5625	1.0	.04	.60	.024	1 060	1.65	22 500	5 060	15 600	3 510	11 000	13 000
XLS-1 1/2	38.1	1.5000	68.3	2.6875	14.3	.5625	1.0	.04	.60	.024	1 140	1.77	23 800	5 350	17 000	3 820	9 800	12 000
XLS-1 5/8	41.3	1.6250	73.0	2.8750	14.3	.5625	1.0	.04	.60	.024	1 220	1.89	24 200	5 400	18 600	4 180	9 000	11 000
XLS-1 5/8	44.5	1.7500	76.2	3.0000	14.3	.5625	1.0	.04	.60	.024	1 300	2.01	25 100	5 640	20 000	4 500	8 200	10 000
XLS-1 7/8	47.6	1.8750	81.0	3.1875	15.9	.6250	1.0	.04	.60	.024	1 540	2.39	29 600	6 650	23 600	5 310	8 200	10 000
XLS-2	50.8	2.0000	84.1	3.3125	15.9	.6250	1.0	.04	.60	.024	1 630	2.53	30 200	6 790	25 500	5 730	7 800	9 500
XLS-2 1/8	54.0	2.1250	87.3	3.4375	15.9	.6250	1.5	.06	.60	.024	1 630	2.53	30 200	6 790	25 500	5 730	7 400	9 000
XLS-2 1/4	57.2	2.2500	90.5	3.5625	15.9	.6250	1.5	.06	.60	.024	1 720	2.67	31 200	7 010	27 000	6 070	7 100	8 700
XLS-2 1/2-S	63.5	2.5000	98.4	3.8750	17.5	.6875	1.5	.06	.60	.024	1 360	2.11	26 000	5 850	22 000	4 950	6 500	7 900
XLS-2 1/2	63.5	2.5000	98.4	3.8750	17.5	.6875	1.5	.06	.60	.024	1 900	2.95	32 500	7 310	31 000	6 740	6 400	7 800
XLS-2 5/8	66.7	2.6250	105.0	4.1250	17.5	.6875	1.5	.06	.60	.024	2 470	3.83	42 300	9 510	39 000	8 770	6 100	7 400
XLS-2 3/4	69.9	2.7500	105.0	4.1250	17.5	.6875	1.5	.06	.60	.024	2 470	3.83	42 300	9 510	39 000	8 770	6 000	7 300
XLS-3	76.2	3.0000	114.0	4.5000	19.1	.7500	2.0	.08	1.00	.040	2 720	4.21	44 200	9 940	44 000	9 890	5 500	6 700
XLS-3 1/4	82.6	3.2500	121.0	4.7500	19.1	.7500	2.0	.08	1.00	.040	2 840	4.40	44 900	10 100	46 500	10 500	5 100	6 200
XLS-3 1/2	88.9	3.5000	127.0	5.0000	19.1	.7500	2.0	.08	1.00	.040	3 090	4.79	47 500	10 700	51 000	11 500	4 800	5 900
XLS-3 3/4	95.3	3.7500	133.0	5.2500	19.1	.7500	2.0	.08	1.00	.040	3 210	4.98	47 500	10 700	53 000	11 900	4 500	5 500
XLS-4 1/4	108.0	4.2500	152.0	6.0000	22.2	.8750	2.0	.08	1.00	.040	4 190	6.50	61 800	13 900	69 500	15 600	3 900	4 800
XLS-4 1/2	114.0	4.5000	159.0	6.2500	22.2	.8750	2.0	.08	1.00	.040	4 350	6.75	61 800	13 900	73 500	16 500	3 800	4 600
XLS-4 3/4	121.0	4.7500	165.0	6.5000	22.2	.8750	2.0	.08	1.00	.040	4 520	7.00	63 700	14 300	76 500	17 200	3 600	4 400
XLS-5	127.0	5.0000	178.0	7.0000	25.4	1.0000	2.0	.08	1.00	.040	5 510	8.54	78 000	17 500	91 500	20 600	3 400	4 100
XLS-5 1/2	140.0	5.5000	191.0	7.5000	25.4	1.0000	2.5	.10	1.00	.040	5 920	9.18	79 300	17 800	100 000	22 500	3 100	3 800
XLS-6	152.0	6.0000	203.0	8.0000	25.4	1.0000	2.5	.10	1.00	.040	6 330	9.81	81 900	18 400	108 000	24 300	2 900	3 500
XLS-6 1/4	159.0	6.2500	216.0	8.5000	28.6	1.1250	2.5	.10	1.00	.040	7 550	11.70	97 500	21 900	129 000	29 000	2 700	3 300
XLS-6 1/2	165.0	6.5000	222.0	8.7500	28.6	1.1250	2.5	.10	1.00	.040	7 800	12.00	99 500	22 400	134 000	30 100	2 600	3 200
XLS-7	178.0	7.0000	241.0	9.5000	31.8	1.2500	3.0	.12	1.50	.060	9 480	14.70	119 000	26 800	160 000	36 000	2 400	2 900
XLS-7 1/4	184.0	7.2500	248.0	9.7500	31.8	1.2500	3.0	.12	1.50	.060	9 740	15.10	121 000	27 200	166 000	37 300	2 300	2 800
XLS-7 3/4	197.0	7.7500	267.0	10.5000	34.9	1.3750	3.0	.12	1.50	.060	11 200	17.40	138 000	31 000	193 000	43 400	2 100	2 600
XLS-8	203.0	8.0000	273.0	10.7500	34.9	1.3750	3.0	.12	1.50	.060	11 600	18.00	140 000	31 500	200 000	45 000	2 100	2 500
XLS-8 1/4	210.0	8.2500	279.0	11.0000	34.9	1.3750	3.0	.12	1.50	.060	12 000	18.60	140 000	31 500	204 000	45 900	2 100	2 500
XLS-8 1/2	216.0	8.5000	292.0	11.5000	38.1	1.5000	3.0	.12	1.50	.060	13 600	21.00	163 000	36 600	232 000	52 200	2 000	2 400
XLS-9	229.0	9.0000	305.0	12.0000	38.1	1.5000	3.0	.12	1.50	.060	15 300	23.70	182 000	40 900	260 000	58 500	1 900	2 300
XLS-10	254.0	10.0000	337.0	13.2500	41.3	1.6250	4.0	.16	1.50	.060	17 300	26.80	190 000	42 700	290 000	65 200	1 600	2 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
For phenolic composition cage, multiply by 1.66 for grease and 2.00 for oil. For machined bronze cage, multiply by 1.25 for grease and 1.50 for oil. For phenolic composition cage, ABEC-5 or 7, multiply by 2.30 for grease and 2.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.

MRC

Single-row angular contact ball bearings R-type, single bearing

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = XF_R + YF_A$ where,

P=Dynamic equivalent radial load

F_R=Radial load

F_A=Thrust load

Z=Number of balls

D=Ball diameter

X=Radial load factor

Y=Thrust load factor

e=Limiting factor for F_A/F_R

Contact angle	F_A/ZD^2 Units N, mm	F_A/ZD^2 Units lb, in.	$F_A/F_R > e$ X	$F_A/F_R > e$ Y	e
	0.172	25		1.47	0.38
	0.345	50		1.40	0.40
	0.689	100		1.30	0.43
	1.030	150		1.23	0.46
15°	1.380	200	0.44	1.19	0.47
	2.070	300		1.12	0.50
	3.450	500		1.02	0.55
	5.170	750		1.00	0.56
	6.890	1000		1.00	0.56

When $F_A/F_R \leq e$, use X = 1.0, Y = 0.

Values of Y and e for loads not shown are obtained from chart below.

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic load rating

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

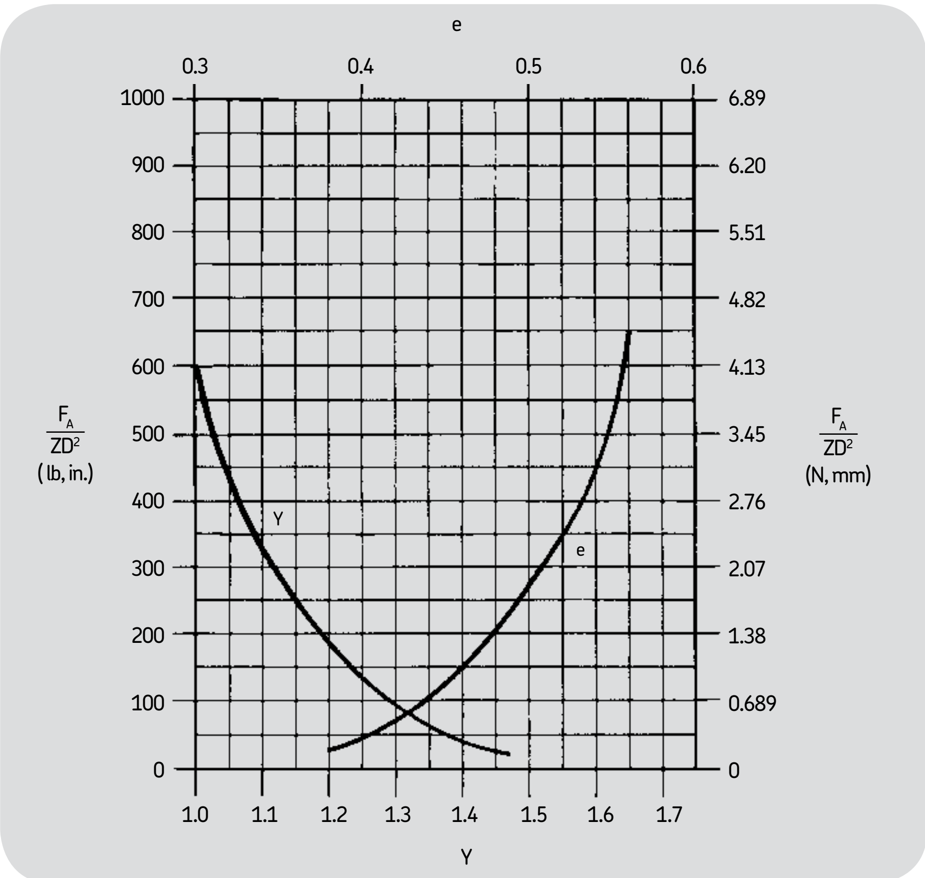
$P_0 = 0.6\,F_R + 0.5\,F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load



MRC

Single-row angular contact ball bearings R-type, single bearing

Dynamic equivalent radial load and life calculation examples

Bearing size: 309R
Speed = 2000 rpm
Basic dynamic load rating (C) = 13200 lbf
$ZD^2 = 4.69$

Case 1

Radial load (F_R) = 1890

Equivalent load (P) = $X F_R + Y F_A$

$P = F_R = 1890$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13200}{1890}\right)^3 = 341 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13200}{1890}\right)^3$$

= 2839 Hrs

Case 2

Radial load (F_R) = 1890

Thrust load (F_A) = 1250

Equivalent load (P) = $X F_R + Y F_A$

$F_A/F_R = 1250/1890 = 0.66$

$X = 0.44$

$Y = 1.15$

$P = 0.44 \times 1890 + 1.15 \times 1250 = 2269$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13200}{2269}\right)^3 = 197 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13200}{2269}\right)^3$$

= 1641 Hrs

Case 3

Thrust load (F_A) = 1250

Equivalent load (P) = $Y F_A$

$F_A/ZD^2 = 1250/4.69 = 267$

$Y = 1.15$

$P = 1.15 \times 1250 = 1438$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13200}{1438}\right)^3 = 773 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L\,10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13200}{1438}\right)^3$$

= 6446 Hrs

Single-row angular contact ball bearings RD-type, duplex

Dynamic equivalent radial load

$P = XF_R + YF_A$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

X = Radial load factor

Y = Thrust load factor

Z = Number of balls

D = Ball diameter

e = Limiting factor for F_A/F_R

Static equivalent radial load

$P_0 = 1.0\ F_R + 0.94\ F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Contact angle	F_A/ZD^2		Tandem DT mounting		DB or DF mounting				e
			$F_A/F_R > e$		$F_A/F_R \leq e$		$F_A/F_R > e$		
	Units N, mm	Units lb, in.	X	Y	X	Y	X	Y	
15°	0.172	25	0.44	1.47	1.00	1.65	0.72	2.39	0.38
	0.345	50		1.40		1.57		2.28	0.40
	0.689	100		1.30		1.46		2.11	0.43
	1.030	150		1.23		1.38		2.00	0.46
	1.380	200		1.19		1.34		1.93	0.47
	2.070	300		1.12		1.26		1.82	0.50
	3.450	500		1.02		1.14		1.66	0.55
	5.170	750		1.00		1.12		1.63	0.56
	6.890	1000		1.00		1.12		1.63	0.56

For tandem DT, when $F_A/F_R < e$, use X = 1.0, Y = 0.
Values of Y for loads not shown are obtained from chart below.

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

P = Dynamic equivalent radial load

n = Speed in rpm

For DB or DF mounting:

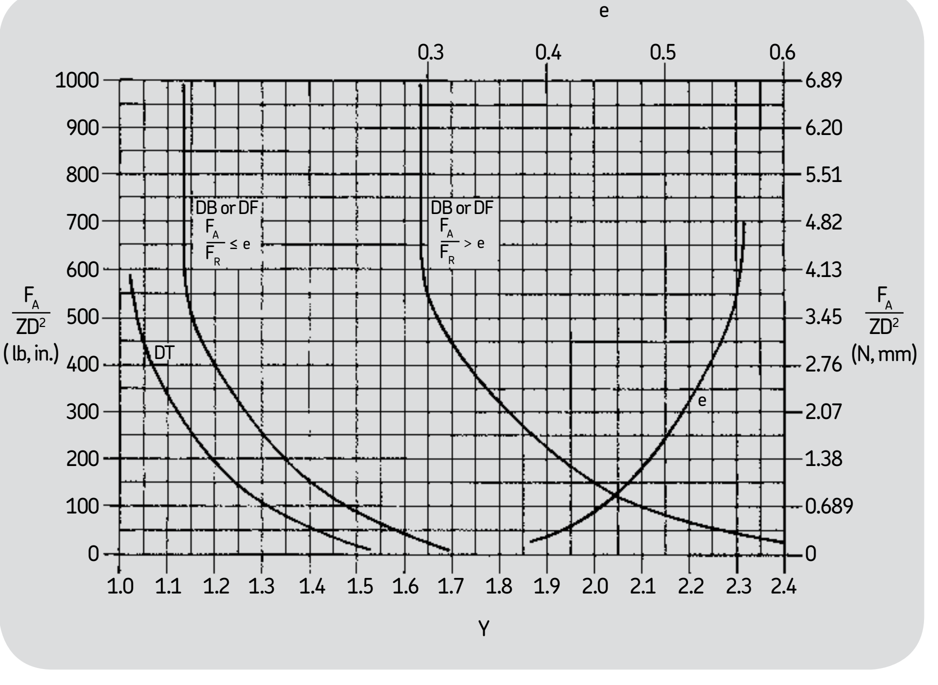
C = Duplex pair dynamic radial load rating (from duplex bearing tables)

or

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where i = 2

For DT tandem mounting:

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where i = number of bearings in set



Single-row angular contact ball bearings RD-type, duplex

Dynamic equivalent radial load and life calculation examples

Bearing size: 309RDU (DB or DF Pair)
Speed: 2000 rpm
Duplex pair basic dynamic radial load
Rating (C) = 21500 lbf
$ZD^2 = 4.69$

Case 1

Radial load (F_R) = 1890
Thrust load (F_A) = 1250
Equivalent load (P) = $X F_R + Y F_A$
$F_A/F_R = 1250/1890 = 0.66$
$F_A/ZD^2 = 1250/4.69 = 267$
Since $F_A/F_R > e$, $X = 0.72$, $Y = 1.86$
$P = 0.72 \times 1890 + 1.86 \times 1250 = 3686$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21500}{3686}\right)^3 = 198 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21500}{3686}\right)^3$$

= 1654 Hrs

Case 2

Radial load (F_R) = 1890
Thrust load (F_A) = 450
Equivalent load (P) = $X F_R + Y F_A$
$F_A/F_R = 450/1890 = 0.24$
$F_A/ZD^2 = 450/4.69 = 96$
Since $F_A/F_R < e$, $X = 1.0$, $Y = 1.46$
$P = 1.0 \times 1890 + 1.46 \times 450 = 2547$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21500}{2547}\right)^3 = 601 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21500}{2547}\right)^3$$

= 5012 Hrs

Case 3

Thrust load (F_A) = 1250
Equivalent load (P) = $X F_R + Y F_A$
$F_A/F_R = 1250/0 = \infty$
$F_A/ZD^2 = 1250/4.69 = 267$
Since $F_A/F_R > e$, $Y = 1.86$
$P = 1.86 \times 1250 = 2325$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21500}{2325}\right)^3 = 791 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L 10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21500}{2325}\right)^3$$

= 6590 Hrs

Bearing size: 309RDT
3 bearings in tandem
Speed: 2000 rpm
Single-row basic dynamic radial
Load rating (C) = 13200 lbf
$ZD^2 = 4.69$

Case 1

Thrust load (F_A) = 2500
Equivalent load (P = $X F_R + Y F_A$
$F_A/F_R = 2500/0 = \infty$
$F_A/ZD^2 = 2500/4.69 = 533$
Since $F_A/F_R > e$, $X = 0.44$, $Y = 1.02$
$P = 1.02 \times 2500 + = 2550$
Load rating = $(i)^{0.7}$ x 13200
= $(3)^{0.7}$ x 13200 = 28481

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{28481}{2550}\right)^3 = 1393 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{28481}{2550}\right)^3$$

= 11611 Hrs

Case 2

Radial load (F_R) = 1890
Thrust load (F_A) = 2500
Equivalent load (P) = $X F_R + Y F_A$
$F_A/F_R = 2500/1890 = 1.32$
$F_A/ZD^2 = 2500/4.69 = 533$
Since $F_A/F_R > e$, $X = 0.44$, $Y = 1.02$
$P = 0.44 \times 1890 + 1.02 \times 2500 = 3382$
Load rating = $(i)^{0.7}$ x 13200
= $(3)^{0.7}$ x 13200 = 28481

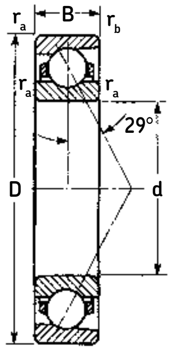
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{28481}{3382}\right)^3 = 597 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{28481}{3382}\right)^3$$

= 4977 Hrs

7000 series single-row 29° angular contact ball bearings



7000 series bearings are single-row 29° angular contact ball bearings having one heavy race shoulder and one counterbored race shoulder on the outer ring. Because of this construction, it is possible to incorporate a greater number of balls than in the deep groove nonfilling notch bearing. The combination of maximum ball complement and the angular contact feature reduces the specific ball loading under thrust load, resulting in moderate to high thrust load carrying capacity.

7000 series angular contact ball bearings should be used in applications in which the thrust load is heavy and beyond the capacity of single-row types; for example, for a heavy thrust load in one direction, or a heavy thrust load in one direction combined with a radial load.

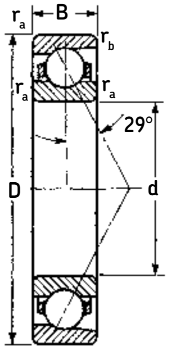
Cage types and materials

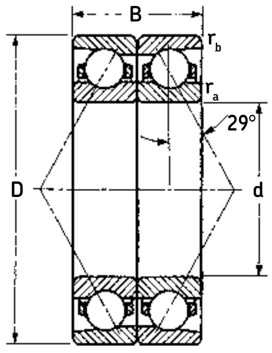
For normal usage: heavy stock, two-piece steel formed pockets, with turned-over fingers or riveted together.

For severe vibration, very high speeds, or high operating temperatures: one-piece, inner ring land-guided, machined construction of suitable material (phenolic/Bakelite composition, machined brass, or special material).

Series		Page
7100D	Extra large - single bearing and duplex set	**128**
7100KR	Extra light - single bearing	**129**
7100KRD	Extra light - duplex set	**130**
7200	Light - single bearing	**131**
7200D	Light - duplex set	**132**
7300	Medium - single bearing	**133**
7300D	Medium - duplex set	**134**
7400D	Heavy - single bearing and duplex set	**135**
7000	Equivalent load and life	**136**
7000	Minimum load calculation	**136**
7000	Life calculation examples	**137**
7000D	Equivalent load and life	**138**
7000D	Life calculation examples	**139**

7100 and 7100D extra large series





7100 series bearings are similar to the 7100KR series but have a larger O.D. and narrower width; and are used for one-directional thrust loads or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

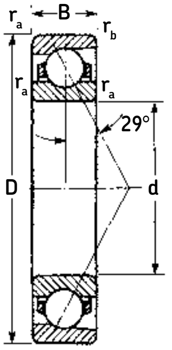
Values for D bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
7120[5]	100	**3.9370**	160	**6.2992**	28	**1.1024**	2.0	**.08**	1.0	**.040**	85 200	**19 200**	86 500	**19 400**	2 600	4 300
7122	110	**4.3307**	175	**6.8898**	30	**1.1811**	2.0	**.08**	1.0	**.040**	104 000	**23 400**	108 000	**24 300**	2 400	4 000
7124[5]	120	**4.7244**	190	**7.4803**	32	**1.2598**	2.0	**.08**	1.0	**.040**	108 000	**24 300**	127 000	**28 600**	2 200	3 700
7126[5]	130	**5.1181**	205	**8.0709**	34	**1.3386**	2.0	**.08**	1.0	**.040**	121 000	**27 200**	134 000	**30 100**	2 100	3 500
7128[5]	140	**5.5118**	220	**8.6614**	36	**1.4173**	2.0	**.08**	1.0	**.040**	138 000	**31 000**	156 000	**35 100**	1 900	3 200
7130	150	**5.9055**	235	**9.2520**	38	**1.4961**	2.0	**.08**	1.0	**.040**	159 000	**35 700**	180 000	**40 500**	1 700	2 800
7132[5]	160	**6.2992**	250	**9.8425**	40	**1.5748**	2.0	**.08**	1.0	**.040**	174 000	**39 100**	204 000	**45 900**	1 600	2 700
7134[5]	170	**6.6929**	265	**10.4331**	42	**1.6535**	2.5	**.10**	1.0	**.040**	190 000	**42 700**	232 000	**52 200**	1 600	2 700
7136[5]	180	**7.0866**	280	**11.0236**	44	**1.7323**	2.5	**.10**	1.0	**.040**	208 000	**46 800**	260 000	**58 500**	1 600	2 600
7138[5]	190	**7.4803**	300	**11.8110**	46	**1.8110**	2.5	**.10**	1.0	**.040**	242 000	**54 400**	315 000	**70 800**	1 400	2 400
7140[5]	200	**7.8740**	320	**12.5984**	48	**1.8898**	2.5	**.10**	1.0	**.040**	260 000	**58 500**	355 000	**79 800**	1 400	2 300
7142[5]	210	**8.2677**	340	**13.3858**	50	**1.9685**	2.5	**.10**	1.0	**.040**	286 000	**64 300**	400 000	**89 900**	1 400	2 300
7144[5]	220	**8.6614**	350	**13.7795**	51	**2.0079**	2.5	**.10**	1.0	**.040**	291 000	**65 400**	415 000	**93 300**	1 300	2 200
7146[5]	230	**9.0551**	370	**14.5669**	53	**2.0866**	3.0	**.12**	1.0	**.040**	312 000	**70 100**	455 000	**102 000**	1 200	2 000
7148[5]	240	**9.4488**	390	**15.3543**	55	**2.1654**	3.0	**.12**	1.0	**.040**	332 000	**74 600**	500 000	**112 000**	1 100	1 900
7152[5]	260	**10.2362**	430	**16.9291**	59	**2.3228**	3.0	**.12**	1.0	**.040**	364 000	**81 800**	585 000	**132 000**	1 100	1 800
7156[5]	280	**11.0236**	460	**18.1102**	63	**2.4803**	3.0	**.12**	1.0	**.040**	403 000	**90 600**	600 000	**135 000**	1 100	1 800
7164[5]	320	**12.5984**	500	**19.6850**	71	**2.7953**	3.0	**.12**	1.0	**.040**	462 000	**104 000**	815 000	**183 000**	960	1 600
7100D																
7120D[5]	100	**3.9370**	160	**6.2992**	56	**2.2047**	2.0	**.08**	1.0	**.040**	140 000	**31 500**	173 000	**38 900**	2 100	3 400
7122D	110	**4.3307**	175	**6.8898**	60	**2.3622**	2.0	**.08**	1.0	**.040**	168 000	**37 800**	216 000	**48 600**	1 900	3 200
7124D[5]	120	**4.7244**	190	**7.4803**	64	**2.5197**	2.0	**.08**	1.0	**.040**	178 000	**40 000**	255 000	**57 300**	1 800	3 000
7126D[5]	130	**5.1181**	205	**8.0709**	68	**2.6772**	2.0	**.08**	1.0	**.040**	195 000	**43 800**	270 000	**60 700**	1 700	2 800
7128D[5]	140	**5.5118**	220	**8.6614**	72	**2.8346**	2.0	**.08**	1.0	**.040**	225 000	**50 600**	310 000	**69 700**	1 500	2 600
7130D	150	**5.9055**	235	**9.2520**	76	**2.9921**	2.0	**.08**	1.0	**.040**	255 000	**57 300**	360 000	**80 900**	1 400	2 200
7132D[5]	160	**6.2992**	250	**9.8425**	80	**3.1496**	2.0	**.08**	1.0	**.040**	286 000	**64 300**	405 000	**91 000**	1 300	2 200
7134D[5]	170	**6.6929**	265	**10.4331**	84	**3.3071**	2.5	**.10**	1.0	**.040**	312 000	**70 100**	465 000	**105 000**	1 300	2 200
7136D[5]	180	**7.0866**	280	**11.0236**	88	**3.4646**	2.5	**.10**	1.0	**.040**	338 000	**76 000**	520 000	**117 000**	1 300	2 100
7138D[5]	190	**7.4803**	300	**11.8110**	92	**3.6220**	2.5	**.10**	1.0	**.040**	390 000	**87 700**	630 000	**142 000**	1 100	1 900
7140D[5]	200	**7.8740**	320	**12.5984**	96	**3.7795**	2.5	**.10**	1.0	**.040**	423 000	**95 100**	695 000	**156 000**	1 100	1 800
7142D[5]	210	**8.2677**	340	**13.3858**	100	**3.9370**	2.5	**.10**	1.0	**.040**	468 000	**105 000**	800 000	**180 000**	1 100	1 800
7144D[5]	220	**8.6614**	350	**13.7795**	102	**4.0157**	2.5	**.10**	1.0	**.040**	475 000	**107 000**	830 000	**187 000**	1 000	1 800
7146D[5]	230	**9.0551**	370	**14.5669**	106	**4.1732**	3.0	**.12**	1.0	**.040**	507 000	**114 000**	915 000	**206 000**	960	1 600
7148D[5]	240	**9.4488**	390	**15.3543**	110	**4.3307**	3.0	**.12**	1.0	**.040**	540 000	**121 000**	1 000 000	**225 000**	880	1 500
7152D[5]	260	**10.2362**	430	**16.9291**	118	**4.6457**	3.0	**.12**	1.0	**.040**	592 000	**133 000**	1 160 000	**261 000**	880	1 400
7156D[5]	280	**11.0236**	460	**18.1102**	126	**4.9606**	3.0	**.12**	1.0	**.040**	663 000	**149 000**	1 200 000	**270 000**	880	1 400
7164D[5]	320	**12.5984**	500	**19.6850**	142	**5.5906**	3.0	**.12**	1.0	**.040**	761 000	**171 000**	1 630 000	**366 000**	770	1 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94 (single) and C by 0.81 and C_0 by 1.47 (duplex).
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.
5) Typically non-stocked sizes, please check availability before designing into equipment.

7100KR extra light series single ball bearings



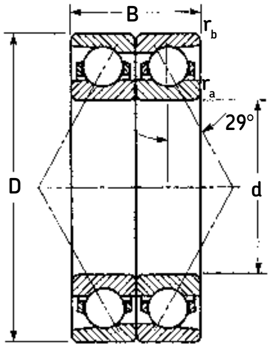
This series is available in bore sizes ranging from 10 mm to 320 mm. One-piece machined nonmetallic or solid bronze cages are considered standard for this series. These bearings are appropriate for use with moderate one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

	Bore		Outside diameter		Width		Fillet radius[1]				Basic radial load rating[2]				Speed rating[3]	
											Dynamic		Static			
MRC bearing number	d mm	in.	D mm	in.	B mm	in.	r_a mm	in.	r_b mm	in.	C[4] N	lbf	C_0 N	lbf	Grease rpm	Oil rpm
7100KR	10	**.3937**	26	**1.0236**	8	**.3150**	.30	**.012**	.10	**.004**	4 620	**1 040**	2 000	**450**	30 000	39 000
7101KR	12	**.4724**	28	**1.1024**	8	**.3150**	.30	**.012**	.10	**.004**	4 940	**1 110**	2 500	**562**	25 000	32 000
7102KR	15	**.5906**	32	**1.2598**	9	**.3543**	.30	**.012**	.10	**.004**	5 400	**1 210**	2 900	**652**	22 000	28 000
7103KR	17	**.6693**	35	**1.3780**	10	**.3937**	.30	**.012**	.10	**.004**	7 610	**1 710**	4 250	**955**	19 000	25 000
7104KR	20	**.7874**	42	**1.6535**	12	**.4724**	.64	**.025**	.30	**.012**	9 560	**2 150**	5 700	**1 280**	16 000	21 000
7105KR	25	**.9843**	47	**1.8504**	12	**.4724**	.64	**.025**	.30	**.012**	10 600	**2 380**	6 950	**1 560**	12 000	16 000
7106KR	30	**1.1811**	55	**2.1654**	13	**.5118**	1.00	**.040**	.30	**.012**	13 800	**3 100**	9 650	**2 170**	11 000	14 000
7107KR	35	**1.3780**	62	**2.4409**	14	**.5512**	1.00	**.040**	.30	**.012**	16 800	**3 780**	12 000	**2 700**	9 200	12 000
7108KR	40	**1.5748**	68	**2.6772**	15	**.5906**	1.00	**.040**	.30	**.012**	17 200	**3 870**	13 200	**2 970**	8 500	11 000
7109KR	45	**1.7717**	75	**2.9528**	16	**.6299**	1.00	**.040**	.30	**.012**	21 200	**4 770**	17 000	**3 820**	7 500	9 800
7110KR	50	**1.9685**	80	**3.1496**	16	**.6299**	1.00	**.040**	.30	**.012**	22 100	**4 970**	18 300	**4 110**	6 900	9 000
7111KR	55	**2.1654**	90	**3.5433**	18	**.7087**	1.00	**.040**	.60	**.024**	29 600	**6 650**	25 500	**5 730**	6 300	8 200
7112KR	60	**2.3622**	95	**3.7402**	18	**.7087**	1.00	**.040**	.60	**.024**	30 700	**6 900**	27 000	**6 070**	5 700	7 400
7113KR	65	**2.5591**	100	**3.9370**	18	**.7087**	1.00	**.040**	.60	**.024**	31 200	**7 010**	29 000	**6 520**	5 400	7 000
7114KR	70	**2.7559**	110	**4.3307**	20	**.7874**	1.00	**.040**	.60	**.024**	34 500	**7 760**	35 500	**7 980**	5 000	6 500
7115KR	75	**2.9528**	115	**4.5276**	20	**.7874**	1.00	**.040**	.60	**.024**	37 700	**8 480**	37 500	**8 430**	4 700	6 100
7116KR	80	**3.1496**	125	**4.9213**	22	**.8661**	1.00	**.040**	.60	**.024**	48 800	**11 000**	49 000	**11 000**	4 500	5 800
7117KR	85	**3.3465**	130	**5.1181**	22	**.8661**	1.00	**.040**	.60	**.024**	49 400	**11 100**	52 000	**11 700**	4 100	5 300
7118KR	90	**3.5433**	140	**5.5118**	24	**.9449**	1.50	**.060**	.60	**.024**	58 500	**13 200**	61 000	**13 700**	3 800	4 900
7119KR	95	**3.7402**	145	**5.7087**	24	**.9449**	1.50	**.060**	.60	**.024**	71 500	**16 100**	72 000	**16 200**	3 600	4 700
7120KR	100	**3.9370**	150	**5.9055**	24	**.9449**	1.50	**.060**	1.00	**.040**	62 400	**14 000**	68 000	**15 300**	3 500	4 500
7121KR	105	**4.1339**	160	**6.2992**	26	**1.0236**	2.00	**.080**	1.00	**.040**	74 100	**16 700**	80 000	**18 000**	3 300	4 300
7122KR	110	**4.3307**	170	**6.6929**	28	**1.1024**	2.00	**.080**	1.00	**.040**	87 100	**19 600**	91 500	**20 600**	3 200	3 800
7124KR	120	**4.7244**	180	**7.0866**	28	**1.1024**	2.00	**.080**	1.00	**.040**	88 400	**19 900**	98 000	**22 000**	2 900	3 800
7126KR	130	**5.1181**	200	**7.8740**	33	**1.2992**	2.00	**.080**	1.00	**.040**	121 000	**27 200**	134 000	**30 100**	2 700	3 500
7128KR	140	**5.5118**	210	**8.2677**	33	**1.2992**	2.00	**.080**	1.00	**.040**	121 000	**27 200**	137 000	**30 800**	2 500	3 300
7130KR	150	**5.9055**	225	**8.8583**	35	**1.3780**	2.00	**.080**	1.00	**.040**	135 000	**30 300**	156 000	**35 100**	2 200	2 900
7132KR	160	**6.2992**	240	**9.4488**	38	**1.4961**	2.00	**.080**	1.00	**.040**	156 000	**35 100**	180 000	**40 500**	2 200	2 800
7134KR	170	**6.6929**	260	**10.2362**	42	**1.6535**	2.00	**.080**	1.00	**.040**	186 000	**41 800**	220 000	**49 500**	2 100	2 700
7136KR	180	**7.0866**	280	**11.0236**	46	**1.8110**	2.00	**.080**	1.00	**.040**	208 000	**46 800**	260 000	**58 500**	2 000	2 600
7138KR	190	**7.4803**	290	**11.4173**	46	**1.8110**	2.00	**.080**	1.00	**.040**	212 000	**47 700**	270 000	**60 700**	1 800	2 400
7140KR	200	**7.8740**	310	**12.2047**	51	**2.0079**	2.00	**.080**	1.00	**.040**	238 000	**53 500**	320 000	**71 900**	1 800	2 300
7144KR	220	**8.6614**	340	**13.3858**	56	**2.2047**	2.50	**.100**	1.00	**.040**	302 000	**67 900**	430 000	**96 700**	1 700	2 200
7148KR	240	**9.4488**	360	**14.1732**	56	**2.2047**	2.50	**.100**	1.00	**.040**	307 000	**69 000**	455 000	**102 000**	1 500	2 000
7152KR	260	**10.2362**	400	**15.7480**	65	**2.5591**	3.00	**.120**	1.50	**.060**	377 000	**84 800**	585 000	**132 000**	1 500	1 900
7156KR	280	**11.0236**	420	**16.5354**	65	**2.5591**	3.00	**.120**	1.50	**.060**	390 000	**87 700**	620 000	**139 000**	1 500	1 900
7160KR	300	**11.8110**	460	**18.1102**	74	**2.9134**	3.00	**.120**	1.50	**.060**	449 000	**101 000**	765 000	**172 000**	1 300	1 700
7164KR	320	**12.5984**	480	**18.8976**	74	**2.9134**	3.00	**.120**	1.50	**.060**	462 000	**104 000**	815 000	**183 000**	1 200	1 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7100KRD extra light series duplex



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

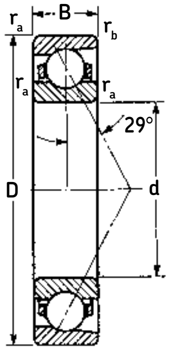
Values for D bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

	Bore		Outside diameter		Width		Fillet radius[1]				Basic radial load rating[2]				Speed rating[3]	
											Dynamic		Static			
MRC bearing number	d		D		B		r_a		r_b		$C^{4)}$		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
7100KRD	10	**.3937**	26	**1.0236**	16	**.6299**	.30	**.012**	.10	**.004**	7 610	**1 710**	4 150	**933**	24 000	31 000
7101KRD	12	**.4724**	28	**1.1024**	16	**.6299**	.30	**.012**	.10	**.004**	8 060	**1 810**	5 000	**1 120**	20 000	26 000
7102KRD	15	**.5906**	32	**1.2598**	18	**.7087**	.30	**.012**	.10	**.004**	8 840	**1 990**	5 850	**1 320**	18 000	22 000
7103KRD	17	**.6693**	35	**1.3780**	20	**.7874**	.30	**.012**	.10	**.004**	12 500	**2 810**	8 500	**1 910**	15 000	20 000
7104KRD	20	**.7874**	42	**1.6535**	24	**.9449**	.64	**.025**	.30	**.012**	15 600	**3 510**	11 400	**2 560**	13 000	17 000
7105KRD	25	**.9843**	47	**1.8504**	24	**.9449**	.64	**.025**	.30	**.012**	17 400	**3 910**	14 000	**3 150**	9 600	13 000
7106KRD	30	**1.1811**	55	**2.1654**	26	**1.0236**	1.00	**.040**	.30	**.012**	22 500	**5 060**	19 300	**4 340**	8 800	11 000
7107KRD	35	**1.3780**	62	**2.4409**	28	**1.1024**	1.00	**.040**	.30	**.012**	27 600	**6 200**	24 000	**5 400**	7 400	9 600
7108KRD	40	**1.5748**	68	**2.6772**	30	**1.1811**	1.00	**.040**	.30	**.012**	28 100	**6 320**	26 000	**5 850**	6 800	8 800
7109KRD	45	**1.7717**	75	**2.9528**	32	**1.2598**	1.00	**.040**	.30	**.012**	34 500	**7 760**	34 000	**7 640**	6 000	7 800
7110KRD	50	**1.9685**	80	**3.1496**	32	**1.2598**	1.00	**.040**	.30	**.012**	35 800	**8 050**	36 500	**8 210**	5 500	7 200
7111KRD	55	**2.1654**	90	**3.5433**	36	**1.4173**	1.00	**.040**	.60	**.024**	47 500	**10 700**	51 000	**11 500**	5 000	6 600
7112KRD	60	**2.3622**	95	**3.7402**	36	**1.4173**	1.00	**.040**	.60	**.024**	49 400	**11 100**	54 000	**12 100**	4 600	5 900
7113KRD	65	**2.5591**	100	**3.9370**	36	**1.4173**	1.00	**.040**	.60	**.024**	50 700	**11 400**	58 500	**13 200**	4 300	5 600
7114KRD	70	**2.7559**	110	**4.3307**	40	**1.5748**	1.00	**.040**	.60	**.024**	55 900	**12 600**	71 000	**16 000**	4 000	5 200
7115KRD	75	**2.9528**	115	**4.5276**	40	**1.5748**	1.00	**.040**	.60	**.024**	61 800	**13 900**	75 000	**16 900**	3 800	4 900
7116KRD	80	**3.1496**	125	**4.9213**	44	**1.7323**	1.00	**.040**	.60	**.024**	79 300	**17 800**	98 000	**22 000**	3 600	4 600
7117KRD	85	**3.3465**	130	**5.1181**	44	**1.7323**	1.00	**.040**	.60	**.024**	80 600	**18 100**	104 000	**23 400**	3 300	4 200
7118KRD	90	**3.5433**	140	**5.5118**	48	**1.8898**	1.50	**.060**	.60	**.024**	95 600	**21 500**	122 000	**27 400**	3 000	3 900
7119KRD	95	**3.7402**	145	**5.7087**	48	**1.8898**	1.50	**.060**	.60	**.024**	117 000	**26 300**	143 000	**32 100**	2 900	3 800
7120-KRD	100	**3.9370**	150	**5.9055**	48	**1.8898**	1.50	**.060**	1.00	**.040**	101 000	**22 700**	137 000	**30 800**	2 800	3 600
7121KRD	105	**4.1339**	160	**6.2992**	52	**2.0472**	2.00	**.080**	1.00	**.040**	121 000	**27 200**	160 000	**36 000**	2 600	3 400
7122KRD	110	**4.3307**	170	**6.6929**	56	**2.2047**	2.00	**.080**	1.00	**.040**	140 000	**31 500**	183 000	**41 100**	2 600	3 300
7124KRD	120	**4.7244**	180	**7.0866**	56	**2.2047**	2.00	**.080**	1.00	**.040**	143 000	**32 100**	196 000	**44 100**	2 300	3 000
7126KRD	130	**5.1181**	200	**7.8740**	66	**2.5984**	2.00	**.080**	1.00	**.040**	195 000	**43 800**	270 000	**60 700**	2 200	2 800
7128KRD	140	**5.5118**	210	**8.2677**	66	**2.5984**	2.00	**.080**	1.00	**.040**	195 000	**43 800**	270 000	**60 700**	2 000	2 600
7130KRD	150	**5.9055**	225	**8.8583**	70	**2.7559**	2.00	**.080**	1.00	**.040**	221 000	**49 700**	315 000	**70 800**	1 800	2 300
7132KRD	160	**6.2992**	240	**9.4488**	76	**2.9921**	2.00	**.080**	1.00	**.040**	255 000	**57 300**	360 000	**80 900**	1 800	2 200
7134KRD	170	**6.6929**	260	**10.2362**	84	**3.3071**	2.00	**.080**	1.00	**.040**	302 000	**67 900**	440 000	**98 900**	1 700	2 200
7136KRD	180	**7.0866**	280	**11.0236**	92	**3.6220**	2.00	**.080**	1.00	**.040**	338 000	**76 000**	520 000	**117 000**	1 600	2 100
7138KRD	190	**7.4803**	290	**11.4173**	92	**3.6220**	2.00	**.080**	1.00	**.040**	345 000	**77 600**	540 000	**121 000**	1 400	1 900
7140KRD	200	**7.8740**	310	**12.2047**	102	**4.0157**	2.00	**.080**	1.00	**.040**	390 000	**87 700**	640 000	**144 000**	1 400	1 800
7144KRD	220	**8.6614**	340	**13.3858**	112	**4.4094**	2.50	**.100**	1.00	**.040**	494 000	**111 000**	865 000	**194 000**	1 400	1 800
7148KRD	240	**9.4488**	360	**14.1732**	112	**4.4094**	2.50	**.100**	1.00	**.040**	494 000	**111 000**	915 000	**206 000**	1 200	1 600
7152KRD	260	**10.2362**	400	**15.7480**	130	**5.1181**	3.00	**.120**	1.50	**.060**	618 000	**139 000**	1 180 000	**265 000**	1 200	1 500
7156KRD	280	**11.0236**	420	**16.5354**	130	**5.1181**	3.00	**.120**	1.50	**.060**	637 000	**143 000**	1 250 000	**281 000**	1 200	1 500
7160KRD	300	**11.8110**	460	**18.1102**	148	**5.8268**	3.00	**.120**	1.50	**.060**	728 000	**164 000**	1 580 000	**355 000**	1 000	1 400
7164KRD	320	**12.5984**	480	**18.8976**	148	**5.8268**	3.00	**.120**	1.50	**.060**	761 000	**171 000**	1 630 000	**366 000**	960	1 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 0.81 and C_0 by 1.47.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7200 light series single ball bearings



The 7200 series contains single-row angular contact ball bearings with a counterbored outer ring. Bore sizes range from 10 mm to 320 mm; and most of these bearings are available with a two-piece pressed steel cage, or a one-piece nonmetallic or solid bronze cage. 7000 series bearings are designed with an initial contact angle of 29°, although some small sizes may have a lesser angle.

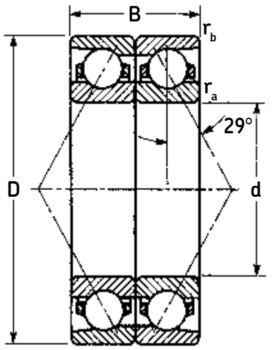
7200 series bearings can be used with moderate to heavy one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

	Bore		Outside diameter		Width		Fillet radius¹⁾				Basic radial load rating²⁾				Speed rating³⁾	
											Dynamic		Static			
MRC bearing number	d mm	d in.	D mm	D in.	B mm	B in.	r_a mm	r_a in.	r_b mm	r_b in.	C⁴⁾ N	C⁴⁾ lbf	C_0 N	C_0 lbf	Grease rpm	Oil rpm
7200	10	**.3937**	30	**1.1811**	9	**.3543**	.64	**.025**	.30	**.012**	5 400	**1 210**	2 750	**618**	28 000	36 000
7201	12	**.4724**	32	**1.2598**	10	**.3937**	.64	**.025**	.30	**.012**	6 240	**1 400**	3 200	**719**	22 000	29 000
7202	15	**.5906**	35	**1.3780**	11	**.4331**	.64	**.025**	.30	**.012**	9 040	**2 030**	4 750	**1 070**	20 000	26 000
7203	17	**.6693**	40	**1.5748**	12	**.4724**	.64	**.025**	.30	**.012**	11 900	**2 680**	6 550	**1 470**	18 000	23 000
7204	20	**.7874**	47	**1.8504**	14	**.5512**	1.00	**.040**	.60	**.024**	12 700	**2 860**	7 200	**1 620**	15 000	19 000
7205	25	**.9843**	52	**2.0472**	15	**.5906**	1.00	**.040**	.60	**.024**	15 300	**3 440**	9 500	**2 140**	12 000	16 000
7206	30	**1.1811**	62	**2.4409**	16	**.6299**	1.00	**.040**	.60	**.024**	16 800	**3 780**	11 800	**2 650**	10 000	13 000
7207	35	**1.3780**	72	**2.8346**	17	**.6693**	1.00	**.040**	.60	**.024**	23 400	**5 260**	17 000	**3 820**	9 200	12 000
7208	40	**1.5748**	80	**3.1496**	18	**.7087**	1.00	**.040**	.60	**.024**	30 700	**6 900**	22 800	**5 130**	7 700	10 000
7209	45	**1.7717**	85	**3.3465**	19	**.7480**	1.00	**.040**	.60	**.024**	30 700	**6 900**	23 200	**5 220**	7 300	9 500
7210	50	**1.9685**	90	**3.5433**	20	**.7874**	1.00	**.040**	.60	**.024**	33 200	**7 460**	27 000	**6 070**	6 400	8 300
7211	55	**2.1654**	100	**3.9370**	21	**.8268**	1.50	**.060**	1.00	**.040**	48 800	**11 000**	37 500	**8 430**	6 000	7 800
7212	60	**2.3622**	110	**4.3307**	22	**.8661**	1.50	**.060**	1.00	**.040**	52 700	**11 800**	44 000	**9 890**	5 400	7 000
7213	65	**2.5591**	120	**4.7244**	23	**.9055**	1.50	**.060**	1.00	**.040**	63 700	**14 300**	54 000	**12 100**	4 900	6 400
7214	70	**2.7559**	125	**4.9213**	24	**.9449**	1.50	**.060**	1.00	**.040**	63 700	**14 300**	55 000	**12 400**	4 600	6 000
7215	75	**2.9528**	130	**5.1181**	25	**.9843**	1.50	**.060**	1.00	**.040**	79 300	**17 800**	69 500	**15 600**	4 300	5 600
7216	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.00	**.080**	1.00	**.040**	74 100	**16 700**	67 000	**15 100**	4 100	5 300
7217	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.00	**.080**	1.00	**.040**	90 400	**20 300**	83 000	**18 700**	3 800	4 900
7218	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.00	**.080**	1.00	**.040**	117 000	**26 300**	118 000	**26 500**	3 600	4 700
7219	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.00	**.080**	1.00	**.040**	121 000	**27 200**	114 000	**25 600**	3 500	4 500
7220	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.00	**.080**	1.00	**.040**	138 000	**31 000**	129 000	**29 000**	3 200	4 100
7221	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.00	**.080**	1.00	**.040**	148 000	**33 300**	137 000	**30 800**	3 000	3 900
7222	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.00	**.080**	1.00	**.040**	163 000	**36 600**	156 000	**35 100**	2 900	3 800
7224	120	**4.7244**	215	**8.4646**	40	**1.5748**	2.00	**.080**	1.00	**.040**	174 000	**39 100**	176 000	**39 600**	2 700	3 500
7226	130	**5.1181**	230	**9.0551**	40	**1.5748**	2.50	**.100**	1.00	**.040**	195 000	**43 800**	208 000	**46 800**	2 500	3 200
7228	140	**5.5118**	250	**9.8425**	42	**1.6535**	2.50	**.100**	1.00	**.040**	208 000	**46 800**	232 000	**52 200**	2 300	3 000
7230	150	**5.9055**	270	**10.6299**	45	**1.7717**	2.50	**.100**	1.00	**.040**	242 000	**54 400**	280 000	**62 900**	2 100	2 700
7232	160	**6.2992**	290	**11.4173**	48	**1.8898**	2.50	**.100**	1.00	**.040**	270 000	**60 700**	325 000	**73 100**	2 000	2 600
7234	170	**6.6929**	310	**12.2047**	52	**2.0472**	3.00	**.120**	1.00	**.040**	286 000	**64 300**	365 000	**82 100**	1 900	2 500
7236	180	**7.0866**	320	**12.5984**	52	**2.0472**	3.00	**.120**	1.00	**.040**	302 000	**67 900**	390 000	**87 700**	1 900	2 400
7238	190	**7.4803**	340	**13.3858**	55	**2.1654**	3.00	**.120**	1.00	**.040**	332 000	**74 600**	450 000	**101 000**	1 700	2 200
7240	200	**7.8740**	360	**14.1732**	58	**2.2835**	3.00	**.120**	1.00	**.040**	351 000	**78 900**	490 000	**110 000**	1 600	2 100
7242	210	**8.2677**	380	**14.9606**	61	**2.4016**	3.00	**.120**	1.00	**.040**	390 000	**87 700**	560 000	**126 000**	1 500	2 000
7244	220	**8.6614**	400	**15.7480**	65	**2.5591**	3.00	**.120**	1.00	**.040**	403 000	**90 600**	600 000	**135 000**	1 500	2 000
7246	230	**9.0551**	420	**16.5354**	68	**2.6772**	3.00	**.120**	1.00	**.040**	442 000	**99 400**	670 000	**151 000**	1 500	1 900
7248	240	**9.4488**	440	**17.3228**	72	**2.8346**	3.00	**.120**	1.00	**.040**	475 000	**107 000**	750 000	**169 000**	1 400	1 800
7250	250	**9.8425**	460	**18.1102**	76	**2.9921**	4.00	**.160**	1.50	**.060**	520 000	**117 000**	830 000	**187 000**	1 400	1 800
7252	260	**10.2362**	480	**18.8976**	80	**3.1496**	4.00	**.160**	1.50	**.060**	559 000	**126 000**	915 000	**206 000**	1 300	1 700
7256	280	**11.0236**	500	**19.6850**	80	**3.1496**	4.00	**.160**	1.50	**.060**	572 000	**129 000**	980 000	**220 000**	1 300	1 700
7260	300	**11.8110**	540	**21.2598**	85	**3.3465**	4.00	**.160**	1.50	**.060**	618 000	**139 000**	1 100 000	**247 000**	1 200	1 600
7264	320	**12.5984**	580	**22.8346**	92	**3.6220**	4.00	**.160**	1.50	**.060**	650 000	**146 000**	1 220 000	**274 000**	1 200	1 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.

7200D light series duplex



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

For duplex sets of 7000 and 9000 series bearings see page 243.

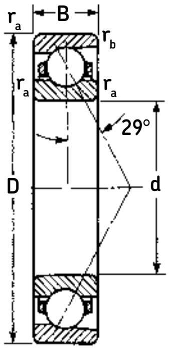
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Fillet radius[1] r_b mm	Fillet radius[1] r_b in.	Basic radial load rating[2] Dynamic C[4] N	Basic radial load rating[2] Dynamic C[4] lbf	Basic radial load rating[2] Static C_0 N	Basic radial load rating[2] Static C_0 lbf	Speed rating[3] Grease rpm	Speed rating[3] Oil rpm
7200D	10	**.3937**	30	**1.1811**	18	**.7087**	.64	**.025**	.30	**.012**	8 840	**1 900**	5 500	**1 240**	22 000	29 000
7201D	12	**.4724**	32	**1.2598**	20	**.7874**	.64	**.025**	.30	**.012**	10 100	**2 270**	6 400	**1 440**	18 000	23 000
7202D	15	**.5906**	35	**1.3780**	22	**.8661**	.64	**.025**	.30	**.012**	14 800	**3 330**	9 500	**2 140**	16 000	21 000
7203D	17	**.6693**	40	**1.5748**	24	**.9449**	.64	**.025**	.30	**.012**	19 500	**4 380**	13 200	**2 970**	14 000	18 000
7204D	20	**.7874**	47	**1.8504**	28	**1.1024**	1.00	**.040**	.60	**.024**	20 800	**4 680**	14 600	**3 280**	12 000	15 000
7205D	25	**.9843**	52	**2.0472**	30	**1.1811**	1.00	**.040**	.60	**.024**	25 100	**5 640**	19 000	**4 270**	9 600	13 000
7206D	30	**1.1811**	62	**2.4409**	32	**1.2598**	1.00	**.040**	.60	**.024**	27 600	**6 200**	23 600	**5 310**	8 000	10 000
7207D	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.00	**.040**	.60	**.024**	37 700	**8 480**	34 000	**7 640**	7 400	9 600
7208D	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.00	**.040**	.60	**.024**	49 400	**11 100**	45 500	**10 200**	6 200	8 000
7209D	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.00	**.040**	.60	**.024**	49 400	**11 100**	46 500	**10 500**	5 800	7 600
7210D	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.00	**.040**	.60	**.024**	54 000	**12 100**	54 000	**12 100**	5 100	6 600
7211D	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.50	**.060**	1.00	**.040**	79 300	**17 800**	75 000	**16 900**	4 800	6 200
7212D	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.50	**.060**	1.00	**.040**	85 200	**19 100**	88 000	**19 800**	4 300	5 600
7213D	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.50	**.060**	1.00	**.040**	104 000	**23 400**	110 000	**24 700**	3 900	5 100
7214D	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.50	**.060**	1.00	**.040**	104 000	**23 400**	110 000	**24 700**	3 700	4 800
7215D	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.50	**.060**	1.00	**.040**	130 000	**29 200**	140 000	**31 500**	3 400	4 500
7216D	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.00	**.080**	1.00	**.040**	121 000	**27 200**	134 000	**30 100**	3 300	4 200
7217D	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.00	**.080**	1.00	**.040**	148 000	**33 300**	166 000	**37 300**	3 000	3 900
7218D	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.00	**.080**	1.00	**.040**	190 000	**42 700**	236 000	**53 100**	2 900	3 800
7219D	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.00	**.080**	1.00	**.040**	199 000	**44 700**	228 000	**51 300**	2 800	3 600
7220D	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.00	**.080**	1.00	**.040**	225 000	**50 600**	260 000	**58 500**	2 600	3 300
7221D	105	**4.1339**	190	**7.4803**	72	**2.8346**	2.00	**.080**	1.00	**.040**	242 000	**54 400**	295 000	**66 300**	2 400	3 100
7222D	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.00	**.080**	1.00	**.040**	265 000	**59 600**	310 000	**69 700**	2 300	3 000
7224D	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.00	**.080**	1.00	**.040**	281 000	**63 200**	355 000	**79 800**	2 200	2 800
7226D	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.50	**.100**	1.00	**.040**	319 000	**71 700**	415 000	**93 300**	2 000	2 600
7228D	140	**5.5118**	250	**9.8425**	84	**3.3071**	2.50	**.100**	1.00	**.040**	338 000	**76 000**	465 000	**105 000**	1 800	2 400
7230D	150	**5.9055**	270	**10.6299**	90	**3.5433**	2.50	**.100**	1.00	**.040**	397 000	**89 200**	560 000	**126 000**	1 700	2 200
7232D	160	**6.2992**	290	**11.4173**	96	**3.7795**	2.50	**.100**	1.00	**.040**	442 000	**99 400**	670 000	**135 000**	1 600	2 100
7234D	170	**6.6929**	310	**12.2047**	104	**4.0945**	3.00	**.120**	1.00	**.040**	468 000	**105 000**	735 000	**165 000**	1 500	2 000
7236D	180	**7.0866**	320	**12.5984**	104	**4.0945**	3.00	**.120**	1.00	**.040**	494 000	**111 000**	780 000	**175 000**	1 500	1 900
7238D	190	**7.4803**	340	**13.3858**	110	**4.3307**	3.00	**.120**	1.00	**.040**	540 000	**121 000**	900 000	**202 000**	1 400	1 800
7240D	200	**7.8740**	360	**14.1732**	116	**4.5669**	3.00	**.120**	1.00	**.040**	572 000	**129 000**	965 000	**217 000**	1 300	1 700
7242D	210	**8.2677**	380	**14.9606**	122	**4.8031**	3.00	**.120**	1.00	**.040**	637 000	**143 000**	1 120 000	**252 000**	1 200	1 600
7244D	220	**8.6614**	400	**15.7480**	130	**5.1181**	3.00	**.120**	1.00	**.040**	650 000	**146 000**	1 200 000	**270 000**	1 200	1 600
7246D	230	**9.0551**	420	**16.5354**	136	**5.3543**	3.00	**.120**	1.00	**.040**	715 000	**161 000**	1 340 000	**301 000**	1 200	1 500
7248D	240	**9.4488**	440	**17.3228**	144	**5.6693**	3.00	**.120**	1.00	**.040**	780 000	**175 000**	1 500 000	**337 000**	1 100	1 400
7250D	250	**9.8425**	460	**18.1102**	152	**5.9843**	4.00	**.160**	1.50	**.060**	852 000	**192 000**	1 660 000	**373 000**	1 100	1 400
7252D	260	**10.2362**	480	**18.8976**	160	**6.2992**	4.00	**.160**	1.50	**.060**	904 000	**203 000**	1 830 000	**411 000**	1 000	1 400
7256D	280	**11.0236**	500	**19.6850**	160	**6.2992**	4.00	**.160**	1.50	**.060**	936 000	**210 000**	2 000 000	**450 000**	1 000	1 400
7260D	300	**11.8110**	540	**21.2598**	170	**6.6929**	4.00	**.160**	1.50	**.060**	1 010 000	**227 000**	2 200 000	**495 000**	960	1 300
7264D	320	**12.5984**	580	**22.8346**	184	**7.2441**	4.00	**.160**	1.50	**.060**	1 060 000	**238 000**	2 400 000	**540 000**	960	1 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 0.81 and C_0 by 1.47.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7300 medium series single ball bearings



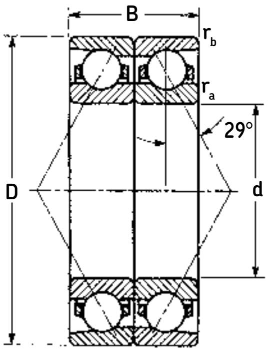
7300 series bearings have the same ring and ball cage construction as the 7200 series but are heavier sectioned bearings with a ball complement capable of handling heavier loads. 7300 series are listed with bore sizes from 10 mm to 280 mm. For two-directional thrust loads, use duplex bearings.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	Basic radial load rating[2] Dynamic C[4] N	lbf	Static C_0 N	lbf	Speed rating[3] Grease rpm	Oil rpm
7300	10	**.3937**	35	**1.3780**	11	**.4331**	.64	**.025**	.60	**.024**	6 370	**1 430**	3 200	**719**	24 000	31 000
7301	12	**.4724**	37	**1.4567**	12	**.4724**	1.00	**.040**	.60	**.024**	7 020	**1 580**	3 750	**843**	19 000	25 000
7302	15	**.5906**	42	**1.6535**	13	**.5118**	1.00	**.040**	.60	**.024**	13 500	**3 030**	7 100	**1 600**	16 000	21 000
7303	17	**.6693**	47	**1.8504**	14	**.5512**	1.00	**.040**	.60	**.024**	15 900	**3 570**	8 650	**1 940**	15 000	19 000
7304	20	**.7874**	52	**2.0472**	15	**.5906**	1.00	**.040**	.60	**.024**	18 600	**4 180**	10 600	**2 380**	13 000	17 000
7305	25	**.9843**	62	**2.4409**	17	**.6693**	1.00	**.040**	.60	**.024**	21 200	**4 770**	13 700	**3 080**	11 000	14 000
7306	30	**1.1811**	72	**2.8346**	19	**.7480**	1.00	**.040**	.60	**.024**	28 100	**6 320**	18 600	**4 180**	9 200	12 000
7307	35	**1.3780**	80	**3.1496**	21	**.8268**	1.50	**.060**	1.00	**.040**	35 800	**8 050**	24 000	**5 400**	8 500	11 000
7308	40	**1.5748**	90	**3.5433**	23	**.9055**	1.50	**.060**	1.00	**.040**	44 200	**9 940**	30 500	**6 860**	7 300	9 500
7309	45	**1.7717**	100	**3.9370**	25	**.9843**	1.50	**.060**	1.00	**.040**	52 700	**11 800**	37 500	**8 430**	6 400	8 300
7310	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.00	**.080**	1.00	**.040**	74 100	**16 700**	53 000	**11 900**	5 800	7 500
7311	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.00	**.080**	1.00	**.040**	85 200	**19 200**	62 000	**13 900**	5 100	6 600
7312	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.00	**.080**	1.00	**.040**	97 500	**21 900**	72 000	**16 200**	4 900	6 400
7313	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.00	**.080**	1.00	**.040**	108 000	**24 300**	86 500	**19 400**	4 600	6 000
7314	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.00	**.080**	1.00	**.040**	111 000	**25 000**	85 000	**19 100**	4 100	5 300
7315	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.00	**.080**	1.00	**.040**	138 000	**31 000**	114 000	**25 600**	3 900	5 000
7316	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.00	**.080**	1.00	**.040**	143 000	**32 100**	120 000	**27 000**	3 600	4 700
7317	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.50	**.100**	1.00	**.040**	163 000	**36 600**	143 000	**32 100**	3 500	4 500
7318	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.50	**.100**	1.00	**.040**	168 000	**37 800**	150 000	**33 700**	3 200	4 200
7319	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.50	**.100**	1.00	**.040**	178 000	**40 000**	166 000	**37 300**	3 100	4 000
7320	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.50	**.100**	1.00	**.040**	190 000	**42 700**	183 000	**41 100**	3 000	3 900
7321	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.50	**.100**	1.00	**.040**	203 000	**45 600**	200 000	**45 000**	2 900	3 800
7322	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.50	**.100**	1.00	**.040**	229 000	**51 500**	236 000	**53 100**	2 700	3 500
7324	120	**4.7244**	260	**10.2362**	55	**2.1654**	2.50	**.100**	1.00	**.040**	260 000	**58 500**	275 000	**61 800**	2 500	3 200
7326	130	**5.1181**	280	**11.0236**	58	**2.2835**	3.00	**.120**	1.00	**.040**	286 000	**64 300**	320 000	**71 900**	2 300	3 000
7328	140	**5.5118**	300	**11.8110**	62	**2.4409**	3.00	**.120**	1.00	**.040**	312 000	**70 100**	375 000	**84 300**	2 200	2 800
7330	150	**5.9055**	320	**12.5984**	65	**2.5591**	3.00	**.120**	1.00	**.040**	345 000	**77 600**	430 000	**96 700**	2 000	2 600
7332	160	**6.2992**	340	**13.3858**	68	**2.6772**	3.00	**.120**	1.00	**.040**	377 000	**84 800**	490 000	**110 000**	1 900	2 500
7334	170	**6.6929**	360	**14.1732**	72	**2.8346**	3.00	**.120**	1.00	**.040**	397 000	**89 200**	520 000	**117 000**	1 900	2 400
7336	180	**7.0866**	380	**14.9606**	75	**2.9528**	3.00	**.120**	1.00	**.040**	423 000	**95 100**	585 000	**132 000**	1 800	2 300
7338	190	**7.4803**	400	**15.7480**	78	**3.0709**	4.00	**.160**	1.50	**.060**	462 000	**104 000**	655 000	**147 000**	1 600	2 100
7340	200	**7.8740**	420	**16.5354**	80	**3.1496**	4.00	**.160**	1.50	**.060**	494 000	**111 000**	720 000	**162 000**	1 500	2 000
7342	210	**8.2677**	440	**17.3228**	84	**3.3071**	4.00	**.160**	1.50	**.060**	527 000	**118 000**	800 000	**180 000**	1 500	1 900
7344	220	**8.6614**	460	**18.1102**	88	**3.4646**	4.00	**.160**	1.50	**.060**	559 000	**126 000**	865 000	**194 000**	1 400	1 800
7348	240	**9.4488**	500	**19.6850**	95	**3.7402**	4.00	**.160**	1.50	**.060**	605 000	**136 000**	965 000	**217 000**	1 400	1 700
7352	260	**10.2362**	540	**21.2598**	102	**4.0157**	5.00	**.200**	2.00	**.080**	663 000	**149 000**	1 140 000	**256 000**	1 300	1 600
7356	280	**11.0236**	580	**22.8346**	108	**4.2520**	5.00	**.200**	2.00	**.080**	741 000	**167 000**	1 340 000	**301 000**	1 200	1 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^{1}/3$ rpm.

7300D medium series duplex



Notes:

“D” indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description. For duplex sets of 7000 and 9000 series bearings see page 243.

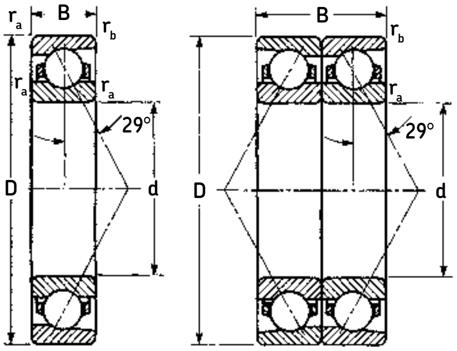
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
7300D	10	**.3937**	35	**1.3780**	22	**.8661**	.64	**.025**	.60	**.024**	10 400	**2 340**	6 400	**1 440**	19 000	25 000
7301D	12	**.4724**	37	**1.4567**	24	**.9449**	1.00	**.040**	.60	**.024**	11 400	**2 560**	7 500	**1 690**	15 000	20 000
7302D	15	**.5906**	42	**1.6535**	26	**1.0236**	1.00	**.040**	.60	**.024**	21 600	**4 860**	14 300	**3 210**	13 000	17 000
7303D	17	**.6693**	47	**1.8504**	28	**1.1024**	1.00	**.040**	.60	**.024**	26 000	**5 850**	17 300	**3 890**	12 000	15 000
7304D	20	**.7874**	52	**2.0472**	30	**1.1811**	1.00	**.040**	.60	**.024**	30 200	**6 790**	21 200	**4 770**	10 000	14 000
7305D	25	**.9843**	62	**2.4409**	34	**1.3386**	1.00	**.040**	.60	**.024**	34 500	**7 760**	27 000	**6 070**	8 800	11 000
7306D	30	**1.1811**	72	**2.8346**	38	**1.4961**	1.00	**.040**	.60	**.024**	46 200	**10 400**	37 500	**8 430**	7 400	9 600
7307D	35	**1.3780**	80	**3.1496**	42	**1.6535**	1.50	**.060**	1.00	**.040**	58 500	**13 200**	48 000	**10 800**	6 800	8 800
7308D	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.50	**.060**	1.00	**.040**	71 500	**16 100**	61 000	**13 700**	5 800	7 600
7309D	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.50	**.060**	1.00	**.040**	85 200	**19 200**	75 000	**16 900**	5 100	6 600
7310D	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.00	**.080**	1.00	**.040**	121 000	**27 200**	106 000	**23 800**	4 600	6 000
7311D	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.00	**.080**	1.00	**.040**	140 000	**31 500**	125 000	**28 100**	4 100	5 300
7312D	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.00	**.080**	1.00	**.040**	159 000	**35 700**	146 000	**32 800**	3 900	5 100
7313D	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.00	**.080**	1.00	**.040**	178 000	**40 000**	173 000	**38 900**	3 700	4 800
7314D	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.00	**.080**	1.00	**.040**	182 000	**40 900**	170 000	**38 200**	3 300	4 200
7315D	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.00	**.080**	1.00	**.040**	225 000	**50 600**	228 000	**51 300**	3 100	4 000
7316D	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.00	**.080**	1.00	**.040**	234 000	**52 600**	240 000	**54 000**	2 900	3 800
7317D	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.50	**.100**	1.00	**.040**	265 000	**59 600**	285 000	**64 100**	2 800	3 600
7318D	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.50	**.100**	1.00	**.040**	276 000	**62 000**	300 000	**67 400**	2 600	3 400
7319D	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.50	**.100**	1.00	**.040**	291 000	**65 400**	325 000	**73 100**	2 500	3 200
7320D	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.50	**.100**	1.00	**.040**	312 000	**70 100**	365 000	**82 100**	2 400	3 100
7321D	105	**4.1339**	225	**8.8583**	98	**3.8583**	2.50	**.100**	1.00	**.040**	332 000	**74 600**	400 000	**89 900**	2 300	3 000
7322D	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.50	**.100**	1.00	**.040**	371 000	**83 400**	475 000	**107 000**	2 200	2 800
7324D	120	**4.7244**	260	**10.2362**	110	**4.3307**	2.50	**.100**	1.00	**.040**	423 000	**95 100**	560 000	**126 000**	2 000	2 600
7326D	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.00	**.120**	1.00	**.040**	468 000	**105 000**	640 000	**144 000**	1 800	2 400
7328D	140	**5.5118**	300	**11.8110**	124	**4.8819**	3.00	**.120**	1.00	**.040**	507 000	**114 000**	735 000	**165 000**	1 800	2 200
7330D	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.00	**.120**	1.00	**.040**	559 000	**126 000**	865 000	**194 000**	1 600	2 100
7332D	160	**6.2992**	340	**13.3858**	136	**5.3543**	3.00	**.120**	1.00	**.040**	618 000	**139 000**	965 000	**217 000**	1 500	2 000
7334D	170	**6.6929**	360	**14.1732**	144	**5.6693**	3.00	**.120**	1.00	**.040**	650 000	**146 000**	1 040 000	**234 000**	1 500	1 900
7336D	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.00	**.120**	1.00	**.040**	689 000	**155 000**	1 160 000	**261 000**	1 400	1 800
7338D	190	**7.4803**	400	**15.7480**	156	**6.1417**	4.00	**.160**	1.50	**.060**	761 000	**171 000**	1 290 000	**270 000**	1 300	1 700
7340D	200	**7.8740**	420	**16.5354**	160	**6.2992**	4.00	**.160**	1.50	**.060**	806 000	**181 000**	1 430 000	**321 000**	1 200	1 600
7342D	210	**8.2677**	440	**17.3228**	168	**6.6142**	4.00	**.160**	1.50	**.060**	852 000	**192 000**	1 600 000	**360 000**	1 200	1 500
7344D	220	**8.6614**	460	**18.1102**	176	**6.9291**	4.00	**.160**	1.50	**.060**	904 000	**203 000**	1 730 000	**389 000**	1 100	1 400
7348D	240	**9.4488**	500	**19.6850**	190	**7.4803**	4.00	**.160**	1.50	**.060**	975 000	**219 000**	1 930 000	**434 000**	1 000	1 400
7352D	260	**10.2362**	540	**21.2598**	204	**8.0315**	5.00	**.200**	2.00	**.080**	1 080 000	**243 000**	2 280 000	**513 000**	960	1 300
7356D	280	**11.0236**	580	**22.8346**	216	**8.5039**	5.00	**.200**	2.00	**.080**	1 210 000	**272 000**	2 650 000	**596 000**	960	1 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 0.81 and C_0 by 1.47.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7400 and 7400D heavy series



7400 series bearings are similar to the 7200 and 7300 series but are heavier sectioned and are used for heavy one-directional thrust loads or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

Values for D bearings are for back-to-back or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2)] Dynamic $C^{4)}$ N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3)] Grease rpm	Oil rpm
7403	17	**.6693**	62	**2.4409**	17	**.6693**	1.0	**.04**	.60	**.024**	26 000	**5 850**	13 700	**3 080**	14 000	18 000
7404	20	**.7874**	72	**2.8346**	19	**.7480**	1.0	**.04**	.60	**.024**	32 500	**7 310**	17 600	**3 960**	12 000	15 000
7405	25	**.9843**	80	**3.1496**	21	**.8268**	1.5	**.06**	1.00	**.040**	42 300	**9 510**	24 500	**5 510**	9 200	12 000
7406	30	**1.1811**	90	**3.5433**	23	**.9055**	1.5	**.06**	1.00	**.040**	54 000	**12 100**	34 000	**7 640**	7 700	10 000
7407	35	**1.3780**	100	**3.9370**	25	**.9843**	1.5	**.06**	1.00	**.040**	63 700	**14 300**	40 500	**9 100**	6 600	8 500
7408	40	**1.5748**	110	**4.3307**	27	**1.0630**	2.0	**.08**	1.00	**.040**	74 100	**16 700**	49 000	**11 000**	5 400	7 700
7409	45	**1.7717**	120	**4.7244**	29	**1.1417**	2.0	**.08**	1.00	**.040**	85 200	**19 200**	57 000	**12 800**	5 300	6 900
7410	50	**1.9685**	130	**5.1181**	31	**1.2205**	2.0	**.08**	1.00	**.040**	95 600	**21 500**	72 000	**16 200**	4 900	6 400
7411	55	**2.1654**	140	**5.5118**	33	**1.2992**	2.0	**.08**	1.00	**.040**	108 000	**24 300**	78 000	**17 500**	4 500	5 800
7412	60	**2.3622**	150	**5.9055**	35	**1.3780**	2.0	**.08**	1.00	**.040**	127 000	**28 600**	93 000	**20 900**	4 100	5 300
7413	65	**2.5591**	160	**6.2992**	37	**1.4567**	2.0	**.08**	1.00	**.040**	138 000	**31 000**	106 000	**23 800**	3 800	4 900
7414	70	**2.7559**	180	**7.0866**	42	**1.6535**	2.5	**.10**	1.00	**.040**	168 000	**37 800**	140 000	**31 500**	3 500	4 600
7415	75	**2.9528**	190	**7.4803**	45	**1.7717**	2.5	**.10**	1.00	**.040**	182 000	**40 900**	156 000	**35 100**	3 300	4 300
7416	80	**3.1496**	200	**7.8740**	48	**1.8898**	2.5	**.10**	1.00	**.040**	190 000	**42 700**	170 000	**38 200**	3 200	4 100
7417	85	**3.3465**	210	**8.2677**	52	**2.0472**	3.0	**.12**	1.00	**.040**	203 000	**45 600**	186 000	**41 800**	2 900	3 800
7418	90	**3.5433**	225	**8.8583**	54	**2.1260**	3.0	**.12**	1.00	**.040**	229 000	**51 500**	220 000	**49 500**	2 700	3 500
7419	95	**3.7402**	250	**9.8425**	55	**2.1654**	3.0	**.12**	1.00	**.040**	255 000	**57 300**	255 000	**57 300**	2 500	3 300
7420	100	**3.9370**	265	**10.4331**	60	**2.3622**	3.0	**.12**	1.00	**.040**	276 000	**62 000**	290 000	**65 200**	2 400	3 200
7421	105	**4.1339**	290	**11.4173**	65	**2.5591**	3.0	**.12**	1.00	**.040**	332 000	**74 600**	325 000	**73 100**	2 300	3 000
7422	110	**4.3307**	320	**12.5984**	70	**2.7559**	3.0	**.12**	1.00	**.040**	371 000	**83 400**	390 000	**87 700**	2 200	2 900
7400D																
7403D	17	**.6693**	62	**2.4409**	34	**1.3386**	1.0	**.04**	.600	**.024**	42 300	**9 510**	27 000	**6 070**	11 000	14 000
7404D	20	**.7874**	72	**2.8346**	38	**1.4961**	1.0	**.04**	.600	**.024**	52 700	**11 800**	35 500	**7 980**	9 600	12 000
7405D	25	**.9843**	80	**3.1496**	42	**1.6535**	1.5	**.06**	1.00	**.040**	68 900	**15 500**	49 000	**11 000**	7 400	9 600
7406D	30	**1.1811**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.00	**.040**	88 400	**19 900**	68 000	**15 300**	6 200	8 000
7407D	35	**1.3780**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.00	**.040**	104 000	**23 400**	81 500	**18 300**	5 300	6 800
7408D	40	**1.5748**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.00	**.040**	121 000	**27 200**	96 500	**21 700**	4 300	6 200
7409D	45	**1.7717**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.00	**.040**	138 000	**31 000**	114 000	**25 600**	4 200	5 500
7410D	50	**1.9685**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.00	**.040**	156 000	**35 100**	146 000	**32 800**	3 900	5 100
7411D	55	**2.1654**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.00	**.040**	178 000	**40 000**	156 000	**35 100**	3 600	4 600
7412D	60	**2.3622**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.00	**.040**	203 000	**45 600**	190 000	**42 700**	3 300	4 200
7413D	65	**2.5591**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.00	**.040**	225 000	**50 600**	275 000	**61 800**	3 000	3 900
7414D	70	**2.7559**	180	**7.0866**	84	**3.3071**	2.5	**.10**	1.00	**.040**	276 000	**62 000**	280 000	**62 900**	2 800	3 700
7415D	75	**2.9528**	190	**7.4803**	90	**3.5433**	2.5	**.10**	1.00	**.040**	291 000	**65 400**	310 000	**69 700**	2 600	3 400
7416D	80	**3.1496**	200	**7.8740**	96	**3.7795**	2.5	**.10**	1.00	**.040**	312 000	**70 100**	340 000	**76 400**	2 500	3 300
7417D	85	**3.3465**	210	**8.2677**	104	**4.0945**	3.0	**.12**	1.00	**.040**	332 000	**74 200**	375 000	**84 300**	2 300	3 000
7418D	90	**3.5433**	225	**8.8583**	108	**4.2520**	3.0	**.12**	1.00	**.040**	371 000	**83 400**	440 000	**98 900**	2 200	2 800
7419D	95	**3.7402**	250	**9.8425**	110	**4.3307**	3.0	**.12**	1.00	**.040**	410 000	**92 200**	510 000	**115 000**	2 000	2 600
7420D	100	**3.9370**	265	**10.4331**	120	**4.7244**	3.0	**.12**	1.00	**.040**	449 000	**101 000**	585 000	**132 000**	1 900	2 600
7421D	105	**4.1339**	290	**11.4173**	130	**5.1181**	3.0	**.12**	1.00	**.040**	540 000	**121 000**	670 000	**151 000**	1 800	2 400
7422D	110	**4.3307**	320	**12.5984**	140	**5.5118**	3.0	**.12**	1.00	**.040**	605 000	**136 000**	800 000	**180 000**	1 700	2 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94 (single) and C by 0.81 and C_0 by 1.47 (duplex).
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

7000 series 29° angular contact ball bearings single bearing

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 0.80$

or

$P = 0.39\,F_R + 0.76\,F_A$ when $F_A/F_R > 0.80$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic radial load rating (from single bearing tables)

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = 0.50\,F_R + 0.34\,F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Minimum thrust load for angular contact ball bearings

Satisfactory operation of angular contact ball bearings requires sufficient traction forces between the balls and races to minimize damage caused by sliding or skidding. This is particularly important at high speeds where the inertia forces of the balls and cage and the viscous drag in the lubricant can have a detrimental influence on the rolling conditions.

The minimum required thrust load can be determined from the following formula.

$$F_A = A\left(\frac{n}{1000}\right)^2 \text{ newtons}$$

or

$$F_A = 0.2248\,A\left(\frac{n}{1000}\right)^2 \text{ pounds}$$

Where, F_A = Minimum thrust load

A = Bearing design factor listed in the following tables

n = Speed in rpm

Note: For duplex bearings mounted in tandem, multiply the single-bearing thrust value by the number of bearings in tandem.

Minimum thrust load A factor

Size	A	Size	A	Size	A	Size	A
7100KR	0.06	7152KR	2784.00	7212	17.51	7305	1.85
7101KR	0.08	7156KR	3121.00	7213	25.86	7306	3.45
7102KR	0.11	7160KR	4790.00	7214	27.74	7307	5.77
7103KR	0.20	7164KR	5325.00	7215	40.59	7308	9.31
7104KR	0.37	7120	63.09	7216	41.61	7309	14.26
7105KR	0.52	7122	94.78	7217	61.05	7310	26.44
7106KR	0.95	7124	131.20	7218	95.12	7311	36.89
7107KR	1.50	7126	150.30	7219	108.60	7312	50.17
7108KR	1.83	7128	200.70	7220	141.50	7313	64.73
7109KR	2.88	7130	264.00	7221	169.80	7314	73.28
7110KR	3.37	7132	342.50	7222	212.20	7315	110.90
7111KR	6.14	7134	435.90	7224	271.90	7316	131.40
7112KR	7.02	7136	547.00	7226	369.40	7317	178.20
7113KR	7.97	7138	794.20	7228	466.10	7318	205.60
7114KR	11.45	7140	977.30	7230	664.90	7319	252.80
7115KR	12.79	7142	1289.00	7232	921.10	7320	314.00
7116KR	20.43	7144	1408.00	7234	1182.00	7321	378.20
7117KR	22.59	7146	1686.00	7236	1316.00	7322	516.40
7118KR	32.62	7148	2003.00	7238	1662.00	7324	713.30
7119KR	44.04	7152	2769.00	7240	1965.00	7326	961.80
7120KR	39.28	7156	3679.00	7242	2538.00	7328	1270.00
7121KR	54.28	7164	5481.00	7244	3048.00	7330	1628.00
7122KR	72.46	7200	0.07	7246	3822.00	7332	2089.00
7124KR	82.13	7201	0.11	7248	4734.00	7334	2442.00
7126KR	147.60	7202	0.19	7250	5799.00	7336	3061.00
7128KR	157.90	7203	0.30	7252	7034.00	7338	3791.00
7130KR	211.10	7204	0.42	7256	7940.00	7340	4644.00
7132KR	276.80	7205	0.94	7260	9950.00	7342	5634.00
7134KR	410.40	7206	1.41	7264	12310.00	7344	6774.00
7136KR	546.70	7207	2.82	7300	0.11	7348	8517.00
7138KR	600.00	7208	4.95	7301	0.15	7352	11310.00
7140KR	831.20	7209	5.46	7302	0.29	7356	15430.00
7144KR	1485.00	7210	6.87	7303	0.63		
7148KR	1685.00	7211	13.36	7304	1.19		

7000 series 29° angular contact ball bearings single bearing

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 11800

Case 1

Radial load (F_R) = 1750
Thrust load (F_A) = 1310
Equivalent load (P) = F_R or 0.39 F_R + 0.76 F_A
F_A/F_R = 1310/1750 = 0.75
Since F_A/F_R < 0.80, P = F_R = 1750

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11800}{1750}\right)^3 = 307 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11800}{1750}\right)^3$$

= 2555 Hrs

Case 2

Radial load (F_R) = 1750
Thrust load (F_A) = 2100
Equivalent load (P) = F_R or 0.39 F_R + 0.76 F_A
F_A/F_R = 2100/1750 = 1.20
Since F_A/F_R > 0.80, P = 0.39 x 1750 + 0.76 x 2100 = 2279

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11800}{2279}\right)^3 = 139 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11800}{2279}\right)^3$$

= 1157 Hrs

Case 3

Thrust load (F_A) = 2100
Equivalent load (P) = 0.39 F_R + 0.76 F_A
F_A/F_R = 2100/0 = ∞
Since F_A/F_R > 0.80, P = 0.76 x 2100 = 1596

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11800}{1596}\right)^3 = 404 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L\,10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11800}{1596}\right)^3$$

= 3368 Hrs

7000D series 29° angular contact ball bearings duplex

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

DB or DF pair

$P = 1.0\,F_R + 0.78\,F_A$ when $F_A / F_R \leq 0.80$

$P = 0.63\,F_R + 1.24\,F_A$ when $F_A / F_R > 0.80$

Tandem DT

$P = 1.0\,F_R$ when $F_A / F_R \leq 0.80$

$P = 0.39\,F_R + 0.76\,F_A$ when $F_A / F_R > 0.80$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

P = Dynamic equivalent radial load

n = Speed in rpm

For DB or DF mounting:

C = Duplex pair dynamic radial load rating (from duplex bearing tables)

or

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where $i = 2$

For DT tandem mounting:

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where i = number of bearings in set

Static equivalent radial load

$P_0 = 1.0\,F_R + 0.66\,F_R$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_R = Thrust load

7000D series 29° angular contact ball bearings duplex

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309DU (DB or DF pair)
Speed: 2000 rpm
Duplex pair basic dynamic radial load rating (C) = 19200

Case 1

Radial load (F_R) = 1750
Thrust load (F_A) = 1310
F_A/F_R = 1310/1750 = 0.75
Since F_A/F_R < 0.80, equivalent load
(P) = 1.0 F_R + 0.78 F_A
= 1.0 x 1750 + 0.78 x 1310 = 2772

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{19200}{2772}\right)^3 = 332 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{19200}{2772}\right)^3$$

= 2769 Hrs

Case 2

Radial load (F_R) = 1750
Thrust load (F_A) = 2100
F_A/F_R = 2100/1750 = 1.20
Since F_A/F_R > 0.80, equivalent load
(P) = 0.63 F_R + 1.24 F_A
= 0.63 x 1750 + 1.24 x 2100 = 3707

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{19200}{3707}\right)^3 = 332 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{19200}{3707}\right)^3$$

= 1158 Hrs

Case 3

Thrust load (F_A) = 2100
F_A/F_R = 2100/0 = ∞
Since F_A/F_R > 0.80, equivalent load
(P) = 0.63 F_R + 1.24 F_A = 1.24 x 2100 = 2604

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{19200}{2604}\right)^3 = 401 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L 10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{19200}{2604}\right)^3$$

= 3340 Hrs

Bearing size: 7309DT
3 bearings in tandem
Speed: 2000 rpm
Single-row basic dynamic radial load rating (C) = 11800

Case 1

Thrust load (F_A) = 4200
F_A/F_R = 4200/0 = ∞
Since F_A/F_R > 0.80, equivalent load
(P) = 0.39 F_R + 0.76 F_A = 0.76 x 4200 = 3192
Load rating = $(i)^{0.7}$ 11800 = $(3)^{0.7}$ × 11800 = 25460

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{25460}{3192}\right)^3 = 507 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{25460}{3192}\right)^3$$

= 4229 Hrs

Case 2

Radial load (F_R) = 3500
Thrust load (F_A) = 4200
F_A/F_R = 4200/3500 = 1.20
Since F_A/F_R > 0.80, equivalent load
(P) = 0.39 F_R + 0.76 F_A
= 0.39 x 3500 + 0.76 x 4200 = 4557
Load rating = $(i)^{0.7}$ 11800 = $(3)^{0.7}$ × 11800 = 25460

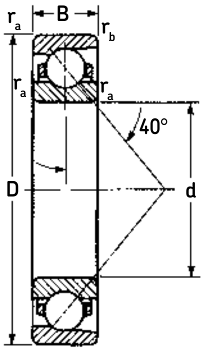
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{25460}{4557}\right)^3 = 174 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{25460}{4557}\right)^3$$

= 1453 Hrs

7000P series single-row 40° angular contact ball bearings



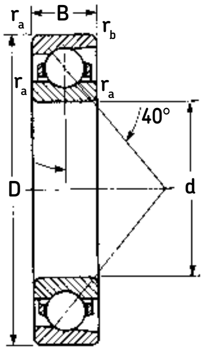
7000P series bearings are similar in design to 7000 series bearings, but the 7000P series bearings have features that give them a greatly increased thrust capacity. They are especially recommended for those applications where maximum thrust capacity is required.

This heavy-duty angular contact ball bearing series is designed with an optimum ball complement and race groove depth, and have a 40° contact angle. 7000P bearings are restricted to applications involving primarily thrust loads. They should **not** be used where the bearing will be subjected to radial load exclusively, or combined radial and thrust load where the radial load is predominant.

Cage types and materials

Furnished in one-piece, inner-ring land-guided, machined brass, phenolic/Bakelite composition or special material.

7200P light series single bearings



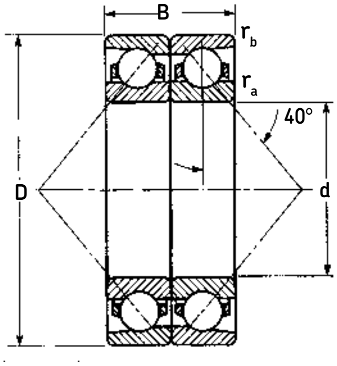
7200P light series bearings are available in bore sizes ranging from 10 mm to 200 mm. They are used with heavy one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
7200P	10	.3937	30	1.1811	9	.3543	.64	.025	.30	.012	7 020	1 580	3 200	719	19 000	28 000
7201P	12	.4724	32	1.2598	10	.3937	.64	.025	.30	.012	7 610	1 710	3 750	843	18 000	26 000
7202P	15	.5906	35	1.3780	11	.4331	.64	.025	.30	.012	8 840	1 990	4 250	955	17 000	24 000
7203P	17	.6693	40	1.5748	12	.4724	.64	.025	.30	.012	11 700	2 630	6 000	1 350	15 000	20 000
7204P	20	.7874	47	1.8504	14	.5512	1.00	.040	.60	.024	14 800	3 330	8 300	1 870	12 000	17 000
7205P	25	.9843	52	2.0472	15	.5906	1.00	.040	.60	.024	16 800	3 780	10 400	2 340	10 000	15 000
7206P	30	1.1811	62	2.4409	16	.6299	1.00	.040	.60	.024	21 200	4 770	12 700	2 860	8 500	12 000
7207P	35	1.3780	72	2.8346	17	.6693	1.00	.040	.60	.024	29 100	6 540	19 300	4 340	8 000	11 000
7208P	40	1.5748	80	3.1496	18	.7087	1.00	.040	.60	.024	32 500	7 310	22 400	5 040	7 000	9 500
7209P	45	1.7717	85	3.3465	19	.7480	1.00	.040	.60	.024	39 000	8 770	27 500	6 180	6 700	9 000
7210P	50	1.9685	90	3.5433	20	.7874	1.00	.040	.60	.024	40 300	9 060	30 000	6 740	6 000	8 000
7211P	55	2.1654	100	3.9370	21	.8268	1.50	.060	1.00	.040	48 800	11 000	37 500	8 430	5 600	7 500
7212P	60	2.3622	110	4.3307	22	.8661	1.50	.060	1.00	.040	58 500	13 200	45 500	10 200	5 000	6 700
7213P	65	2.5591	120	4.7244	23	.9055	1.50	.060	1.00	.040	63 700	14 300	51 000	11 500	4 500	6 000
7214P	70	2.7559	125	4.9213	24	.9449	1.50	.060	1.00	.040	68 900	15 500	56 000	12 600	4 300	5 600
7215P	75	2.9528	130	5.1181	25	.9843	1.50	.060	1.00	.040	71 500	16 100	60 000	13 500	4 000	5 300
7216P	80	3.1496	140	5.5118	26	1.0236	2.00	.080	1.00	.040	83 200	18 700	71 000	16 000	3 800	5 000
7217P	85	3.3465	150	5.9055	28	1.1024	2.00	.080	1.00	.040	95 600	21 500	83 000	18 700	3 600	4 800
7218P	90	3.5433	160	6.2992	30	1.1811	2.00	.080	1.00	.040	108 000	24 300	95 000	21 400	3 400	4 500
7219P	95	3.7402	170	6.6929	32	1.2598	2.00	.080	1.00	.040	124 000	27 900	110 000	24 700	3 200	4 300
7220P	100	3.9370	180	7.0866	34	1.3386	2.00	.080	1.00	.040	130 000	29 200	125 000	28 100	3 000	4 000
7221P	105	4.1339	190	7.4803	36	1.4173	2.00	.080	1.00	.040	143 000	32 100	129 000	29 000	2 800	3 800
7222P	110	4.3307	200	7.8740	38	1.4961	2.00	.080	1.00	.040	153 000	34 400	156 000	35 100	2 600	3 600
7224P	120	4.7244	215	8.4646	40	1.5748	2.00	.080	1.00	.040	165 000	37 100	163 000	36 600	2 200	3 200
7226P	130	5.1181	230	9.0551	40	1.5748	2.50	.100	1.00	.040	186 000	41 800	193 000	43 400	1 900	2 800
7228P	140	5.5118	250	9.8425	42	1.6535	2.50	.100	1.00	.040	199 000	44 700	216 000	48 600	1 800	2 600
7230P	150	5.9055	270	10.6299	45	1.7717	2.50	.100	1.00	.040	216 000	48 600	260 000	58 500	1 700	2 400
7232P	160	6.2992	290	11.4173	48	1.8898	2.50	.100	1.00	.040	238 000	53 500	280 000	62 900	1 600	2 200
7234P	170	6.6929	310	12.2047	52	2.0472	3.00	.120	1.00	.040	265 000	59 600	335 000	75 300	1 600	2 200
7236P	180	7.0866	320	12.5984	52	2.0472	3.00	.120	1.00	.040	276 000	62 000	355 000	79 800	1 500	2 000
7238P	190	7.4803	340	13.3858	55	2.1654	3.00	.120	1.00	.040	302 000	67 900	405 000	91 000	1 400	1 900
7240P	200	7.8740	360	14.1732	58	2.2835	3.00	.120	1.00	.040	319 000	71 700	440 000	98 900	1 300	1 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7200PD light series duplex



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

For duplex sets of 7000 and 9000 series bearings see page 243.

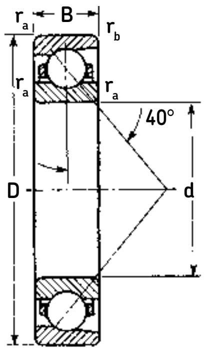
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore		Outside diameter		Width		Fillet radius[1]				Basic radial load rating[2]				Speed rating[3]	
	d		D		B		r_a		r_b		Dynamic C[4]		Static C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
7200PD	10	.3937	30	**1.1811**	18	**.7087**	.64	**.025**	.30	**.012**	11 400	**2 560**	6 400	**1 440**	16 000	22 000
7201PD	12	.4724	32	**1.2598**	20	**.7874**	.64	**.025**	.30	**.012**	12 500	**2 810**	7 500	**1 690**	13 000	18 000
7202PD	15	.5906	35	**1.3780**	22	**.8661**	.64	**.025**	.30	**.012**	14 300	**3 210**	8 500	**1 910**	12 000	17 000
7203PD	17	.6693	40	**1.5748**	24	**.9449**	.64	**.025**	.30	**.012**	19 000	**4 270**	12 000	**2 700**	11 000	16 000
7204PD	20	.7874	47	**1.8504**	28	**1.1024**	1.00	**.040**	.60	**.024**	24 200	**5 440**	16 600	**3 730**	9 500	14 000
7205PD	25	.9843	52	**2.0472**	30	**1.1811**	1.00	**.040**	.60	**.024**	27 000	**6 070**	20 800	**4 680**	8 500	12 000
7206PD	30	**1.1811**	62	**2.4409**	32	**1.2598**	1.00	**.040**	.60	**.024**	34 500	**7 760**	25 500	**5 730**	7 500	10 000
7207PD	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.00	**.040**	.60	**.024**	47 500	**10 700**	39 000	**8 770**	6 300	8 500
7208PD	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.00	**.040**	.60	**.024**	52 700	**11 800**	45 000	**10 100**	5 600	7 500
7209PD	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.00	**.040**	.60	**.024**	62 400	**14 000**	55 000	**12 400**	5 300	7 000
7210PD	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.00	**.040**	.60	**.024**	65 000	**14 600**	60 000	**13 500**	4 800	6 300
7211PD	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.50	**.060**	1.00	**.040**	79 300	**17 800**	75 000	**16 900**	4 500	6 000
7212PD	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.50	**.060**	1.00	**.040**	95 600	**21 500**	91 600	**20 600**	4 000	5 300
7213PD	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.50	**.060**	1.00	**.040**	104 000	**23 400**	100 000	**22 500**	3 600	4 800
7214PD	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.50	**.060**	1.00	**.040**	112 000	**25 200**	112 000	**25 200**	3 400	4 500
7215PD	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.50	**.060**	1.00	**.040**	117 000	**26 300**	120 000	**27 000**	3 200	4 300
7216PD	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.00	**.080**	1.00	**.040**	135 000	**30 300**	140 000	**31 500**	3 000	4 000
7217PD	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.00	**.080**	1.00	**.040**	156 000	**35 100**	166 000	**37 300**	2 800	3 800
7218PD	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.00	**.080**	1.00	**.040**	178 000	**40 000**	190 000	**42 700**	2 600	3 600
7219PD	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.00	**.080**	1.00	**.040**	199 000	**44 700**	220 000	**49 500**	2 400	3 400
7220PD	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.00	**.080**	1.00	**.040**	212 000	**47 700**	250 000	**56 200**	2 200	3 200
7221PD	105	**4.1339**	190	**7.4803**	72	**2.8346**	2.00	**.080**	1.00	**.040**	229 000	**51 500**	260 000	**58 500**	2 000	3 000
7222PD	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.00	**.080**	1.00	**.040**	251 000	**56 400**	310 000	**69 700**	1 900	2 800
7224PD	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.00	**.080**	1.00	**.040**	270 000	**60 700**	325 000	**73 100**	1 700	2 400
7226PD	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.50	**.100**	1.00	**.040**	302 000	**67 900**	390 000	**87 700**	1 700	2 400
7228PD	140	**5.5118**	250	**9.8425**	84	**3.3071**	2.50	**.100**	1.00	**.040**	319 000	**71 700**	430 000	**96 700**	1 600	2 200
7230PD	150	**5.9055**	270	**10.6299**	90	**3.5433**	2.50	**.100**	1.00	**.040**	351 000	**78 900**	520 000	**117 000**	1 500	2 000
7232PD	160	**6.2992**	290	**11.4173**	96	**3.7795**	2.50	**.100**	1.00	**.040**	390 000	**87 700**	560 000	**126 000**	1 300	1 700
7234PD	170	**6.6929**	310	**12.2047**	104	**4.0945**	3.00	**.120**	1.00	**.040**	436 000	**98 000**	655 000	**147 000**	1 200	1 600
7236PD	180	**7.0866**	320	**12.5984**	104	**4.0945**	3.00	**.120**	1.00	**.040**	449 000	**101 000**	710 000	**160 000**	1 100	1 500
7238PD	190	**7.4803**	340	**13.3858**	110	**4.3307**	3.00	**.120**	1.00	**.040**	488 000	**110 000**	815 000	**183 000**	1 100	1 500
7240PD	200	**7.8740**	360	**14.1732**	116	**4.5669**	3.00	**.120**	1.00	**.040**	520 000	**117 000**	880 000	**198 000**	1 000	1 400

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.08 and C_0 by 1.93.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7300P medium series single ball bearings



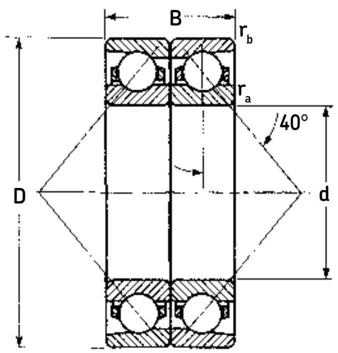
7300P medium series bearings are available in bore sizes from 10 mm to 200 mm. They can accommodate very heavy one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	r_b mm	in.	Basic radial load rating[2)] Dynamic C[4)] N	lbf	Static C_0 N	lbf	Speed rating[3)] Grease rpm	Oil rpm
7300P	10	.3937	35	1.3780	11	.4331	.64	.025	.30	.012	9 360	2 100	4 150	933	18 000	26 000
7301P	12	.4724	37	1.4567	12	.4724	1.00	.040	.60	.024	11 200	2 520	5 000	1 120	17 000	24 000
7302P	15	.5906	42	1.6535	13	.5118	1.00	.040	.60	.024	12 700	2 860	6 100	1 370	15 000	20 000
7303P	17	.6693	47	1.8504	14	.5512	1.00	.040	.60	.024	16 800	3 780	8 500	1 910	13 000	18 000
7304P	20	.7874	52	2.0472	15	.5906	1.00	.040	.60	.024	18 600	4 180	9 500	2 140	11 000	16 000
7305P	25	.9843	62	2.4409	17	.6693	1.00	.040	.60	.024	24 200	5 440	13 400	3 010	9 000	13 000
7306P	30	1.1811	72	2.8346	19	.7480	1.00	.040	.60	.024	32 500	7 310	19 600	4 410	8 000	11 000
7307P	35	1.3780	80	3.1496	21	.8268	1.50	.060	1.00	.040	39 700	8 920	24 500	5 510	7 500	10 000
7308P	40	1.5748	90	3.5433	23	.9055	1.50	.060	1.00	.040	47 500	10 700	30 500	6 860	6 700	9 000
7309P	45	1.7717	100	3.9370	25	.9843	1.50	.060	1.00	.040	59 200	13 300	40 000	8 990	6 000	8 000
7310P	50	1.9685	110	4.3307	27	1.0630	2.00	.080	1.00	.040	68 900	15 500	52 000	11 700	5 300	7 000
7311P	55	2.1654	120	4.7244	29	1.1417	2.00	.080	1.00	.040	79 300	17 800	56 000	12 600	4 800	6 300
7312P	60	2.3622	130	5.1181	31	1.2205	2.00	.080	1.00	.040	90 400	20 300	64 000	14 400	4 500	6 000
7313P	65	2.5591	140	5.5118	33	1.2992	2.00	.080	1.00	.040	101 000	22 700	80 000	18 000	4 300	5 600
7314P	70	2.7559	150	5.9055	35	1.3780	2.00	.080	1.00	.040	117 000	26 300	93 000	20 900	3 800	5 000
7315P	75	2.9528	160	6.2992	37	1.4567	2.00	.080	1.00	.040	127 000	28 600	100 000	22 500	3 600	4 800
7316P	80	3.1496	170	6.6929	39	1.5354	2.00	.080	1.00	.040	138 000	31 000	110 000	24 700	3 400	4 500
7317P	85	3.3465	180	7.0866	41	1.6142	2.50	.100	1.00	.040	148 000	33 300	122 000	27 400	3 200	4 300
7318P	90	3.5433	190	7.4803	43	1.6929	2.50	.100	1.00	.040	159 000	35 700	137 000	30 800	3 000	4 000
7319P	95	3.7402	200	7.8740	45	1.7717	2.50	.100	1.00	.040	168 000	37 800	150 000	33 700	2 800	3 800
7320P	100	3.9370	215	8.4646	47	1.8504	2.50	.100	1.00	.040	190 000	42 700	190 000	42 700	2 600	3 600
7321P	105	4.1339	225	8.8583	49	1.9291	2.50	.100	1.00	.040	203 000	45 600	196 000	44 100	2 400	3 400
7322P	110	4.3307	240	9.4488	50	1.9685	2.50	.100	1.00	.040	212 000	47 700	228 000	51 300	2 200	3 200
7324P	120	4.7244	260	10.2362	55	2.1654	2.50	.100	1.00	.040	238 000	53 500	265 000	59 600	1 900	2 800
7326P	130	5.1181	280	11.0236	58	2.2835	3.00	.120	1.00	.040	276 000	62 000	305 000	68 600	1 800	2 600
7328P	140	5.5118	300	11.8110	62	2.4409	3.00	.120	1.00	.040	302 000	67 900	345 000	77 600	1 700	2 400
7330P	150	5.9055	320	12.5984	65	2.5591	3.00	.120	1.00	.040	325 000	73 100	390 000	87 700	1 600	2 200
7332P	160	6.2992	340	13.3858	68	2.6772	3.00	.120	1.00	.040	345 000	77 600	425 000	95 500	1 500	2 000
7334P	170	6.6929	360	14.1732	72	2.8346	3.00	.120	1.00	.040	377 000	84 800	490 000	110 000	1 400	1 900
7336P	180	7.0866	380	14.9606	75	2.9528	3.00	.120	1.00	.040	403 000	90 600	540 000	121 000	1 300	1 800
7338P	190	7.4803	400	15.7480	78	3.0709	4.00	.160	1.50	.060	416 000	93 500	570 000	128 000	1 200	1 700
7340P	200	7.8740	420	16.5354	80	3.1496	4.00	.160	1.50	.060	449 000	101 000	655 000	147 000	1 100	1 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7300PD medium series duplex



Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an

additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

For duplex sets of 7000 and 9000 series bearings see page 243.

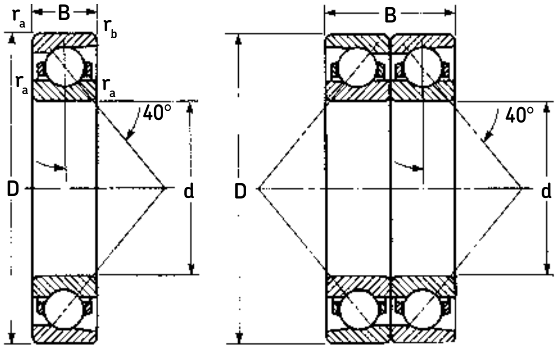
Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore		Outside diameter		Width		Fillet radius[1]				Basic radial load rating[2]				Speed rating[3]	
											Dynamic		Static			
	d		D		B		r_a		r_b		C[4]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
7300PD	10	**.3937**	35	**1.3780**	22	**.8661**	.64	**.025**	.30	**.012**	15 300	**3 440**	8 300	**1 870**	15 000	21 000
7301PD	12	**.4724**	37	**1.4567**	24	**.9449**	1.00	**.040**	.60	**.024**	18 200	**4 090**	10 200	**2 290**	14 000	19 000
7302PD	15	**.5906**	42	**1.6535**	26	**1.0236**	1.00	**.040**	.60	**.024**	20 300	**4 560**	12 200	**2 740**	11 000	16 000
7303PD	17	**.6693**	47	**1.8504**	28	**1.1024**	1.00	**.040**	.60	**.024**	27 600	**6 200**	17 000	**3 820**	9 500	14 000
7304PD	20	**.7874**	52	**2.0472**	30	**1.1811**	1.00	**.040**	.60	**.024**	30 200	**6 790**	19 000	**4 270**	9 000	13 000
7305PD	25	**.9843**	62	**2.4409**	34	**1.3386**	1.00	**.040**	.60	**.024**	39 000	**8 770**	27 000	**6 070**	7 500	10 000
7306PD	30	**1.1811**	72	**2.8346**	38	**1.4961**	1.00	**.040**	.60	**.024**	52 700	**11 800**	39 000	**8 770**	6 700	9 000
7307PD	35	**1.3780**	80	**3.1496**	42	**1.6535**	1.50	**.060**	1.00	**.040**	63 700	**14 300**	49 000	**11 000**	6 000	8 000
7308PD	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.50	**.060**	1.00	**.040**	76 100	**17 100**	61 000	**13 700**	5 300	7 000
7309PD	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.50	**.060**	1.00	**.040**	97 500	**21 900**	80 000	**18 000**	4 800	6 300
7310PD	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.00	**.080**	1.00	**.040**	112 000	**25 200**	104 000	**23 400**	4 300	5 600
7311PD	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.00	**.080**	1.00	**.040**	130 000	**29 200**	112 000	**25 200**	3 800	5 000
7312PD	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.00	**.080**	1.00	**.040**	148 000	**33 300**	129 000	**29 000**	3 600	4 800
7313PD	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.00	**.080**	1.00	**.040**	165 000	**37 100**	160 000	**36 000**	3 200	4 300
7314PD	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.00	**.080**	1.00	**.040**	190 000	**42 700**	186 000	**41 800**	3 000	4 000
7315PD	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.00	**.080**	1.00	**.040**	208 000	**46 800**	200 000	**45 000**	2 800	3 800
7316PD	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.00	**.080**	1.00	**.040**	225 000	**50 600**	220 000	**49 500**	2 600	3 600
7317PD	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.50	**.100**	1.00	**.040**	238 000	**53 500**	245 000	**55 100**	2 400	3 400
7318PD	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.50	**.100**	1.00	**.040**	255 000	**57 300**	270 000	**60 700**	2 200	3 200
7319PD	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.50	**.100**	1.00	**.040**	276 000	**62 000**	300 000	**67 400**	2 000	3 000
7320PD	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.50	**.100**	1.00	**.040**	307 000	**69 000**	380 000	**85 400**	1 900	2 800
7321PD	105	**4.1339**	225	**8.8583**	98	**3.8583**	2.50	**.100**	1.00	**.040**	325 000	**73 100**	390 000	**87 700**	1 800	2 600
7322PD	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.50	**.100**	1.00	**.040**	345 000	**77 600**	455 000	**102 000**	1 700	2 400
7324PD	120	**4.7244**	260	**10.2362**	110	**4.3307**	2.50	**.100**	1.00	**.040**	390 000	**87 700**	530 000	**119 000**	1 600	2 200
7326PD	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.00	**.120**	1.00	**.040**	449 000	**101 000**	610 000	**137 000**	1 500	2 000
7328PD	140	**5.5118**	300	**11.8110**	124	**4.8819**	3.00	**.120**	1.00	**.040**	488 000	**110 000**	695 000	**156 000**	1 400	1 900
7330PD	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.00	**.120**	1.00	**.040**	540 000	**121 000**	780 000	**175 000**	1 200	1 700
7332PD	160	**6.2992**	340	**13.3858**	136	**5.3543**	3.00	**.120**	1.00	**.040**	553 000	**124 000**	850 000	**191 000**	1 200	1 600
7334PD	170	**6.6929**	360	**14.1732**	144	**5.6693**	3.00	**.120**	1.00	**.040**	605 000	**136 000**	965 000	**217 000**	1 000	1 500
7336PD	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.00	**.120**	1.00	**.040**	650 000	**146 000**	1 100 000	**247 000**	950	1 400
7338PD	190	**7.4803**	400	**15.7480**	156	**6.1417**	4.00	**.160**	1.50	**.060**	676 000	**152 000**	1 160 000	**261 000**	950	1 400
7340PD	200	**7.8740**	420	**16.5354**	160	**6.2992**	4.00	**.160**	1.50	**.060**	741 000	**167 000**	1 320 000	**297 000**	880	1 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.08 and C_0 by 1.93.
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7400P and 7400PD
heavy series



7400P series bearings are similar to the 7200P and 7300P series, but are heavier sectioned, and are used for very heavy thrust loads or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

Notes:

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

For duplex sets of 7000 and 9000 series bearings see page 243.

Values for D bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs where available.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
7405P	25	.9843	80	3.1496	21	.8268	1.5	.060	1.0	.040	39 700	8 920	23 600	5 310	7 000	10 000
7406P	30	1.1811	90	3.5433	23	.9055	1.5	.060	1.0	.040	47 500	10 700	29 000	6 520	6 300	9 000
7407P	35	1.3780	100	3.9370	25	.9843	1.5	.060	1.0	.040	60 500	13 600	38 000	8 540	5 600	7 500
7408P	40	1.5748	110	4.3307	27	1.0630	2.0	.080	1.0	.040	70 200	15 800	45 000	10 100	5 300	7 000
7409P	45	1.7717	120	4.7244	29	1.1417	2.0	.080	1.0	.040	85 200	19 200	55 000	12 400	4 800	6 300
7410P	50	1.9685	130	5.1181	31	1.2205	2.0	.080	1.0	.040	95 600	21 500	64 000	14 400	4 300	6 000
7411P	55	2.1654	140	5.5118	33	1.2992	2.0	.080	1.0	.040	111 000	25 000	76 500	17 200	4 000	5 600
7412P	60	2.3622	150	5.9055	35	1.3780	2.0	.080	1.0	.040	119 000	26 800	86 500	19 400	3 600	5 000
7413P	65	2.5591	160	6.2992	37	1.4567	2.0	.080	1.0	.040	130 000	29 200	96 500	21 700	3 400	4 800
7414P	70	2.7559	180	7.0866	42	1.6535	2.5	.100	1.0	.040	159 000	35 700	127 000	28 600	3 000	4 300
7415P	75	2.9528	190	7.4803	45	1.7717	2.5	.100	1.0	.040	168 000	37 800	140 000	31 500	2 800	4 000
7416P	80	3.1496	200	7.8740	48	1.8898	2.5	.100	1.0	.040	183 000	41 100	156 000	35 100	2 600	3 800
7417P	85	3.3465	210	8.2677	52	2.0472	3.0	.120	1.0	.040	190 000	42 700	166 000	37 300	2 500	3 600
7418P	90	3.5433	225	8.8583	54	2.1260	3.0	.120	1.0	.040	216 000	48 600	200 000	45 000	2 400	3 400
7419P	95	3.7402	250	9.8425	55	2.1654	3.0	.120	1.0	.040	251 000	56 400	245 000	55 100	2 200	3 000
7420P	100	3.9370	265	10.4331	60	2.3622	3.0	.120	1.0	.040	276 000	62 000	275 000	61 800	2 000	2 800
7421P	105	4.1339	290	11.4173	65	2.5591	3.0	.120	1.0	.040	265 000	59 600	280 000	62 900	1 900	2 600
7400PD																
7405PD	25	.9843	80	3.1496	42	1.6535	1.5	.060	1.0	.040	65 000	14 500	47 500	10 600	5 600	8 000
7406PD	30	1.1811	90	3.5433	46	1.8110	1.5	.060	1.0	.040	78 000	17 400	58 500	13 000	5 000	7 200
7407PD	35	1.3780	100	3.9370	50	1.9685	1.5	.060	1.0	.040	97 500	22 100	76 500	17 100	4 500	6 000
7408PD	40	1.5748	110	4.3307	54	2.1260	2.0	.080	1.0	.040	114 000	25 700	90 000	20 200	4 300	5 600
7409PD	45	1.7717	120	4.7244	58	2.2835	2.0	.080	1.0	.040	138 000	31 200	110 000	24 800	3 800	5 000
7410PD	50	1.9685	130	5.1181	62	2.4409	2.0	.080	1.0	.040	156 000	34 900	129 000	28 800	3 400	4 800
7411PD	55	2.1654	140	5.5118	66	2.5984	2.0	.080	1.0	.040	182 000	40 600	153 000	34 400	3 200	4 500
7412PD	60	2.3622	150	5.9055	70	2.7559	2.0	.080	1.0	.040	195 000	43 600	173 000	38 800	2 800	4 000
7413PD	65	2.5591	160	6.2992	74	2.9134	2.0	.080	1.0	.040	212 000	47 400	193 000	43 400	2 700	3 800
7414PD	70	2.7559	180	7.0866	84	3.3071	2.5	.100	1.0	.040	260 000	58 000	255 000	57 200	2 400	3 400
7415PD	75	2.9528	190	7.4803	90	3.5433	2.5	.100	1.0	.040	276 000	61 400	280 000	63 000	2 200	3 200
7416PD	80	3.1496	200	7.8740	96	3.7795	2.5	.100	1.0	.040	296 000	66 500	310 000	69 700	2 000	3 000
7417PD	85	3.3465	210	8.2677	104	4.0945	3.0	.120	1.0	.040	307 000	69 400	335 000	74 600	2 000	2 800
7418PD	90	3.5433	225	8.8583	108	4.2520	3.0	.120	1.0	.040	351 000	78 900	400 000	89 900	1 900	2 700
7419PD	95	3.7402	250	9.8425	110	4.3307	3.0	.120	1.0	.040	410 000	92 200	490 000	110 000	1 800	2 400
7420PD	100	3.9370	265	10.4331	120	4.7244	3.0	.120	1.0	.040	449 000	101 000	550 000	124 000	1 600	2 200
7421PD	105	4.1339	290	11.4173	130	5.1181	3.0	.120	1.0	.040	436 000	96 900	560 000	126 000	1 500	2 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85 (single) and C by 1.08 and C_0 by 1.93 (duplex).
3) Listed values are for machined bronze cage, ABEC-1.
For phenolic composition cage, multiply by 1.33 for both grease and oil. For phenolic composition cage, ABEC-5 or 7, multiply by 1.86 for both grease and oil. For pressed steel cage, ABEC-1, multiply by 0.67 for grease and 0.80 for oil. The speed rating adjustment factors have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7000P series 40° angular contact ball bearings single ball bearing

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 1.14$

or

$P = 0.35\ F_R + 0.57\ F_A$ when $F_A/F_R > 1.14$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic radial load rating (from single bearing tables)

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = 0.5\ F_R + 0.26\ F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_A = Radial load

F_A = Thrust load

Minimum thrust load for angular contact ball bearings

Satisfactory operation of angular contact ball bearings requires sufficient traction forces between the balls and races to minimize damage caused by sliding or skidding. This is particularly important at high speeds where the inertia forces of the balls and cage and the viscous drag in the lubricant can have a detrimental influence on the rolling conditions.

The minimum required thrust load can be determined from the following formula.

$$F_A = A\left(\frac{n}{1000}\right)^2 \text{ newtons}$$

or

$$F_A = 0.2248\,A\left(\frac{n}{1000}\right)^2 \text{ pounds}$$

Where, F_A = Minimum thrust load

A = Bearing design factor listed in the following tables

n = Speed in rpm

Note: For duplex bearings mounted in tandem, multiply the single-bearing thrust value by the number of bearings in tandem.

Minimum thrust load A factor

Size	A	Size	A
7200P	0.23	7310P	36.26
7201P	0.29	7311P	57.36
7202P	0.42	7312P	77.30
7203P	0.74	7313P	111.40
7204P	1.32	7314P	144.60
7205P	1.90	7315P	182.70
7206P	3.45	7316P	215.80
7207P	6.73	7317P	269.40
7208P	9.28	7318P	332.30
7209P	13.13	7319P	405.70
7210P	15.48	7320P	629.40
7211P	23.88	7321P	673.40
7212P	35.31	7322P	904.70
7213P	44.55	7324P	1227.00
7214P	53.74	7326P	1631.00
7215P	61.15	7328P	2128.00
7216P	84.07	7330P	2731.00
7217P	112.90	7332P	3198.00
7218P	148.50	7334P	3717.00
7219P	191.90	7336P	5006.00
7220P	224.10	7338P	5739.00
7221P	282.70	7340P	7048.00
7222P	352.10	7405P	10.80
7224P	450.50	7406P	16.17
7226P	604.70	7407P	27.54
7228P	761.60	7408P	38.49
7230P	1074.00	7409P	58.46
7232P	1314.00	7410P	78.46
7234P	1777.00	7411P	111.70
7236P	1981.00	7412P	143.60
7238P	2499.00	7413P	181.90
7240P	3081.00	7414P	309.20
7300P	0.41	7415P	376.40
7301P	0.59	7416P	452.40
7302P	0.85	7417P	542.30
7303P	1.53	7418P	724.60
7304P	1.91	7419P	1083.00
7305P	3.85	7420P	1387.00
7306P	7.39	7421P	1546.00
7307P	11.66		
7308P	17.31		
7309P	29.08		

7000P series 40° angular contact ball bearings single bearing

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309P
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 13300

Case 1

Radial load (F_R) = 1750

Thrust load (F_A) = 1960

F_A/F_R = 1960/1750 = 1.12

Since F_A/F_R < 1.14, equivalent load (P) = F_R = 1750

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13300}{1750}\right)^3 = 439 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13300}{1750}\right)^3$$

= 3658 Hrs

Case 2

Radial load (F_R) = 1750

Thrust load (F_A) = 2450

F_A/F_R = 2450/1750 = 1.40

Since F_A/F_R > 1.14, equivalent load (P) = 0.35 F_R + 0.57 F_A

P = 0.35 x 1750 +0.57 x 2450 = 2009

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13300}{2009}\right)^3 = 290 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13300}{2009}\right)^3$$

= 2418 Hrs

Case 3

Thrust load (F_A) = 2450

F_A/F_R = 2450/0 = ∞

Since F_A/F_R > 1.14, equivalent load (P) = 0.35 F_R + W0.57 F_A

P = 0.57 x 2450 = 1397

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13300}{1397}\right)^3 = 863 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13300}{1397}\right)^3$$

= 7191 Hrs

7000PD series 40° angular contact ball bearings duplex

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

DB or DF pair

$P = 1.0\ F_R + 0.55\ F_A$ when $F_A / F_R \leq 1.14$

$P = 0.57\ F_R + 0.93\ F_A$ when $F_A / F_R > 1.14$

Tandem DT

$P = 1.0\ F_R$ when $F_A / F_R \leq 1.14$

$P = 0.35\ F_R + 0.57\ F_A$ when $F_A / F_R > 1.14$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

P = Dynamic equivalent radial load

n = Speed in rpm

For DB or DF mounting:

C = Duplex pair dynamic radial load rating (from duplex bearing tables)

or

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where i = 2

For DT tandem mounting:

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where i = number of bearings in set

Static equivalent radial load

$P_0 = 1.0\ F_R + 0.52\ F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309PDT

3 bearings in tandem

Speed: 2000 rpm

Single-row basic dynamic radial load rating (C) = 13300

Case 1

Thrust load (F_A) = 4200

$F_A/F_R = 4200/0 = \infty$

Since $F_A/F_R > 1.14$, equivalent load

$(P) = 0.35\ F_R + 0.57\ F_A = 0.57 \times 4200 = 2394$

or

Load rating = $(i)^{0.7} \times 13300 = (3)^{0.7} \times 13300 = 28697$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{28697}{2394}\right)^3 = 1722 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{28697}{2394}\right)^3$$

= 14353 Hrs

Case 2

Radial load (F_R) = 3500

Thrust load (F_A) = 4200

$F_A/F_R = 4200/3500 = 1.20$

Since $F_A/F_R > 1.14$, equivalent load

$(P) = 0.35\ F_R + 0.57\ F_A$

$= 0.35 \times 3500 + 0.57 \times 4200 = 3619$

Load rating = $(i)^{0.7} \times 13300 = (3)^{0.7} \times 13300 = 28697$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{28697}{3619}\right)^3 = 299 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{28697}{3619}\right)^3$$

= 4155 Hrs

7000PD series 40° angular contact ball bearings duplex

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309PDU (DB or DF pair)
Speed: 2000 rpm
Duplex pair basic dynamic radial load rating (C) = 21900

Case 1

Radial load (F_R) = 1750
Thrust load (F_A) = 1960
F_A/F_R = 1960/1750 = 1.12
Since F_A/F_R < 1.14, equivalent load
(P) = 1.0 F_R + 0.55 F_A
= 1.0 x 1750 +0.55 x 1960 = 2828

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{2828}\right)^3 = 464 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{2828}\right)^3$$

= 3870 Hrs

Case 2

Radial load (F_R) = 1750
Thrust load (F_A) = 2450
F_A/F_R = 2450/1750 = 1.40
Since F_A/F_R > 1.14, equivalent load
(P) = 0.57 F_R + 0.93 F_A
= 0.57 x 1750 +0.93 x 2450 = 3276

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{3276}\right)^3 = 299 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{3276}\right)^3$$

= 2490 Hrs

Case 3

Thrust load (F_A) = 2450
F_A/F_R = 2450/0 = ∞
Since F_A/F_R > 1.14, equivalent load
(P) = 0.57 F_R + 0.93 F_A = 0.93 x 2450 = 2279

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{2279}\right)^3 = 887 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L\,10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{2279}\right)^3$$

= 7395 Hrs

Case 4

Radial load (F_R) = 1750
F_A/F_R = 0/1750 = 0
Since F_A/F_R < 1.14, equivalent load
(P) = 1.0 F_R + 0.55 F_A = 1.0 x 1750 = 1750

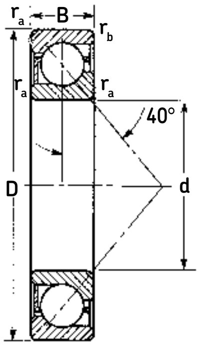
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{1750}\right)^3 = 1960 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{1750}\right)^3$$

= 16332 Hrs

7000PJ series single-row 40° angular contact ball bearings



Angular contact ball bearings with a PJ suffix have one heavy race shoulder and one counterbored race shoulder on the outer ring; opposing one heavy race shoulder and one counterbored race shoulder on the inner ring. Because of this construction, it is possible for this bearing to incorporate a greater number of balls than a deep groove, nonfilling notch bearing. The combination of maximum ball complement, optimum race groove depth, and the 40° contact angle results in high thrust load carrying capacity.

7000PJ series bearings are particularly suitable for positions where the thrust is always present in **one** direction. They should **not** be used where the bearing is subjected to radial load only; or combined radial and thrust load where the radial load is predominant. When heavy thrust must be taken in both directions, the PJD series angular contact ball bearings may be mounted in a back-to-back or face-to-face duplex arrangement with another angular contact bearing.

7000PJ series bearings are available with either pressed brass or machined brass, ball centered cages. The low shoulder diameters on the nonthrust sides of the inner and outer rings, combined with large clearances between the land diameters and the cage allow for large quantities of oil to flow through these bearings. The increased oil flow reduces operating temperature and theoretically increases bearing life.

ABEC-3 bore tolerances reduce the range of interference fits between the shaft and bearing bore. These tighter tolerances result in closer control of preload and minimize the risk of thermal runaway.

Series		Page
7200PJ	Light - single bearing	**154**
7200PJD	Light - duplex set	**154**
7300PJ	Medium - single bearing	**155**
7300PJD	Medium - duplex set	**155**
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7000PJ	Equivalent load and life	**158**
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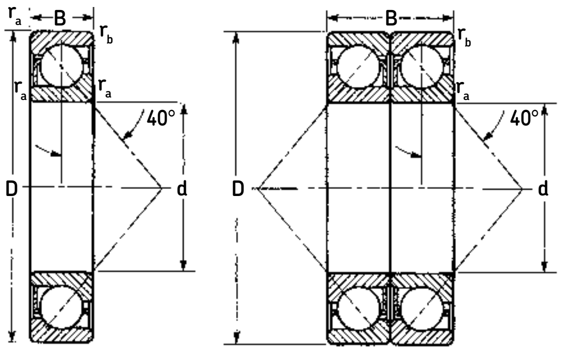
7200PJ light series and 7200PJD light series duplex



7200PJ and PJD series bearings are used for heavy one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

Notes:
"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

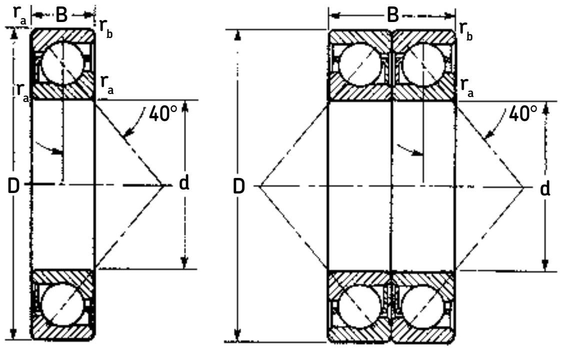
Values for PJD bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and -3 are stocked as half-pairs, where available.

	Bore		Outside diameter		Width		Fillet radius[1]				Basic radial load rating[2]				Speed rating[3]	
											Dynamic		Static			
MRC bearing number	d mm	in.	D mm	in.	B mm	in.	r_a mm	in.	r_b mm	in.	C[4] N	lbf	C_0 N	lbf	Grease rpm	Oil rpm
7205PJ	25	**.9843**	52	**2.0472**	15	**.5906**	1.0	**.04**	.60	**.024**	15 600	**3 510**	10 200	**2 290**	10 000	15 000
7206PJ	30	**1.1811**	62	**2.4409**	16	**.6299**	1.0	**.04**	.60	**.024**	23 800	**5 350**	15 600	**3 510**	8 500	12 000
7207PJ	35	**1.3780**	72	**2.8346**	17	**.6693**	1.0	**.04**	.60	**.024**	30 700	**6 900**	20 800	**4 680**	8 000	11 000
7208PJ	40	**1.5748**	80	**3.1496**	18	**.7087**	1.0	**.04**	.60	**.024**	36 400	**8 180**	26 000	**5 850**	7 000	9 500
7209PJ	45	**1.7717**	85	**3.3465**	19	**.7480**	1.0	**.04**	.60	**.024**	37 700	**8 480**	28 000	**6 300**	6 700	9 000
7210PJ	50	**1.9685**	90	**3.5433**	20	**.7874**	1.0	**.04**	.60	**.024**	39 000	**8 770**	30 500	**6 860**	6 000	8 000
7211PJ	55	**2.1654**	100	**3.9370**	21	**.8268**	1.5	**.06**	1.00	**.040**	48 800	**11 000**	38 000	**8 540**	5 600	7 500
7212PJ	60	**2.3622**	110	**4.3307**	22	**.8661**	1.5	**.06**	1.00	**.040**	57 200	**12 900**	45 500	**10 200**	5 000	6 700
7213PJ	65	**2.5591**	120	**4.7244**	23	**.9055**	1.5	**.06**	1.00	**.040**	66 300	**14 900**	54 000	**12 100**	4 500	6 000
7214PJ	70	**2.7559**	125	**4.9213**	24	**.9449**	1.5	**.06**	1.00	**.040**	71 500	**16 100**	60 000	**13 500**	4 300	5 600
7215PJ	75	**2.9528**	130	**5.1181**	25	**.9843**	1.5	**.06**	1.00	**.040**	72 800	**16 400**	64 000	**14 400**	4 000	5 300
7216PJ	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.0	**.08**	1.00	**.040**	83 200	**18 700**	73 500	**16 500**	3 800	5 000
7217PJ	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.0	**.08**	1.00	**.040**	95 600	**21 500**	83 000	**18 700**	3 600	4 800
7218PJ	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.0	**.08**	1.00	**.040**	108 000	**24 300**	96 500	**21 700**	3 400	4 500
7200PJD																
7205PJD	25	**.9843**	52	**2.0472**	30	**1.1811**	1.0	**.04**	.60	**.024**	25 100	**5 640**	20 400	**4 590**	8 500	12 000
7206PJD	30	**1.1811**	62	**2.4409**	32	**1.2598**	1.0	**.04**	.60	**.024**	39 000	**8 770**	31 000	**6 970**	7 500	10 000
7207PJD	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.0	**.04**	.60	**.024**	50 700	**11 400**	41 500	**9 330**	6 300	8 500
7208PJD	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.0	**.04**	.60	**.024**	59 200	**13 300**	52 000	**11 700**	5 600	7 500
7209PJD	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.0	**.04**	.60	**.024**	61 800	**13 900**	56 000	**12 600**	5 300	7 000
7210PJD	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.0	**.04**	.60	**.024**	63 700	**14 300**	61 000	**13 700**	4 800	6 300
7211PJD	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.5	**.06**	1.00	**.040**	78 000	**17 500**	76 500	**17 200**	4 500	6 000
7212PJD	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.5	**.06**	1.00	**.040**	93 600	**21 000**	91 500	**20 600**	4 000	5 300
7213PJD	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.5	**.06**	1.00	**.040**	108 000	**24 300**	108 000	**24 300**	3 600	4 800
7214PJD	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.5	**.06**	1.00	**.040**	114 000	**25 600**	118 000	**26 500**	3 400	4 500
7215PJD	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.5	**.06**	1.00	**.040**	119 000	**26 800**	127 000	**28 600**	3 200	4 300
7216PJD	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.0	**.08**	1.00	**.040**	135 000	**30 400**	146 000	**32 800**	3 000	4 000
7217PJD	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.0	**.08**	1.00	**.040**	156 000	**35 100**	166 000	**37 300**	2 800	3 800
7218PJD	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.0	**.08**	1.00	**.040**	178 000	**40 000**	193 000	**43 400**	2 600	3 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85 (single) and C by 1.08 and C_0 by 1.93 (duplex).
3) Listed values are for pressed brass and steel or polyamide cage. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

7300PJ medium series and 7300PJD medium series duplex



7300PJ and PJD series bearings are used for very heavy one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

Notes:
"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

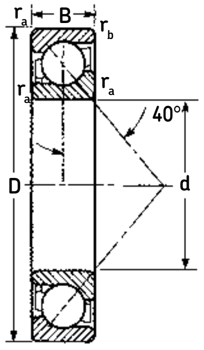
Values for PJD bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

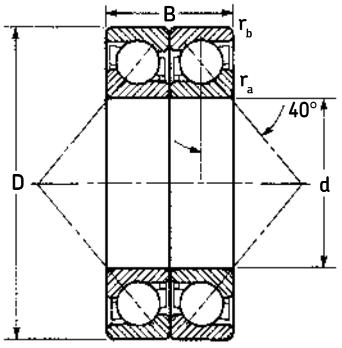
ABEC-1 and -3 ARE stocked as half-pairs, where available.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	r_b mm	in.	Basic radial load rating[2)] Dynamic C[4)] N	lbf	Static C_0 N	lbf	Speed rating[3)] Grease rpm	Oil rpm
7304PJ	20	.7874	52	2.0472	15	.5906	1.0	.04	.60	.024	19 000	4 270	10 400	2 340	11 000	16 000
7305PJ	25	.9843	62	2.4409	17	.6693	1.0	.04	.60	.024	26 000	5 850	15 600	3 510	9 000	13 000
7306PJ	30	1.1811	72	2.8346	19	.7480	1.0	.04	.60	.024	34 500	7 760	21 200	4 770	8 000	11 000
7307PJ	35	1.3780	80	3.1496	21	.8268	1.5	.06	1.00	.040	39 000	8 770	24 500	5 510	7 500	10 000
7308PJ	40	1.5748	90	3.5433	23	.9055	1.5	.06	1.00	.040	49 400	11 100	33 500	7 530	6 700	9 000
7309PJ	45	1.7717	100	3.9370	25	.9843	1.5	.06	1.00	040	60 500	13 600	41 500	9 330	6 000	8 000
7310PJ	50	1.9685	110	4.3307	27	1.0630	2.0	.08	1.00	.040	74 100	16 700	51 000	11 500	5 300	7 000
7311PJ	55	2.1654	120	4.7244	29	1.1417	2.0	.08	1.00	.040	85 200	19 200	60 000	13 500	4 800	6 300
7312PJ	60	2.3622	130	5.1181	31	1.2205	2.0	.08	1.00	.040	95 600	21 500	69 500	15 600	4 500	6 000
7313PJ	65	2.5591	140	5.5118	33	1.2992	2.0	.08	1.00	.040	108 000	24 300	80 000	18 000	4 300	5 600
7314PJ	70	2.7559	150	5.9055	35	1.3780	2.0	.08	1.00	.040	119 000	26 800	90 000	20 200	3 800	5 000
7315PJ	75	2.9528	160	6.2992	37	1.4567	2.0	.08	1.00	.040	133 000	29 900	106 000	23 800	3 600	4 800
7316PJ	80	3.1496	170	6.6929	39	1.5354	2.0	.08	1.00	.040	143 000	32 200	118 000	26 500	3 400	4 500
7317PJ	85	3.3465	180	7.0866	41	1.6142	2.5	.10	1.00	.040	153 000	34 400	132 000	29 700	3 200	4 300
7318PJ	90	3.5433	190	7.4803	43	1.6929	2.5	.10	1.00	.040	165 000	37 100	146 000	32 800	3 000	4 000
7319PJ	95	3.7402	200	7.8740	45	1.7717	2.5	.10	1.00	.040	178 000	40 000	163 000	36 600	2 800	3 800
7300PJD																
7304PJD	20	.7874	52	2.0472	30	1.1811	1.0	.04	.60	.024	30 700	6 900	20 800	4 680	9 000	13 000
7305PJD	25	.9843	62	2.4409	34	1.3386	1.0	.04	.60	.024	42 300	9 510	31 000	6 970	7 500	10 000
7306PJD	30	1.1811	72	2.8346	38	1.4961	1.0	.04	.60	.024	55 900	12 600	42 500	9 550	6 700	9 000
7307PJD	35	1.3780	80	3.1496	42	1.6535	1.5	.06	1.00	.040	62 400	14 000	49 000	11 000	6 000	8 000
7308PJD	40	1.5748	90	3.5433	46	1.8110	1.5	.06	1.00	.040	79 300	17 800	65 500	14 700	5 300	7 000
7309PJD	45	1.7717	100	3.9370	50	1.9685	1.5	.06	1.00	.040	97 500	21 900	81 500	18 300	4 800	6 300
7310PJD	50	1.9685	110	4.3307	54	2.1260	2.0	.08	1.00	.040	119 000	26 800	102 000	22 900	4 300	5 600
7311PJD	55	2.1654	120	4.7244	58	2.2835	2.0	.08	1.00	.040	138 000	31 000	120 000	27 000	3 800	5 000
7312PJD	60	2.3622	130	5.1181	62	2.4409	2.0	.08	1.00	.040	156 000	35 100	140 000	31 500	3 600	4 800
7313PJD	65	2.5591	140	5.5118	66	2.5984	2.0	.08	1.00	.040	174 000	39 100	160 000	36 000	3 200	4 300
7314PJD	70	2.7559	150	5.9055	70	2.7559	2.0	.08	1.00	.040	195 000	43 800	180 000	40 500	3 000	4 000
7315PJD	75	2.9528	160	6.2992	74	2.9134	2.0	.08	1.00	.040	212 000	47 700	212 000	47 700	2 800	3 800
7316PJD	80	3.1496	170	6.6929	78	3.0709	2.0	.08	1.00	.040	229 000	51 500	236 000	53 100	2 600	3 600
7317PJD	85	3.3465	180	7.0866	82	3.2283	2.5	.10	1.00	.040	251 000	56 400	265 000	59 600	2 400	3 400
7318PJD	90	3.5433	190	7.4803	86	3.3858	2.5	.10	1.00	.040	270 000	60 700	290 000	65 200	2 200	3 200
7319PJD	95	3.7402	200	7.8740	90	3.5433	2.5	.10	1.00	.040	286 000	64 300	325 000	73 100	2 000	3 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85 (single) and C by 1.08 and C_0 by 1.93 (duplex).
3) Listed values are for pressed brass and steel or polyamide cage. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

7400PJ heavy series and 7400PJD heavy series duplex





7400PJ and PJD series bearings are similar to the 7200PJ and 7300PJ series, but are heavier sectioned; and are used for very heavy one-directional thrust loads, or combined radial and thrust loads where the thrust load is predominant.

Caution: Single bearings are not to be used where only radial loads are present. For two-directional thrust loads, use duplex bearings.

Notes:
"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

Values for D bearings are for back-to-back (DB) or face-to-face (DF) mounting arrangements.

ABEC-1 and 3 are stocked as half-pairs, where available.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	r_b mm	in.	Basic radial load rating[2)] Dynamic C[4)] N	lbf	Static C_0 N	lbf	Speed rating[3)] Grease rpm	Oil rpm
7405PJ	25	**.9843**	80	**3.1496**	21	**.8268**	1.5	**.060**	1.0	**.040**	39 700	**8 920**	23 600	**5 310**	7 000	10 000
7406PJ	30	**1.1811**	90	**3.5433**	23	**.9055**	1.5	**.060**	1.0	**.040**	47 500	**10 700**	29 000	**6 520**	6 300	9 000
7407PJ	35	**1.3780**	100	**3.9370**	25	**.9843**	1.5	**.060**	1.0	**.040**	60 500	**13 600**	38 000	**8 540**	5 600	7 500
7408PJ	40	**1.5748**	110	**4.3307**	27	**1.0630**	2.0	**.080**	1.0	**.040**	70 200	**15 800**	45 500	**10 200**	5 300	7 000
7409PJ	45	**1.7717**	120	**4.7244**	29	**1.1417**	2.0	**.080**	1.0	**.040**	85 200	**19 200**	55 000	**12 400**	4 800	6 300
7410PJ	50	**1.9685**	130	**5.1181**	31	**1.2205**	2.0	**.080**	1.0	**.040**	95 600	**21 500**	64 000	**14 400**	4 300	6 000
7411PJ	55	**2.1654**	140	**5.5118**	33	**1.2992**	2.0	**.080**	1.0	**.040**	111 000	**25 000**	76 500	**17 200**	4 000	5 600
7412PJ	60	**2.3622**	150	**5.9055**	35	**1.3780**	2.0	**.080**	1.0	**.040**	119 000	**26 800**	86 500	**19 400**	3 600	5 000
7413PJ	65	**2.5591**	160	**6.2992**	37	**1.4567**	2.0	**.080**	1.0	**.040**	130 000	**29 200**	96 500	**21 700**	3 400	4 800
7414PJ	70	**2.7559**	180	**7.0866**	42	**1.6535**	2.5	**.100**	1.0	**.040**	159 000	**35 700**	127 000	**28 600**	3 000	4 300
7415PJ	75	**2.9528**	190	**7.4803**	45	**1.7717**	2.5	**.100**	1.0	**.040**	168 000	**37 800**	140 000	**31 500**	2 800	4 000
7416PJ	80	**3.1496**	200	**7.8740**	48	**1.8898**	2.5	**.100**	1.0	**.040**	178 000	**40 000**	153 000	**34 400**	2 600	3 800
7417PJ	85	**3.3465**	210	**8.2677**	52	**2.0472**	3.0	**.120**	1.0	**.040**	190 000	**42 700**	166 000	**37 300**	2 500	3 600
7418PJ	90	**3.5433**	225	**8.8583**	54	**2.1260**	3.0	**.120**	1.0	**.040**	216 000	**48 600**	200 000	**45 000**	2 400	3 400
7419PJ	95	**3.7402**	250	**9.8425**	55	**2.1654**	3.0	**.120**	1.0	**.040**	251 000	**56 400**	245 000	**55 100**	2 200	3 000
7420PJ	100	**3.9370**	265	**10.4331**	60	**2.3622**	3.0	**.120**	1.0	**.040**	276 000	**62 000**	275 000	**61 800**	2 000	2 800
7421PJ	105	**4.1339**	290	**11.4173**	65	**2.5591**	3.0	**.120**	1.0	**.040**	265 000	**59 600**	280 000	**62 900**	1 900	2 600
7400PJD																
7405PJD	25	**.9843**	80	**3.1496**	42	**1.6535**	1.5	**.060**	1.0	**.040**	65 000	**14 500**	47 500	**10 600**	5 600	8 000
7406PJD	30	**1.1811**	90	**3.5433**	46	**1.8110**	1.5	**.060**	1.0	**.040**	78 000	**17 400**	58 500	**13 000**	5 000	7 200
7407PJD	35	**1.3780**	100	**3.9370**	50	**1.9685**	1.5	**.060**	1.0	**.040**	97 500	**22 100**	76 500	**17 100**	4 500	6 000
7408PJD	40	**1.5748**	110	**4.3307**	54	**2.1260**	2.0	**.080**	1.0	**.040**	114 000	**25 700**	91 000	**20 400**	4 300	5 600
7409PJD	45	**1.7717**	120	**4.7244**	58	**2.2835**	2.0	**.080**	1.0	**.040**	138 000	**31 200**	110 000	**24 800**	3 800	5 000
7410PJD	50	**1.9685**	130	**5.1181**	62	**2.4409**	2.0	**.080**	1.0	**.040**	156 000	**34 900**	129 000	**28 800**	3 400	4 800
7411PJD	55	**2.1654**	140	**5.5118**	66	**2.5984**	2.0	**.080**	1.0	**.040**	182 000	**40 600**	153 000	**34 400**	3 200	4 500
7412PJD	60	**2.3622**	150	**5.9055**	70	**2.7559**	2.0	**.080**	1.0	**.040**	195 000	**43 600**	173 000	**38 800**	2 800	4 000
7413PJD	65	**2.5591**	160	**6.2992**	74	**2.9134**	2.0	**.080**	1.0	**.040**	212 000	**47 400**	193 000	**43 400**	2 700	3 800
7414PJD	70	**2.7559**	180	**7.0866**	84	**3.3071**	2.5	**.100**	1.0	**.040**	260 000	**58 000**	255 000	**57 200**	2 400	3 400
7415PJD	75	**2.9528**	190	**7.4803**	90	**3.5433**	2.5	**.100**	1.0	**.040**	276 000	**61 400**	280 000	**63 000**	2 200	3 200
7416PJD	80	**3.1496**	200	**7.8740**	96	**3.7795**	2.5	**.100**	1.0	**.040**	288 000	**64 800**	306 000	**68 800**	2 000	3 000
7417PJD	85	**3.3465**	210	**8.2677**	104	**4.0945**	3.0	**.120**	1.0	**.040**	307 000	**69 400**	335 000	**74 600**	2 000	2 800
7418PJD	90	**3.5433**	225	**8.8583**	108	**4.2520**	3.0	**.120**	1.0	**.040**	351 000	**78 900**	400 000	**89 900**	1 900	2 700
7419PJD	95	**3.7402**	250	**9.8425**	110	**4.3307**	3.0	**.120**	1.0	**.040**	410 000	**92 200**	490 000	**110 000**	1 800	2 400
7420PJD	100	**3.9370**	265	**10.4331**	120	**4.7244**	3.0	**.120**	1.0	**.040**	449 000	**101 000**	550 000	**124 000**	1 600	2 200
7421PJD	105	**4.1339**	290	**11.4173**	130	**5.1181**	3.0	**.120**	1.0	**.040**	436 000	**96 900**	560 000	**126 000**	1 500	2 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85 (single) and C by 1.08 and C_0 by 1.93 (duplex).
3) Listed values are for machined bronze cage, ABEC-1. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

7000PJ series 40° angular contact ball bearings single bearing

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 1.14$

or

$P = 0.35\ F_R + 0.57\ F_A$ when $F_A/F_R > 1.14$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic radial load rating (from single bearing tables)

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = 0.5\ F_R + 0.26\ F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Minimum thrust load for angular contact ball bearings

Satisfactory operation of angular contact ball bearings requires sufficient traction forces between the balls and races to minimize damage caused by sliding or skidding. This is particularly important at high speeds where the inertia forces of the balls and cage and the viscous drag in the lubricant can have a detrimental influence on the rolling conditions.

The minimum required thrust load can be determined from the following formula.

$$F_A = A\left(\frac{n}{1000}\right)^2 \text{ newtons}$$

or

$$F_A = 0.2248\,A\left(\frac{n}{1000}\right)^2 \text{ pounds}$$

where, F_A = Minimum thrust load

A = Bearing design factor listed in the following tables

n = Speed in rpm

Note: For duplex bearings mounted in tandem, multiply the single-bearing thrust value by the number of bearings in tandem.

Minimum thrust load A factor

Size	A	Size	A
7205PJ	1.71	7304PJ	2.07
7206PJ	4.07	7305PJ	4.30
7207PJ	7.29	7306PJ	8.13
7208PJ	10.92	7307PJ	11.10
7209PJ	12.80	7308PJ	18.88
7210PJ	15.04	7309PJ	29.19
7211PJ	23.48	7310PJ	45.54
7212PJ	34.61	7311PJ	62.57
7213PJ	47.73	7312PJ	84.44
7214PJ	56.67	7313PJ	111.50
7215PJ	63.52	7314PJ	144.60
7216PJ	84.96	7315PJ	184.90
7217PJ	113.70	7316PJ	233.80
7218PJ	148.60	7317PJ	291.90
		7318PJ	360.00
		7319PJ	439.50

7000PJ series 40° angular contact ball bearings single bearing

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309PJ
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 13600

Case 1

Radial load (F_R) = 1750
Thrust load (F_A) = 1960
F_A/F_R = 1960/1750 = 1.12
Since F_A/F_R < 1.14, equivalent load (P) = F_R = 1750

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13600}{1750}\right)^3 = 469 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13600}{1750}\right)^3$$

= 3911 Hrs

Case 2

Radial load (F_R) = 1750
Thrust load (F_A) = 2450
F_A/F_R = 2450/1750 = 1.40
Since F_A/F_R > 1.14, equivalent load (P) = 0.35 F_R + 0.57 F_A
P = 0.35 x 1750 +0.57 x 2450 = 2009

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13600}{2009}\right)^3 = 310 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13600}{2009}\right)^3$$

= 2585 Hrs

Case 3

Thrust load (F_A) = 2450
F_A/F_R = 2450/0 = ∞
Since F_A/F_R > 1.14, equivalent load (P) = 0.35 F_R + 0.57 F_A
P = 0.57 x 2450 = 1397

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13600}{1397}\right)^3 = 923 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L\,10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13600}{1397}\right)^3$$

= 7689 Hrs

7000PJD series 40° angular contact ball bearings duplex

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

DB or DF pair

$P = 1.0\,F_R + 0.55\,F_A$ when $F_A/F_R \leq 1.14$

$P = 0.57\,F_R + 0.93\,F_A$ when $F_A/F_R > 1.14$

Tandem DT

$P = 1.0\,F_R$ when $F_A/F_R \leq 1.14$

$P = 0.35\,F_R + 0.57\,F_A$ when $F_A/F_R > 1.14$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

P = Dynamic equivalent radial load

n = Speed in rpm

For DB or DF mounting:

C = Duplex pair dynamic radial load rating (from duplex bearing tables)

or

C = Single-row dynamic radial load rating times $(i)^{0.7}$, where i = 2

For tandem mounting:

C = Single-row dynamic radial load rating times $(i)^{0.7}$ where i = number of bearings in set

Static equivalent radial load

$P_0 = 1.0\,F_R + 0.52\,F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309PJDT

3 bearings in tandem

Speed: 2000 rpm

Single-row basic dynamic radial load rating (C) = 13600

Case 1

Thrust load (F_A) = 4200

$F_A/F_R = 4200/0 = \infty$

Since $F_A/F_R > 1.14$, equivalent load

(P) = $0.35\,F_R + 0.57\,F_A = 0.57 \times 4200 = 2394$

Load rating = $(i)^{0.7} \times 13600 = (3)^{0.7} \times 13600 = 29344$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{29344}{2394}\right)^3 = 1842 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{29344}{2394}\right)^3$$

= 15346 Hrs

Case 2

Radial load (F_R) = 3500

Thrust load (F_A) = 4200

$F_A/F_R = 4200/3500 = 1.20$

Since $F_A/F_R > 1.14$, equivalent load

(P) = $0.35\,F_R + 0.57\,F_A$

= $0.35 \times 3500 + 0.57 \times 4200 = 3619$

Load rating = $(i)^{0.7} \times 13600 = (3)^{0.7} \times 13600 = 29344$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{29344}{3619}\right)^3 = 533 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{29344}{3619}\right)^3$$

= 4442 Hrs

7000PJD series 40° angular contact ball bearings duplex

Dynamic equivalent radial load and life calculation examples

Bearing size: 7309PJDU (DB or DF pair)
Speed: 2000 rpm
Duplex pair basic dynamic radial load rating (C) = 21900

Case 1

Radial load (F_R) = 1750

Thrust load (F_A) = 1960

F_A/F_R = 1960/1750 = 1.12

Since $F_A/F_R < 1.14$, equivalent load

(P) = 1.0 F_R + 0.55 F_A

= 1.0 x 1750 +0.55 x 1960 = 2828

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{2828}\right)^3 = 464 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{2828}\right)^3$$

= 3870 Hrs

Case 2

Radial load (F_R) = 1750

Thrust load (F_A) = 2450

F_A/F_R = 2450/1750 = 1.40

Since $F_A/F_R > 1.14$, equivalent load

(P) = 0.57 F_R + 0.93 F_A

= 0.57 x 1750 +0.93 x 2450 = 3276

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{3276}\right)^3 = 299 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{3276}\right)^3$$

= 2490 Hrs

Case 3

Thrust load (F_A) = 2450

$F_A/F_R = 2450/0 = \infty$

Since $F_A/F_R > 1.14$, equivalent load

(P) = 0.57 F_R + 0.93 F_A = 0.93 x 2450 = 2279

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{2279}\right)^3 = 887 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L\,10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{2279}\right)^3$$

= 7395 Hrs

Case 4

Radial load (F_R) = 1750

F_A/F_R = 0/1750 = 0

Since $F_A/F_R < 1.14$, equivalent load

(P) = 1.0 F_R + 0.55 F_A = 1.0 x 1750 = 1750

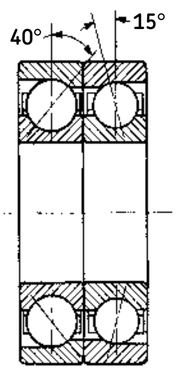
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{21900}{1750}\right)^3 = 1960 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{21900}{1750}\right)^3$$

= 16332 Hrs

PumPac® 8000, 8000BB and 8000AAB series



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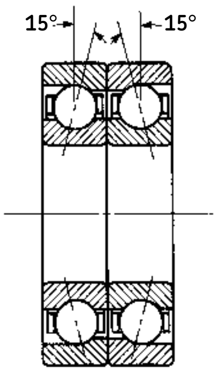
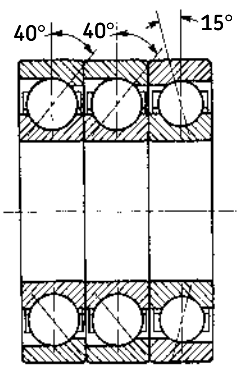


8000BB



8000AAB

The PumPac 8000 series consists of a matched set of 40° (A) and 15° (B) angular contact ball bearings with computer optimized internal design. They are manufactured to ABEC-3 tolerances and are supplied with an inner ring centered machined brass cage.

Also available is the 8000BB PumPac Diamond series consisting of two 15° (B) bearings in a back-to-back (DB) arrangement; and the 8000AAB series consisting of two 40° (A) bearings in tandem, matched back-to-back (DB) with one 15° (B) bearing. Each arrangement incorporates a small amount of axial clearance, when clamped, to compensate for mounting fits and thermal growth.

PumPac 8000, 8000BB and 8000AAB series

The PumPac 8000 series is used in centrifugal pumps, large vertical electric motors, compressors, centrifuges, and other applications subject to thrust loads operating at relatively high speeds. The bearings are mounted so that the 40° (A) bearing takes the primary thrust load.

Traditionally, matched sets of 40° angular contact ball bearings are used to obtain maximum theoretical fatigue life, but in most instances only a fraction of the calculated life is actually achieved. At the heart of these premature failures are phenomena known as “ball sliding” and “ball shuttling” in the unloaded (or inactive) bearing. Angular contact bearings used in high speed (e.g. 3600 rpm) pumps and other applications require a minimum axial load for proper operation. Without axial load, gyroscopic forces in the unloaded bearing can cause the balls to rotate perpendicular to their true rolling axis and momentarily lose contact with the raceway. As a result, a microscopic wear (or lapping) process occurs giving the appearance of a burnished or polished raceway. The oil film thickness separating the ball and raceway is reduced, producing friction and heat which lowers oil viscosity and accelerates wear. This thermally unstable condition dramatically reduces bearing service life.

The main benefit of the PumPac system is that the 15° (B) bearing is designed with considerably less internal clearance than the 40° (A) bearing, making it less susceptible to the gyroscopic forces which result in ball sliding or shuttling. The 15° bearing also provides additional radial stiffness helping to maintain the integrity of the shaft and mechanical seals. The 40° (loaded) bearing provides sufficient axial rigidity under the imposed thrust load. The 0 is furnished with a one piece, inner ring land-guided, machined brass cage and is manufactured to meet ABEC-3 grade tolerances. Dimensional stability is assured by heat treating the bearing’s rings and rolling elements for operation up to 375° F (190° C).

For identification purposes, the 40° bearing is marked with the letter “A,” and the 15° bearing with the letter “B”. A “V” is etched on the outer ring surface of the pair so that the apex falls on the “B” bearing. The pair should always be mounted so that the “V” points in the same direction as the primary thrust load, which places this load on bearing “A”. Any reversing load is carried on bearing “B”.

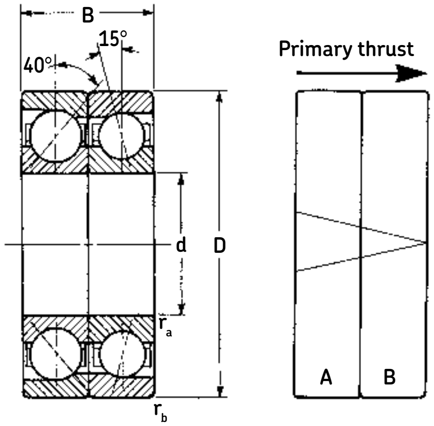
The PumPac is also available in the 8000BB PumPac Diamond series, which consists of a matched set of 15° (B) bearings in a back-to-back arrangement. When mounted correctly, the marking on the outer ring surface forms a diamond. This series is desirable in high speed, lightly loaded applications in which axial loads are balanced, resulting in reduced operating temperatures and increased life.

For applications involving very heavy primary thrust loads, the PumPac may be furnished as a triplex set identified as the 8000AAB series. It consists of two 40° (A) bearings in tandem matched back-to-back (DB) with one 15° (B) bearing. The outer ring surface of the set is marked with a “V” pointing in the direction of primary thrust.

For applications having a rotating shaft and stationary housing, an ISO k5 shaft fit and an ISO H6 housing fit are recommended as shown in the table on page 168.

Note: The basic radial load rating, C, is calculated according to the actual bearing geometry and not according to ISO/ABMA Standards.

PumPac 8000 series



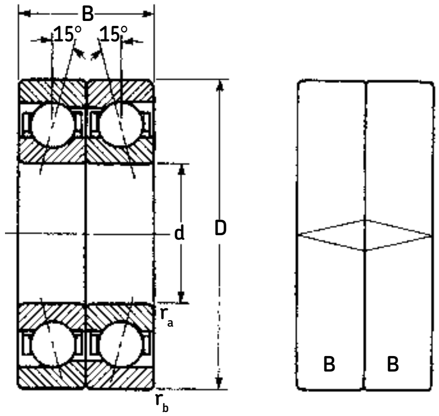
ABEC-3 tolerances

The PumPac 8000 series consists of one 40° (A) bearing and one 15° (B) bearing.

MRC bearing number	Bore d		Outside diameter D		Width B		Fillet radius[1] r_a		r_b		Basic radial load rating[2] 40° (A) Dynamic C[4]		Static C_0		15° (B) Dynamic C[4]		Static C_0		Speed rating[3] Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	N	lbf	N	lbf	rpm	rpm
8218	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.0	**.08**	1.0	**.04**	133 000	**29 900**	143 000	**32 100**	124 000	**27 900**	108 000	**24 300**	3 400	4 500
8219	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.0	**.08**	1.0	**.04**	151 000	**33 900**	163 000	**36 600**	133 000	**29 900**	118 000	**26 500**	3 200	4 300
8220	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.0	**.08**	1.0	**.04**	159 000	**35 700**	173 000	**38 900**	146 000	**32 800**	134 000	**30 100**	3 000	4 000
8222	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.0	**.08**	1.0	**.04**	190 000	**42 700**	220 000	**49 500**	182 000	**40 900**	170 000	**38 200**	2 600	3 600
8224	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.0	**.08**	1.0	**.04**	238 000	**53 500**	245 000	**55 100**	199 000	**44 700**	193 000	**43 400**	2 200	3 200
8238	190	**7.4803**	340	**13.3858**	110	**4.3307**	3.0	**.12**	1.0	**.04**	351 000	**78 900**	570 000	**128 000**	377 000	**84 800**	500 000	**112 000**	1 400	1 900
8308	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.0	**.04**	60 500	**13 600**	45 500	**10 200**	48 800	**11 000**	33 500	**7 530**	6 700	9 000
8309	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.0	**.04**	76 100	**17 100**	61 000	**13 700**	58 500	**13 200**	40 500	**9 100**	6 000	8 000
8310	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.0	**.04**	87 100	**19 600**	72 000	**16 200**	76 100	**17 100**	52 000	**11 700**	5 300	7 000
8311	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.0	**.04**	101 000	**22 700**	85 000	**19 100**	88 400	**19 900**	61 000	**13 700**	4 800	6 300
8312	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.0	**.04**	114 000	**25 600**	96 500	**21 700**	101 000	**22 700**	71 000	**16 000**	4 500	6 000
8313	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.0	**.04**	127 000	**28 500**	112 000	**25 200**	108 000	**24 300**	80 000	**18 000**	4 300	5 600
8314	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.0	**.04**	148 000	**33 300**	134 000	**31 500**	121 000	**27 200**	93 000	**20 900**	3 800	5 000
8315	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.0	**.04**	159 000	**35 700**	150 000	**33 700**	146 000	**32 800**	114 000	**25 600**	3 600	4 800
8316	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.0	**.08**	1.0	**.04**	172 000	**38 700**	166 000	**37 300**	159 000	**35 700**	129 000	**29 200**	3 400	4 500
8317	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.5	**.10**	1.0	**.04**	186 000	**41 800**	186 000	**41 800**	174 000	**39 100**	146 000	**32 800**	3 200	4 300
8318	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.5	**.10**	1.0	**.04**	199 000	**44 700**	204 000	**45 900**	186 000	**41 800**	160 000	**36 000**	3 000	4 000
8319	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.5	**.10**	1.0	**.04**	212 000	**47 600**	228 000	**51 300**	199 000	**44 700**	180 000	**40 500**	2 800	3 800
8320	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.5	**.10**	1.0	**.04**	238 000	**53 500**	270 000	**60 700**	212 000	**47 700**	200 000	**45 000**	2 600	3 600
8322	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.5	**.10**	1.0	**.04**	265 000	**59 600**	320 000	**71 900**	255 000	**57 300**	255 000	**57 300**	2 200	3 200
8326	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.0	**.12**	1.0	**.04**	345 000	**77 500**	455 000	**102 000**	296 000	**66 500**	345 000	**77 600**	1 800	2 600
8330	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.0	**.12**	1.0	**.04**	410 000	**92 100**	585 000	**132 000**	390 000	**87 700**	475 000	**107 000**	1 600	2 200
8336	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.0	**.12**	1.0	**.04**	507 000	**114 000**	815 000	**183 000**	475 000	**107 000**	640 000	**144 000**	1 300	1 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating of bearing (A), multiply C by 1.75 and C_0 by 3.85. For thrust rating of bearing (B), multiply C by 0.83 and C_0 by 2.00.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

PumPac Diamond 8000BB series



ABEC-3 tolerances

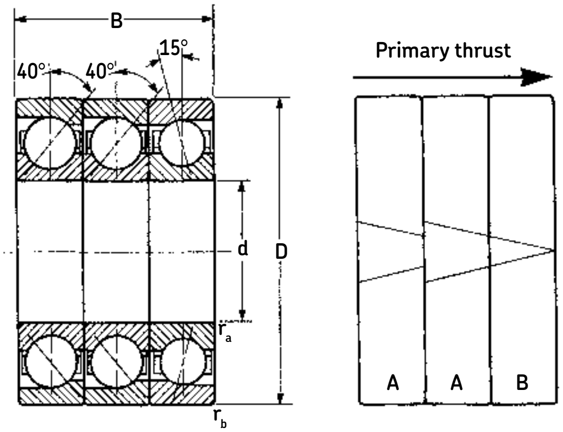
The PumPac 8000BB series consists of two 15° (B) bearings.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
8218BB	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.0	**.08**	1.0	**.04**	203 000	**45 600**	216 000	**48 600**	3 800	5 400
8219BB	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.0	**.08**	1.0	**.04**	216 000	**48 600**	236 000	**53 100**	3 600	5 100
8220BB	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.0	**.08**	1.0	**.04**	238 000	**53 500**	270 000	**60 700**	3 400	4 800
8222BB	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.0	**.08**	1.0	**.04**	296 000	**66 500**	340 000	**76 400**	3 000	4 400
8224BB	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.0	**.08**	1.0	**.04**	319 000	**71 800**	390 000	**87 700**	2 800	4 100
8238BB	190	**7.4803**	340	**13.3858**	110	**4.3307**	3.0	**.12**	1.0	**.04**	605 000	**136 000**	1 000 000	**225 000**	1 800	2 600
8308BB	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.0	**.04**	79 300	**17 800**	67 000	**15 100**	7 500	11 000
8309BB	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.0	**.04**	95 600	**21 500**	81 500	**18 300**	6 800	9 600
8310BB	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.0	**.04**	124 000	**27 900**	104 000	**23 400**	6 300	9 000
8311BB	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.0	**.04**	143 000	**32 100**	122 000	**27 400**	5 600	8 100
8312BB	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.0	**.04**	165 000	**37 100**	143 000	**32 100**	5 000	7 200
8313BB	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.0	**.04**	174 000	**39 100**	160 000	**36 000**	4 800	6 800
8314BB	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.0	**.04**	199 000	**44 700**	190 000	**42 700**	4 500	6 300
8315BB	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.0	**.04**	238 000	**53 500**	228 000	**51 300**	4 300	6 000
8316BB	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.0	**.08**	1.0	**.04**	255 000	**57 300**	260 000	**58 500**	3 800	5 400
8317BB	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.5	**.10**	1.0	**.04**	281 000	**63 200**	292 000	**65 600**	3 600	5 100
8318BB	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.5	**.10**	1.0	**.04**	302 000	**67 900**	325 000	**73 100**	3 400	4 800
8319BB	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.5	**.10**	1.0	**.04**	325 000	**73 100**	360 000	**80 900**	3 300	4 500
8320BB	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.5	**.10**	1.0	**.04**	345 000	**77 600**	400 000	**89 900**	3 000	4 400
8322BB	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.5	**.10**	1.0	**.04**	416 000	**93 500**	510 000	**115 000**	2 600	3 900
8326BB	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.0	**.12**	1.0	**.04**	475 000	**107 000**	695 000	**156 000**	2 300	3 300
8330BB	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.0	**.12**	1.0	**.04**	624 000	**140 000**	950 000	**214 000**	2 000	2 900
8336BB	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.0	**.12**	1.0	**.04**	780 000	**175 000**	1 270 000	**286 000**	1 600	2 400

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 0.51 and C_0 by 1.00.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.

MRC

PumPac 8000AAB series



ABEC-3 tolerances

The PumPac 8000AAB series consists of two 40° (A) bearings and one 15° (B) bearing.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] 40° (A) Dynamic C[4] N	40° (A) Dynamic C[4] lbf	40° (A) Static C_0 N	40° (A) Static C_0 lbf	15° (B) Dynamic C[4] N	15° (B) Dynamic C[4] lbf	15° (B) Static C_0 N	15° (B) Static C_0 lbf	Speed rating[3] Grease rpm	Speed rating[3] Oil rpm
8218AAB	90	**3.5433**	160	**6.2992**	90	**3.5433**	2.0	**.08**	1.0	**.04**	216 000	**48 500**	285 000	**64 100**	124 000	**27 900**	108 000	**24 300**	3 400	4 500
8219AAB	95	**3.7402**	170	**6.6929**	96	**3.7795**	2.0	**.08**	1.0	**.04**	247 000	**55 500**	325 000	**73 100**	133 000	**29 900**	118 000	**26 500**	3 200	4 300
8220AAB	100	**3.9370**	180	**7.0866**	102	**4.0157**	2.0	**.08**	1.0	**.04**	260 000	**58 400**	345 000	**78 700**	146 000	**32 800**	134 000	**30 100**	3 000	4 000
8222AAB	110	**4.3307**	200	**7.8740**	114	**4.4882**	2.0	**.08**	1.0	**.04**	307 000	**69 000**	440 000	**98 900**	182 000	**40 900**	170 000	**38 200**	2 600	3 600
8224AAB	120	**4.7244**	215	**8.4646**	120	**4.7244**	2.0	**.08**	1.0	**.04**	390 000	**87 600**	490 000	**110 000**	199 000	**44 700**	193 000	**43 400**	2 200	3 200
8238AAB	190	**7.4803**	340	**13.3858**	165	**6.4961**	3.0	**.12**	1.0	**.04**	572 000	**129 000**	1140 000	**256 000**	377 000	**84 800**	500 000	**112 000**	1 400	1 900
8308AAB	40	**1.5748**	90	**3.5433**	69	**2.7165**	1.5	**.06**	1.0	**.04**	97 500	**21 900**	91 500	**20 600**	48 800	**11 000**	33 500	**7 530**	6 700	9 000
8309AAB	45	**1.7717**	100	**3.9370**	75	**2.9528**	1.5	**.06**	1.0	**.04**	124 000	**27 900**	122 000	**27 400**	58 500	**13 200**	40 500	**9 100**	6 000	8 000
8310AAB	50	**1.9685**	110	**4.3307**	81	**3.1890**	2.0	**.08**	1.0	**.04**	143 000	**32 100**	143 000	**32 100**	76 100	**17 100**	52 000	**11 700**	5 300	7 000
8311AAB	55	**2.1654**	120	**4.7244**	87	**3.4252**	2.0	**.08**	1.0	**.04**	165 000	**37 100**	170 000	**38 200**	88 400	**19 900**	61 000	**13 700**	4 800	6 300
8312AAB	60	**2.3622**	130	**5.1181**	93	**3.6614**	2.0	**.08**	1.0	**.04**	186 000	**41 800**	193 000	**43 400**	101 000	**22 700**	71 000	**16 000**	4 500	6 000
8313AAB	65	**2.5591**	140	**5.5118**	99	**3.8976**	2.0	**.08**	1.0	**.04**	208 000	**46 700**	224 000	**50 400**	108 000	**24 300**	80 000	**18 000**	4 300	5 600
8314AAB	70	**2.7559**	150	**5.9055**	105	**4.1339**	2.0	**.08**	1.0	**.04**	242 000	**54 400**	270 000	**60 700**	121 000	**27 200**	93 000	**20 900**	3 800	5 000
8315AAB	75	**2.9528**	160	**6.2992**	111	**4.3701**	2.0	**.08**	1.0	**.04**	260 000	**58 400**	300 000	**67 400**	146 000	**32 800**	114 000	**25 600**	3 600	4 800
8316AAB	80	**3.1496**	170	**6.6929**	117	**4.6063**	2.0	**.08**	1.0	**.04**	281 000	**63 100**	335 000	**75 300**	159 000	**35 700**	129 000	**29 200**	3 400	4 500
8317AAB	85	**3.3465**	180	**7.0866**	123	**4.8425**	2.5	**.10**	1.0	**.04**	302 000	**67 900**	375 000	**84 300**	174 000	**39 100**	146 000	**32 800**	3 200	4 300
8318AAB	90	**3.5433**	190	**7.4803**	129	**5.0787**	2.5	**.10**	1.0	**.04**	325 000	**73 000**	405 000	**91 000**	186 000	**41 800**	160 000	**36 000**	3 000	4 000
8319AAB	95	**3.7402**	200	**7.8740**	135	**5.3150**	2.5	**.10**	1.0	**.04**	345 000	**77 500**	455 000	**102 000**	199 000	**44 700**	180 000	**40 500**	2 800	3 800
8320AAB	100	**3.9370**	215	**8.4646**	141	**5.5512**	2.5	**.10**	1.0	**.04**	390 000	**87 600**	540 000	**121 000**	212 000	**47 700**	200 000	**45 000**	2 600	3 600
8322AAB	110	**4.3307**	240	**9.4488**	150	**5.9055**	2.5	**.10**	1.0	**.04**	436 000	**98 000**	640 000	**144 000**	255 000	**57 300**	255 000	**57 300**	2 200	3 200
8326AAB	130	**5.1181**	280	**11.0236**	174	**6.8504**	3.0	**.12**	1.0	**.04**	559 000	**126 000**	915 000	**206 000**	296 000	**66 500**	345 000	**77 600**	1 800	2 600
8330AAB	150	**5.9055**	320	**12.5984**	195	**7.6772**	3.0	**.12**	1.0	**.04**	663 000	**149 000**	1180 000	**265 000**	390 000	**87 700**	475 000	**107 000**	1 600	2 200
8336AAB	180	**7.0866**	380	**14.9606**	225	**8.8583**	3.0	**.12**	1.0	**.04**	824 000	**185 000**	1630 000	**366 000**	475 000	**107 000**	640 000	**144 000**	1 300	1 600

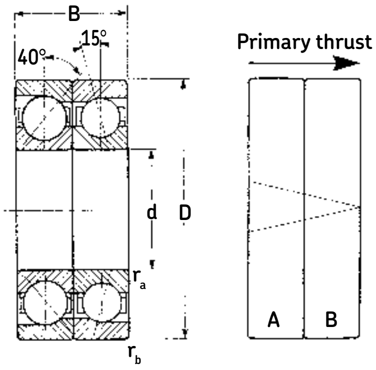
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating of (AA) multiply C by 1.75 and C_0 by 3.85. For thrust rating of (B) multiply C by 0.83 and C_0 by 2.00.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

PumPac shaft and housing fits

MRC bearing number	Shaft diameter (k5) Maximum mm	in.	Minimum mm	in.	Fit[2] .001 mm	.0001 in.	Housing diameter (H6)[1] Maximum mm	in.	Minimum mm	in.	Fit[2] .001 mm	.0001 in.
8218	90.018	**3.5440**	90.003	**3.5434**	3T-33T	**1T-13T**	160.025	**6.3002**	160.000	**6.2992**	0-43L	**0-17L**
8219	95.018	**3.7409**	95.003	**3.7403**	3T-33T	**1T-13T**	170.025	**6.6939**	170.000	**6.6929**	0-43L	**0-17L**
8220	100.018	**3.9377**	100.003	**3.9371**	3T-33T	**1T-13T**	180.025	**7.0876**	180.000	**7.0866**	0-43L	**0-17L**
8222	110.018	**4.3314**	110.003	**4,3308**	3T-33T	**1T-13T**	200.029	**7.8751**	200.000	**7.8740**	0-49L	**0-19L**
8224	120.018	**4.7251**	120.003	**4.7245**	3T-33T	**1T-13T**	215.029	**8.4657**	215.000	**8.4646**	0-49L	**0-19L**
8238	190.024	**7.4812**	190.004	**7.4805**	4T-46T	**2T-18T**	340.036	**13.3872**	340.000	**13.3858**	0-64L	**0-25L**
8308	40.013	**1.5753**	40.002	**1.5749**	2T-23T	**1T-9T**	90.022	**3.5442**	90.000	**3.5433**	0-35L	**0-14L**
8309	45.013	**1.7722**	45.002	**1.7718**	2T-23T	**1T-9T**	100.022	**3.9379**	100.000	**3.9370**	0-35L	**0-14L**
8310	50.013	**1.9690**	50.002	**1.9686**	2T-23T	**1T-9T**	110.022	**4.3316**	110.000	**4.3307**	0-35L	**0-14L**
8311	55.015	**2.1660**	55.002	**2.1655**	2T-27T	**1T-11T**	120.022	**4.7253**	120.000	**4.7244**	0-35L	**0-14L**
8312	60.015	**2.3628**	60.002	**2.3623**	2T-27T	**1T-11T**	130.025	**5.1191**	130.000	**5.1181**	0-40L	**0-16L**
8313	65.015	**2.5597**	65.002	**2.5592**	2T-27T	**1T-11T**	140.025	**5.5128**	140.000	**5.5118**	0-40L	**0-16L**
8314	70.015	**2.7565**	70.002	**2.7560**	2T-27T	**1T-11T**	150.025	**5.9065**	150.000	**5.9055**	0-40L	**0-16L**
8315	75.015	**2.9534**	75.002	**2.9529**	2T-27T	**1T-11T**	160.025	**6.3002**	160.000	**6.2992**	0-43L	**0-17L**
8316	80.015	**3.1502**	80.002	**3.1497**	2T-27T	**1T-11T**	170.025	**6.6939**	170.000	**6.6929**	0-43L	**0-17L**
8317	85.018	**3.3472**	85.003	**3.3466**	3T-33T	**1T-13T**	180.025	**7.0876**	180.000	**7.0866**	0-43L	**0-17L**
8318	90.018	**3.5440**	90.003	**3.5434**	3T-33T	**1T-13T**	190.029	**7.4814**	190.000	**7.4803**	0-49L	**0-19L**
8319	95.018	**3.7409**	95.003	**3.7403**	3T-33T	**1T-13T**	200.029	**7.8751**	200.000	**7.8740**	0-49L	**0-19L**
8320	100.018	**3.9377**	100.003	**3.9371**	3T-33T	**1T-13T**	215.029	**8.4657**	215.000	**8.4646**	0-49L	**0-19L**
8322	110.018	**4.3314**	110.003	**4.3308**	3T-33T	**1T-13T**	240.029	**9.4499**	240.000	**9.4488**	0-49L	**0-19L**
8326	130.021	**5.1189**	130.003	**5.1182**	3T-39T	**1T-15T**	280.032	**11.0249**	280.000	**11.0236**	0-57L	**0-23L**
8330	150.021	**5.9063**	150.003	**5.9056**	3T-39T	**1T-15T**	320.036	**12.5998**	320.000	**12.5984**	0-64L	**0-25L**
8336	180.021	**7.0874**	180.003	**7.0867**	3T-39T	**1T-15T**	380.036	**14.9620**	380.000	**14.9606**	0-64L	**0-25L**

1) Cast iron or steel housings. For aluminum or other soft metal housings make housing bore limits same as bearing O.D. limits.
2) "T" indicates tight, "L" indicates loose.

PumPac mounting instructions



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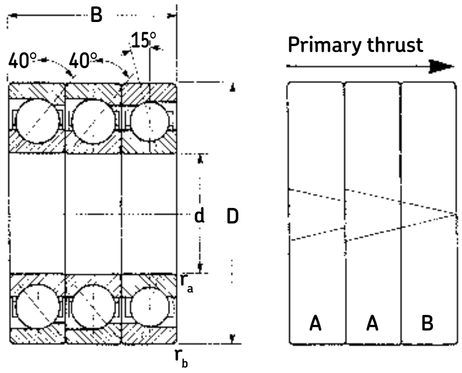


8000AAB

PumPac bearings require proper mounting orientation with respect to the direction of the imposed primary thrust load, which must be taken by the 40° ("A") bearing. They should be installed so that the "V" etched on the O.D. of the bearings points in the direction of the primary thrust load, as illustrated below for PumPac 8000 and 8000AAB arrangements.

PumPac dynamic and static equivalent radial load and life rating

The following method considers only thrust load in either direction with negligible radial load. For combined radial and thrust loads consult MRC Technical Services for analysis.

Dynamic equivalent radial load

Primary thrust on bearing A (40°)

$P = 0.57\ F_A$

Reversing thrust on bearing B (15°)

$P = YF_A$

P = Dynamic equivalent radial load

F_A = Thrust load

Y = Thrust load factor

Z = Number of balls

D = Ball diameter

$\frac{F_A}{ZD^2}$ N, m	$\frac{F_A}{ZD^2}$ lb, in.	Y
0.172	25	1.47
0.345	50	1.40
0.689	100	1.30
1.030	150	1.23
1.380	200	1.19
2.070	300	1.12
3.450	500	1.02
5.170	750	1.00
6.890	1,000	1.00

Size	ZD^2 mm	in.	Size	ZD^2 mm	in.	Size	ZD^2 mm	in.
8218B	7410	11.50	8310B	3990	6.19	8318B	11800	18.3
8219B	7900	12.30	8311B	4690	7.26	8319B	13100	20.3
8220B	9070	14.10	8312B	5430	8.42	8320B	14400	22.4
8222B	11700	18.10	8313B	5930	9.19	8322B	18900	29.3
8224B	13100	20.30	8314B	6800	10.50	8326B	25700	39.8
8238B	31200	48.40	8315B	8390	13.00	8330B	31500	48.8
8308B	2450	3.80	8316B	9470	14.70	8336B	45700	70.9
8309B	3020	4.69	8317B	10600	16.50			

Values of Y for loads not shown are obtained from chart at below.

Static equivalent radial load

Bearing A (40°)

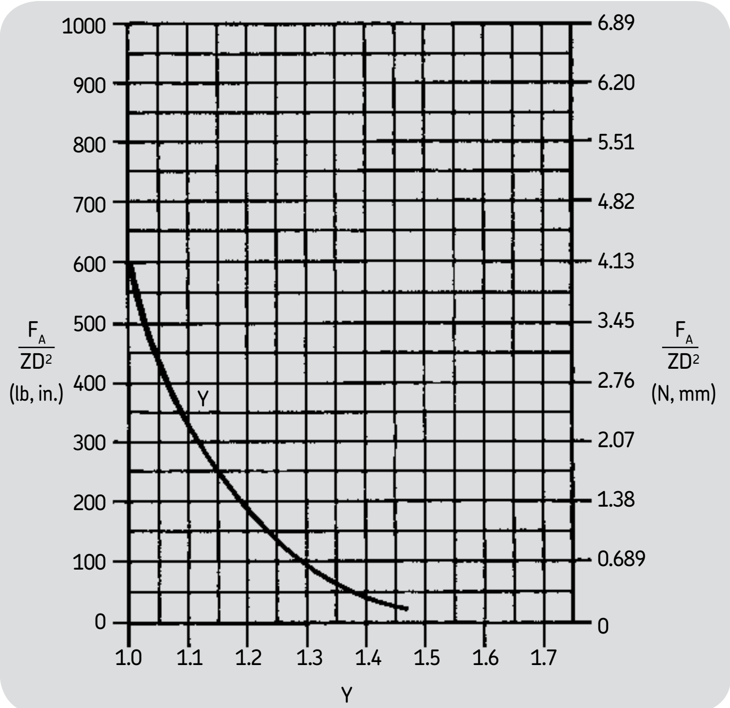
$P_0 = 0.26\ F_A$

Bearing B (15°)

$P_0 = 0.5\ F_A$

P_0 = Static equivalent radial load

F_A = Thrust load



Minimum thrust load for angular contact ball bearings

Satisfactory operation of angular contact ball bearings requires sufficient traction forces between the balls and races to minimize damage caused by sliding or skidding. This is particularly important at high speeds where the inertia forces of the balls and cage and the viscous drag in the lubricant can have a detrimental influence on the rolling conditions.

The minimum required thrust load can be determined from the following formula.

$$F_A = A\left(\frac{n}{1000}\right)^2 \text{ newtons}$$

or

$$F_A = 0.2248\,A\left(\frac{n}{1000}\right)^2 \text{ pounds}$$

where, F_A = Minimum thrust load

A = Bearing design factor listed in the following tables

n = Speed in rpm

Note: For duplex bearings mounted in tandem, multiply the single-bearing thrust value by the number of bearings in tandem.

Minimum thrust load A factor

Size	A	Size	A
8218	148.50	8313	114.40
8219	191.90	8314	144.60
8220	224.10	8315	182.70
8222	352.10	8316	215.80
8224	450.50	8317	269.40
8238	2499.00	8318	332.30
8308	17.31	8319	405.70
8309	29.08	8320	629.40
8310	36.26	8322	904.70
8311	57.36	8330	2731.00
8312	77.30	8336	5006.00

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Basic dynamic radial load rating (from single bearing tables)

P = Dynamic equivalent radial load

n = Speed in rpm

Notes: For 8000BB series, see page 124. For combined radial and thrust loads, please contact MRC.

PumPac 8000, 8000BB Diamond and 8000AAB series

Dynamic equivalent radial load and life calculation examples

PumPac 8000 series

Bearing size: 8310

Speed: 3500 rpm

Basic dynamic radial load rating (C):

Bearing A = 19600 lbf

Bearing B = 17100 lbf

Bearing A

Primary thrust load (F_A) = 3000

Equivalent load (P) = 0.57 F_A

P = 0.57 × 3000 = 1710

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{19600}{1710}\right)^3 = 1506 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 3500}\left(\frac{19600}{1710}\right)^3$$

= 7171 Hrs

Bearing B

Reversing thrust load (F_A) = 1000

F_A/ZD^2 = 1000/6.19 = 162

Equivalent load (P) = Y F_A

Y = 1.22

P = 1.22 × 1000 = 1220

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{17100}{1220}\right)^3 = 2754 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 3500}\left(\frac{17100}{1220}\right)^3$$

= 13113 Hrs

PumPac 8000BB Diamond series

Bearing size: 8317BB

Speed: 3000 rpm

Basic dynamic radial load rating (C):

$$\text{Single bearing} = \frac{C}{(2)^{0.7}} = \frac{63200}{1.625} = 38904 \text{ lbf}$$

Primary thrust bearing

Primary thrust load (F_A) = 2500

F_A/ZD^2 = 2500/16.5 = 152

Equivalent load (P) = Y F_A

Y = 1.23

P = 1.23 × 2500 = 3075

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{38904}{3075}\right)^3 = 2025 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 3000}\left(\frac{38904}{3075}\right)^3$$

= 11251 Hrs

Reversing thrust bearing

Reversing thrust load (F_A) = 1000

F_A/ZD^2 = 1000/16.5 = 61

Equivalent load (P) = Y F_A

Y = 1.38

P = 1.38 × 1000 = 1380

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{38904}{1380}\right)^3 = 22405 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 3000}\left(\frac{38904}{1380}\right)^3$$

= 124472 Hrs

PumPac 8000AAB series

Bearing size: 8314 AAB

Speed: 3500 rpm

Basic dynamic radial load rating (C):

Bearings AA = 54400 lbf

Bearing B = 27200 lbf

Bearings AA

Primary thrust load (F_A) = 5000

Equivalent load (P) = 0.57 F_A

P = 0.57 × 5000 = 2850

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{54400}{2850}\right)^3 = 6954 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 3500}\left(\frac{54400}{2850}\right)^3$$

= 33116 Hrs

Bearing B

Reversing thrust load (F_A) = 1500

F_A/ZD^2 = 1500/10.5 = 143

Equivalent load (P) = Y F_A

Y = 1.24

P = 1.24 × 1500 = 1860

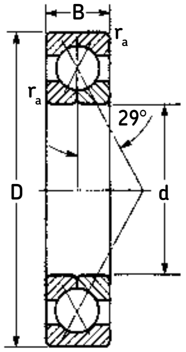
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{27200}{1860}\right)^3 = 3127 \times 10^6 \text{ Rev.}$$

or

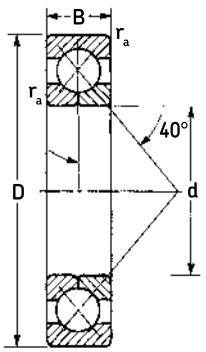
$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 3500}\left(\frac{27200}{1860}\right)^3$$

= 14892 Hrs

9000 series single-row 29° and 40° split ring angular contact ball bearings



9000U



9000UP

9000H

9000UH

9000S

Demand for a two-directional maximum thrust capacity bearing requiring minimum space has resulted in extensive use of the MRC 9000 series bearings.

9000U is the standard construction. It is an angular contact ball bearing with one-piece outer ring and two-piece inner ring construction. It has maximum ball complement and a one-piece machined ball cage. The cage construction completely retains the balls for unit handling during installation. The bearings of this series have similar internal characteristics and identical external dimensions to bearings in the MRC 7000 series, which are angular contact, one-directional thrust bearings.

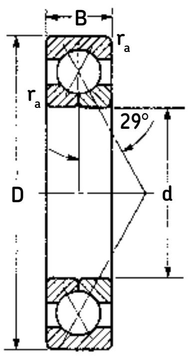
9000UP is similar to the 9000U, except that its internal characteristics provide greater two-directional thrust capacity for applications in which such capacity is the primary requirement. It can be used in combination with a corresponding duplex ground 7000P bearing.

9000H has a two-piece outer ring and a one-piece inner ring. Recommended only where the outer ring can be positively clamped. When duplexed, bearing can be used with a corresponding duplex-ground 7000 series bearing.

9000UH has two-piece construction of both inner and outer rings. The use of this bearing is confined to those applications where endplay must be held to an absolute minimum.

9000S has one-piece construction of both inner and outer ring. Assembly of the ball complement is accomplished by eccentric displacement of the outer ring. The use of this type is recommended where endplay and tilt must be held to a minimum, but where maximum capacity is not required.

9100UK and 9200U series split inner ring angular contact ball bearings

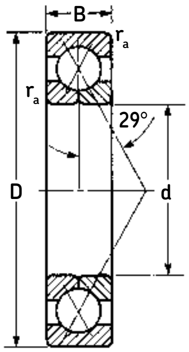


For duplex sets of 7000 and 9000 series bearings see page 243.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C[4] lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Speed rating[3] Oil rpm
9100UK	10	**.3937**	26	**1.0236**	8	**.3150**	.30	**.012**	4 620	**1 040**	2 080	**468**	30 000	39 000
9101UK	12	**.4724**	28	**1.1024**	8	**.3150**	.30	**.012**	5 070	**1 140**	2 500	**562**	25 000	32 000
9102UK	15	**.5906**	32	**1.2598**	9	**.3543**	.30	**.012**	5 400	**1 210**	2 900	**652**	22 000	28 000
9103UK	17	**.6693**	35	**1.3780**	10	**.3937**	.30	**.012**	7 610	**1 710**	4 250	**955**	19 000	25 000
9104UK	20	**.7874**	42	**1.6535**	12	**.4724**	.64	**.025**	9 560	**2 150**	5 600	**1 260**	16 000	21 000
9105UK	25	**.9843**	47	**1.8504**	12	**.4724**	.64	**.025**	10 600	**2 380**	6 950	**1 560**	12 000	16 000
9106UK	30	**1.1811**	55	**2.1654**	13	**.5118**	1.00	**.040**	13 800	**3 100**	9 650	**2 170**	11 000	14 000
9107UK	35	**1.3780**	62	**2.4409**	14	**.5512**	1.00	**.040**	16 800	**3 780**	12 000	**2 700**	9 200	12 000
9108UK	40	**1.5748**	68	**2.6772**	15	**.5906**	1.00	**.040**	17 200	**3 870**	13 200	**2 970**	8 500	11 000
9109UK	45	**1.7717**	75	**2.9528**	16	**.6299**	1.00	**.040**	21 200	**4 770**	17 000	**3 820**	7 500	9 800
9110UK	50	**1.9685**	80	**3.1496**	16	**.6299**	1.00	**.040**	22 100	**4 970**	18 300	**4 110**	6 900	9 000
9111UK	55	**2.1654**	90	**3.5433**	18	**.7087**	1.00	**.040**	29 600	**6 650**	25 500	**5 730**	6 300	8 200
9112UK	60	**2.3622**	95	**3.7402**	18	**.7087**	1.00	**.040**	30 200	**6 790**	27 000	**6 070**	5 700	7 400
9113UK	65	**2.5591**	100	**3.9370**	18	**.7087**	1.00	**.040**	31 200	**7 010**	29 000	**6 520**	5 400	7 000
9114UK	70	**2.7559**	110	**4.3307**	20	**.7874**	1.00	**.040**	34 500	**7 760**	35 500	**7 980**	5 000	6 500
9115UK	75	**2.9528**	115	**4.5276**	20	**.7874**	1.00	**.040**	37 700	**8 480**	37 500	**8 430**	4 700	6 100
9116UK	80	**3.1496**	125	**4.9213**	22	**.8661**	1.00	**.040**	48 800	**11 000**	49 000	**11 000**	4 500	5 800
9117UK	85	**3.3465**	130	**5.1181**	22	**.8661**	1.00	**.040**	49 400	**11 100**	52 000	**11 700**	4 100	5 300
9118UK	90	**3.5433**	140	**5.5118**	24	**.9449**	1.50	**.060**	58 500	**13 200**	61 000	**13 700**	3 800	4 900
9119UK	95	**3.7402**	145	**5.7087**	24	**.9449**	1.50	**.060**	71 500	**16 100**	71 000	**16 000**	3 600	4 700
9120UK	100	**3.9370**	150	**5.9055**	24	**.9449**	1.50	**.060**	62 400	**14 000**	68 000	**15 300**	3 500	4 500
9121UK	105	**4.1339**	160	**6.2992**	26	**1.0236**	2.00	**.080**	74 100	**16 700**	80 000	**18 000**	3 300	4 300
9122UK	110	**4.3307**	170	**6.6929**	28	**1.1024**	2.00	**.080**	87 100	**19 600**	91 500	**20 600**	3 200	3 800
9200U														
9202U	15	**.5906**	35	**1.3780**	11	**.4331**	.64	**.025**	8 060	**1 810**	4 750	**1 070**	20 000	26 000
9203U	17	**.6693**	40	**1.5748**	12	**.4724**	.64	**.025**	9 950	**2 240**	6 100	**1 370**	18 000	23 000
9204U	20	**.7874**	47	**1.8504**	14	**.5512**	1.00	**.040**	11 900	**2 680**	7 100	**1 600**	15 000	19 000
9205U	25	**.9843**	52	**2.0472**	15	**.5906**	1.00	**.040**	14 300	**3 210**	8 800	**1 980**	12 000	16 000
9206U	30	**1.1811**	62	**2.4409**	16	**.6299**	1.00	**.040**	16 800	**3 780**	11 800	**2 650**	10 000	13 000
9207U	35	**1.3780**	72	**2.8346**	17	**.6693**	1.00	**.040**	23 400	**5 260**	17 000	**3 820**	9 200	12 000
9208U	40	**1.5748**	80	**3.1496**	18	**.7087**	1.00	**.040**	30 700	**6 900**	22 800	**5 130**	7 700	10 000
9209U	45	**1.7717**	85	**3.3465**	19	**.7480**	1.00	**.040**	31 900	**7 170**	25 000	**5 620**	7 300	9 500
9210U	50	**1.9685**	90	**3.5433**	20	**.7874**	1.00	**.040**	33 200	**7 460**	27 000	**6 070**	6 400	8 300
9211U	55	**2.1654**	100	**3.9370**	21	**.8268**	1.50	**.060**	48 800	**11 000**	37 500	**8 430**	6 000	7 800
9212U	60	**2.3622**	110	**4.3307**	22	**.8661**	1.50	**.060**	52 700	**11 800**	44 000	**9 890**	5 400	7 000
9213U	65	**2.5591**	120	**4.7244**	23	**.9055**	1.50	**.060**	63 700	**14 300**	54 000	**12 100**	4 900	6 400
9214U	70	**2.7559**	125	**4.9213**	24	**.9449**	1.50	**.060**	63 700	**14 300**	55 000	**12 400**	4 600	6 000
9215U	75	**2.9528**	130	**5.1181**	25	**.9843**	1.50	**.060**	76 100	**17 100**	65 500	**14 700**	4 300	5 600
9216U	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.00	**.080**	78 000	**17 500**	71 000	**16 000**	4 100	5 300
9217U	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.00	**.080**	90 400	**20 300**	85 000	**19 100**	3 800	4 900
9218U	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.00	**.080**	112 000	**25 100**	98 000	**22 000**	3 600	4 700
9219U	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.00	**.080**	117 000	**26 300**	108 000	**24 300**	3 500	4 500
9220U	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.00	**.080**	130 000	**29 200**	122 000	**27 400**	3 200	4 100
9221U	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.00	**.080**	148 000	**33 300**	137 000	**30 800**	3 000	3 900
9222U	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.00	**.080**	163 000	**36 600**	156 000	**35 100**	2 900	3 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined bronze cage, ABEC-1. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

9300U series split inner ring angular contact ball bearings

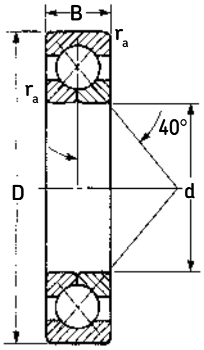


For duplex sets of 7000 and 9000 series bearings see page 243.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1)] r_a mm	Fillet radius[1)] r_a in.	Basic radial load rating[2)] Dynamic C[4)] N	Dynamic C[4)] lbf	Static C_0 N	Static C_0 lbf	Speed rating[3)] Grease rpm	Speed rating[3)] Oil rpm
9302U	15	**.5906**	42	**1.6535**	13	**.5118**	1.0	**.04**	9 950	**2 240**	6 100	**1 370**	16 000	21 000
9303U	17	**.6693**	47	**1.8504**	14	**.5512**	1.0	**.04**	12 100	**2 720**	7 500	**1 690**	15 000	19 000
9304U	20	**.7874**	52	**2.0472**	15	**.5906**	1.0	**.04**	18 600	**4 180**	10 600	**2 380**	13 000	17 000
9305U	25	**.9843**	62	**2.4409**	17	**.6693**	1.0	**.04**	21 200	**4 770**	13 700	**3 080**	11 000	14 000
9306U	30	**1.1811**	72	**2.8346**	19	**.7480**	1.0	**.04**	28 100	**6 320**	18 600	**4 180**	9 200	12 000
9307U	35	**1.3780**	80	**3.1496**	21	**.8268**	1.5	**.06**	35 800	**8 050**	24 000	**5 400**	8 500	11 000
9308U	40	**1.5748**	90	**3.5433**	23	**.9055**	1.5	**.06**	44 200	**9 940**	31 000	**7 000**	7 300	9 500
9309U	45	**1.7717**	100	**3.9370**	25	**.9843**	1.5	**.06**	52 700	**11 800**	38 000	**8 540**	6 400	8 300
9310U	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.0	**.08**	68 900	**15 500**	49 000	**11 000**	5 800	7 500
9311U	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.0	**.08**	80 600	**18 100**	57 000	**12 800**	5 100	6 600
9312U	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.0	**.08**	92 300	**20 700**	65 500	**14 700**	4 900	6 400
9313U	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.08**	97 500	**21 900**	75 000	**16 900**	4 600	6 000
9314U	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.0	**.08**	111 000	**25 000**	85 000	**19 100**	4 100	5 300
9315U	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.0	**.08**	130 000	**29 200**	106 000	**23 800**	3 900	5 000
9316U	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.0	**.08**	143 000	**32 100**	120 000	**27 000**	3 600	4 700
9317U	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**.10**	153 000	**34 400**	134 000	**30 100**	3 500	4 500
9318U	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.5	**.10**	168 000	**37 800**	150 000	**33 700**	3 200	4 200
9319U	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.5	**.10**	178 000	**40 000**	166 000	**37 300**	3 100	4 000
9320U	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**.10**	190 000	**42 700**	183 000	**41 100**	3 000	3 900
9321U	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.5	**.10**	203 000	**45 600**	200 000	**45 000**	2 900	3 800
9322U	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**.10**	229 000	**51 500**	236 000	**53 100**	2 700	3 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined bronze cage, ABEC-1. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.

9200UP and 9300UP series split inner ring angular contact ball bearings



For duplex sets of 7000 and 9000 series bearings
see page 243.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Basic radial load rating[2)] Dynamic $C^{4)}$ N	lbf	Static C_0 N	lbf	Speed rating[3)] Grease rpm	Oil rpm
9202UP	15	**.5906**	35	**1.3780**	11	**.4331**	.64	**.025**	8 840	**1 990**	4 250	**955**	17 000	24 000
9203UP	17	**.6693**	40	**1.5748**	12	**.4724**	.64	**.025**	11 700	**2 630**	6 000	**1 350**	15 000	20 000
9204UP	20	**.7874**	47	**1.8504**	14	**.5512**	1.00	**.040**	14 800	**3 330**	8 300	**1 870**	12 000	17 000
9205UP	25	**.9843**	52	**2.0472**	15	**.5906**	1.00	**.040**	16 800	**3 780**	10 400	**2 340**	10 000	15 000
9206UP	30	**1.1811**	62	**2.4409**	16	**.6299**	1.00	**.040**	21 200	**4 770**	12 700	**2 860**	8 500	12 000
9207UP	35	**1.3780**	72	**2.8346**	17	**.6693**	1.00	**.040**	29 100	**6 540**	19 300	**4 340**	8 000	11 000
9208UP	40	**1.5748**	80	**3.1496**	18	**.7087**	1.00	**.040**	32 500	**7 310**	22 400	**5 040**	7 000	9 500
9209UP	45	**1.7717**	85	**3.3465**	19	**.7480**	1.00	**.040**	39 000	**8 770**	27 500	**6 180**	6 700	9 000
9210UP	50	**1.9685**	90	**3.5433**	20	**.7874**	1.00	**.040**	40 300	**9 060**	30 000	**6 740**	6 000	8 000
9211UP	55	**2.1654**	100	**3.9370**	21	**.8268**	1.50	**.060**	48 800	**11 000**	37 500	**8 430**	5 600	7 500
9212UP	60	**2.3622**	110	**4.3307**	22	**.8661**	1.50	**.060**	58 500	**13 200**	45 500	**10 200**	5 000	6 700
9213UP	65	**2.5591**	120	**4.7244**	23	**.9055**	1.50	**.060**	63 700	**14 300**	51 000	**11 500**	4 500	6 000
9214UP	70	**2.7559**	125	**4.9213**	24	**.9449**	1.50	**.060**	68 900	**15 500**	56 000	**12 600**	4 300	5 600
9215UP	75	**2.9528**	130	**5.1181**	25	**.9843**	1.50	**.060**	71 500	**16 100**	60 000	**13 500**	4 000	5 300
9216UP	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.00	**.080**	83 200	**18 700**	71 000	**16 000**	3 800	5 000
9217UP	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.00	**.080**	95 600	**21 500**	83 000	**18 700**	3 600	4 800
9218UP	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.00	**.080**	108 000	**24 300**	95 000	**21 400**	3 400	4 500
9219UP	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.00	**.080**	124 000	**27 900**	110 000	**24 700**	3 200	4 300
9220UP	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.00	**.080**	130 000	**29 200**	125 000	**28 100**	3 000	4 000
9221UP	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.00	**.080**	143 000	**32 100**	129 000	**29 000**	2 800	3 800
9222UP	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.00	**.080**	153 000	**34 400**	156 000	**35 100**	2 600	3 600
9300UP														
9302UP	15	**.5906**	42	**1.6535**	13	**.5118**	1.00	**.040**	12 700	**2 860**	6 100	**1 370**	15 000	20 000
9303UP	17	**.6693**	47	**1.8504**	14	**.5512**	1.00	**.040**	16 800	**3 780**	8 500	**1 910**	13 000	18 000
9304UP	20	**.7874**	52	**2.0472**	15	**.5906**	1.00	**.040**	18 600	**4 180**	9 500	**2 140**	11 000	16 000
9305UP	25	**.9843**	62	**2.4409**	17	**.6693**	1.00	**.040**	24 200	**5 440**	13 400	**3 010**	9 000	13 000
9306UP	30	**1.1811**	72	**2.8346**	19	**.7480**	1.00	**.040**	32 500	**7 310**	19 600	**4 410**	8 000	11 000
9307UP	35	**1.3780**	80	**3.1496**	21	**.8268**	1.50	**.060**	39 700	**8 920**	24 500	**5 510**	7 500	10 000
9308UP	40	**1.5748**	90	**3.5433**	23	**.9055**	1.50	**.060**	47 500	**10 700**	30 500	**6 860**	6 700	9 000
9309UP	45	**1.7717**	100	**3.9370**	25	**.9843**	1.50	**.060**	59 200	**13 300**	40 000	**8 990**	6 000	8 000
9310UP	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.00	**.080**	68 900	**15 500**	52 000	**11 700**	5 300	7 000
9311UP	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.00	**.080**	79 300	**17 800**	56 000	**12 600**	4 800	6 300
9312UP	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.00	**.080**	90 400	**20 300**	64 000	**14 400**	4 500	6 000
9313UP	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.00	**.080**	101 000	**22 700**	80 000	**18 000**	4 300	5 600
9314UP	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.00	**.080**	117 000	**26 300**	93 000	**20 900**	3 800	5 000
9315UP	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.00	**.080**	127 000	**28 600**	100 000	**22 500**	3 600	4 800
9316UP	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.00	**.080**	138 000	**31 000**	110 000	**24 700**	3 400	4 500
9317UP	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.50	**.100**	148 000	**33 300**	122 000	**27 400**	3 200	4 300
9318UP	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.50	**.100**	159 000	**35 700**	137 000	**30 800**	3 000	4 000
9319UP	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.50	**.100**	168 000	**37 800**	150 000	**33 700**	2 800	3 800
9320UP	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.50	**.100**	190 000	**42 700**	190 000	**42 700**	2 600	3 600
9321UP	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.50	**.100**	203 000	**45 600**	196 000	**44 100**	2 400	3 400
9322UP	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.50	**.100**	212 000	**47 700**	228 000	**51 300**	2 200	3 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.75 and C_0 by 3.85.
3) Listed values are for machined bronze cage, ABEC-1. The values have been determined through historical application and practice. For a more complete explanation, see page 272.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

9000U series split inner ring 29° angular contact ball bearings single bearing

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 0.80$

or

$P = 0.39\ F_R + 0.76\ F_A$ when $F_A/F_R > 0.80$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Consult MRC Bearing Services when

$F_A/F_R > 1.0$

Static equivalent radial load

$P_0 = 0.50\ F_R + 0.34\ F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{(millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{(hours)}$$

C = Basic dynamic radial load rating (from single bearing tables)

P = Dynamic equivalent radial load

n = Speed in rpm

Minimum thrust load for angular contact ball bearings

Satisfactory operation of angular contact ball bearings requires sufficient traction forces between the balls and races to minimize damage caused by sliding or skidding. This is particularly important at high speeds where the inertia forces of the balls and cage and the viscous drag in the lubricant can have a detrimental influence on the rolling conditions.

The minimum required thrust load can be determined from the following formula.

$$F_A = A\left(\frac{n}{1000}\right)^2 \text{ newtons}$$

or

$$F_A = 0.2248\,A\left(\frac{n}{1000}\right)^2 \text{ pounds}$$

Where, F_A = Minimum thrust load

A = Bearing design factor listed in the following tables

n = Speed in rpm

Note: For duplex bearings mounted in tandem, multiply the single-bearing thrust value by the number of bearings in tandem.

Minimum thrust load A factor

Size	A	Size	A	Size	A	Size	A
9100UK	0.06	9212U	17.51	9203UP	0.74	9315UP	182.70
9101UK	0.08	9213U	25.86	9204UP	1.32	9316UP	215.80
9102UK	0.11	9214U	27.74	9205UP	1.90	9317UP	269.40
9103UK	0.20	9215U	40.59	9206UP	3.45	9318UP	332.30
9104UK	0.37	9216U	41.61	9207UP	6.73	9319UP	405.70
9105UK	0.52	9217U	61.05	9208UP	9.28	9320UP	629.40
9106UK	0.95	9218U	95.12	9209UP	13.13	9321UP	673.40
9107UK	1.50	9219U	108.60	9210UP	15.48	9322UP	904.70
9108UK	1.83	9220U	141.50	9211UP	23.88		
9109UK	2.88	9221U	169.80	9212UP	35.31		
9110UK	3.37	9222U	212.20	9213UP	44.55		
9111UK	6.14	9302U	0.29	9214UP	53.74		
9112UK	7.02	9303U	0.63	9215UP	61.15		
9113UK	7.97	9304U	1.19	9216UP	84.07		
9114UK	11.45	9305U	1.85	9217UP	112.9		
9115UK	12.79	9306U	3.45	9218UP	148.5		
9116UK	20.43	9307U	5.77	9219UP	191.9		
9117UK	22.59	9308U	9.31	9220UP	224.1		
9118UK	32.62	9309U	14.26	9221UP	282.7		
9119UK	44.04	9310U	26.44	9222UP	352.1		
9120UK	39.28	9311U	36.89	9302UP	0.85		
9121UK	54.28	9312U	50.17	9303UP	1.53		
9122UK	72.46	9313U	64.73	9304UP	1.91		
9202U	0.19	9314U	73.28	9305UP	3.85		
9203U	0.30	9315U	110.90	9306UP	7.39		
9204U	0.42	9316U	131.40	9307UP	11.66		
9205U	0.94	9317U	178.20	9308UP	17.31		
9206U	1.41	9318U	205.60	9309UP	29.08		
9207U	2.82	9319U	252.80	9310UP	36.26		
9208U	4.95	9320U	314.00	9311UP	57.36		
9209U	5.46	9321U	378.20	9312UP	77.30		
9210U	6.87	9322U	516.40	9313UP	111.40		
9211U	13.36	9202UP	0.42	9314UP	144.60		

9000U series split inner ring 29° angular contact ball bearings single bearing

Dynamic equivalent radial load and life calculation examples

Bearing size: 9309U
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 11800

Case 1

Radial load (F_R) = 1750
Thrust load (F_A) = 1310
Equivalent load (P) = F_R or 0.39 F_R + 0.76 F_A
F_A/F_R = 1310/1750 = 0.75
Since F_A/F_R < 0.80, P = F_R = 1750

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11800}{1750}\right)^3 = 307\times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11800}{1750}\right)^3$$

= 2555 Hrs

Case 2

Radial load (F_R) = 1750
Thrust load (F_A) = 2100
Equivalent load (P) = F_R or 0.39 F_R + 0.76 F_A
F_A/F_R = 2100/1750 = 1.20
Since F_A/F_R > 0.80, P = 0.39 x 1750 + 0.76 x 2100 = 2279

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11800}{2279}\right)^3 = 139 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11800}{2279}\right)^3$$

= 1157 Hrs

Case 3

Thrust load (F_A) = 2100
Equivalent load (P) = 0.39 F_R + 0.76 F_A
F_A/F_R = 2100/0 = ∞
Since F_A/F_R > 0.80, (P) = 0.76 x 2100 = 1596

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{11800}{1596}\right)^3 = 404 \times 10^6 \text{ Rev.}$$

or

$$\text{Life } (L\,10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{11800}{1596}\right)^3$$

= 3368 Hrs

9000UP series split inner ring 40° angular contact ball bearings single bearing

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 1.14$

or

$P = 0.35\ F_R\ +\ 0.57\ F_A$ when $F_A/F_R > 1.14$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Consult MRC Bearing Services when

$F_A/F_R > 1.0$

Life rating

$L10 = \left(\frac{C}{P}\right)^3$ (millions of revolutions)

or

$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3$ (hours)

C = Basic dynamic radial load rating
  (from single bearing tables)

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = 0.5\ F_R + 0.26\ F_A$

P_0 is always ≥ FR

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

9000UP series split inner ring 40° angular contact ball bearings single bearing

Dynamic equivalent radial load and life calculation examples

Bearing size: 9309UP
Speed: 2000 rpm
Basic dynamic radial load rating (C) = 13300

Case 1

Radial load (F_R) = 1750
Thrust load (F_A) = 1960
F_A/F_R = 1960/1750 = 1.12
Since $F_A/F_R < 1.14$, equivalent load (P) = F_R = 1750

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13300}{1750}\right)^3 = 439 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13300}{1750}\right)^3$$

= 3658 Hrs

Case 2

Radial load (F_R) = 1750
Thrust load (F_A) = 2450
F_A/F_R = 2450/1750 = 1.40
Since $F_A/F_R > 1.14$, equivalent load (P) = 0.35 F_R + 0.57 F_A
P = 0.35 × 1750 + 0.57 × 2450 = 2009

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13300}{2009}\right)^3 = 290 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13300}{2009}\right)^3$$

= 2418 Hrs

Case 3

Thrust load (F_A) = 2450
$F_A/F_R = 2450/0 = \infty$
Since $F_A/F_R > 1.14$, equivalent load (P) = 0.35 F_R + 0.57 F_A

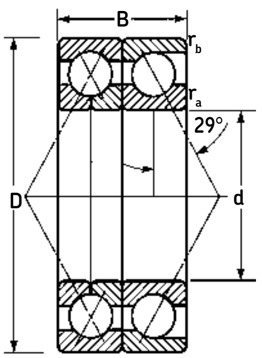
$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{13300}{1397}\right)^3 = 863 \times 10^6 \text{ Rev.}$$

or

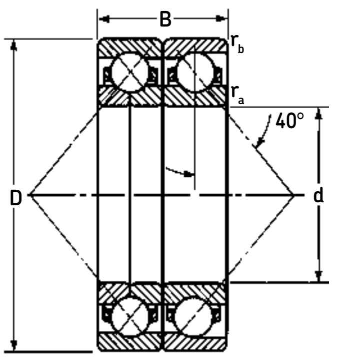
$$\text{Life (L 10}_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 2000}\left(\frac{13300}{1397}\right)^3$$

= 7191 Hrs

97000U2 and 97000UP2 series angular contact ball bearings



97000U2



97000UP2

97000U and 97000H series

The 97000U series consists of a matched set of 9000UDT and 7000DT flush ground bearings having a 29° contact angle. The 97000H series consists of a matched set of 9000HDT (split outer ring) and 7000DT flush ground bearings.

97000UP and 97000HP series

The 97000UP series consists of a matched set of 9000UPDT and 7000PDT flush ground bearings having a 40° contact angle. The 97000HP series consists of a matched set of 9000HPDT (split outer ring) and 7000PDT flush ground bearings.

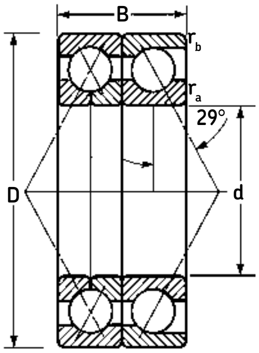
Typical mountings

The bearings are usually mounted in pairs. This arrangement divides the thrust load in one direction while accommodating reversing thrust load. To increase thrust capacity in one direction it is possible to mount additional 7000DT or 7000PDT bearings in tandem.

Cage types and materials

Furnished in one-piece, inner ring land-guided, machined brass or special material.

97200U2 light series



This series consists of a matched set of 9200UDT and 7200DT flush ground bearings having a 29° contact angle. One-piece, inner ring land-guided, machined brass cages are standard for this series.

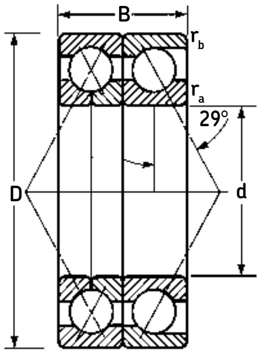
These bearings are mounted in pairs in applications where substantial thrust loads are present. This arrangement divides the thrust load in one direction while accommodating reversing thrust load. To increase thrust capacity in one direction, additional 7200DT bearings may be mounted in tandem.

For proper mounting orientation refer to page 243.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
97207U2	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.0	**.04**	.60	**.024**	37 700	**8 480**	34 000	**7 640**	7 400	9 600
97208U2	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.0	**.04**	.60	**.024**	49 400	**11 100**	45 500	**10 200**	6 200	8 000
97209U2	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.0	**.04**	.60	**.024**	49 400	**11 100**	46 500	**10 500**	5 800	7 600
97210U2	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.0	**.04**	.60	**.024**	54 000	**12 100**	54 000	**12 100**	5 100	6 600
97211U2	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.5	**.06**	1.00	**.040**	79 300	**17 800**	75 000	**16 900**	4 800	6 200
97212U2	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.5	**.06**	1.00	**.040**	85 200	**19 100**	88 000	**19 800**	4 300	5 600
97213U2	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.5	**.06**	1.00	**.040**	104 000	**23 400**	110 000	**24 700**	3 900	5 100
97214U2	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.5	**.06**	1.00	**.040**	104 000	**23 400**	110 000	**24 700**	3 700	4 800
97215U2	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.5	**.06**	1.00	**.040**	130 000	**29 200**	140 000	**31 500**	3 400	4 500
97216U2	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.0	**.08**	1.00	**.040**	121 000	**27 200**	134 000	**30 100**	3 300	4 200
97217U2	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.0	**.08**	1.00	**.040**	148 000	**33 300**	166 000	**37 300**	3 000	3 900
97218U2	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.0	**.08**	1.00	**.040**	190 000	**42 700**	236 000	**53 100**	2 900	3 800
97219U2	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.0	**.08**	1.00	**.040**	199 000	**44 700**	228 000	**51 300**	2 800	3 600
97220U2	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.0	**.08**	1.00	**.040**	225 000	**50 600**	260 000	**58 500**	2 600	3 300
97221U2	105	**4.1339**	190	**7.4803**	72	**2.8346**	2.0	**.08**	1.00	**.040**	242 000	**54 400**	295 000	**66 300**	2 400	3 100
97222U2	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.0	**.08**	1.00	**.040**	265 000	**59 600**	310 000	**69 700**	2 300	3 000
97224U2	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.0	**.08**	1.00	**.040**	281 000	**63 200**	355 000	**79 800**	2 200	2 800
97226U2	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.5	**.10**	1.00	**.040**	319 000	**71 700**	415 000	**93 300**	2 000	2 600
97228U2	140	**5.5118**	250	**9.8425**	84	**3.3071**	2.5	**.10**	1.00	**.040**	338 000	**76 000**	465 000	**105 000**	1 800	2 400
97230U2	150	**5.9055**	270	**10.6299**	90	**3.5433**	2.5	**.10**	1.00	**.040**	397 000	**89 200**	560 000	**126 000**	1 700	2 200
97232U2	160	**6.2992**	290	**11.4173**	96	**3.7795**	2.5	**.10**	1.00	**.040**	442 000	**99 400**	670 000	**135 000**	1 600	2 100
97234U2	170	**6.6929**	310	**12.2047**	104	**4.0945**	3.0	**.12**	1.00	**.040**	468 000	**105 000**	735 000	**165 000**	1 500	2 000
97236U2	180	**7.0866**	320	**12.5984**	104	**4.0945**	3.0	**.12**	1.00	**.040**	494 000	**111 000**	780 000	**175 000**	1 500	1 900

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined brass cage. Values have been determined through historical application and practice.
4) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.

97300U2 medium series



This series consists of a matched set of 9300UDT and 7300DT flush ground bearings having a 29° contact angle. One-piece, inner ring land-guided, machined brass cages are standard for this series.

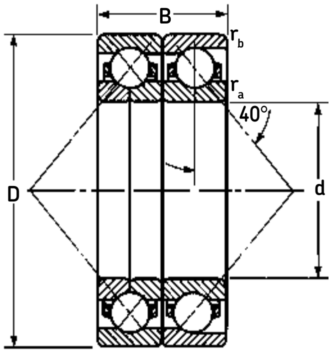
These bearings are mounted in pairs in applications where substantial thrust loads are present. This arrangement divides the thrust load in one direction while accommodating reversing thrust load. To increase thrust capacity in one direction, additional 7300DT bearings may be mounted in tandem.

For proper mounting orientation refer to page 243.

	Bore		Outside diameter		Width		Fillet radius[1]				Basic radial load rating[2]				Speed rating[3]	
											Dynamic		Static			
MRC bearing number	d mm	in.	D mm	in.	B mm	in.	r_a mm	in.	r_b mm	in.	C[4] N	lbf	C_0 N	lbf	Grease rpm	Oil rpm
97307U2	35	**1.3780**	80	**3.1496**	42	**1.6535**	1.5	**.06**	1.0	**.040**	58 500	**13 200**	48 000	**10 800**	6 800	8 800
97308U2	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.0	**.040**	71 500	**16 100**	61 000	**13 700**	5 800	7 600
97309U2	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.0	**.040**	85 200	**19 200**	75 000	**16 900**	5 100	6 600
97310U2	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.0	**.040**	121 000	**27 200**	106 000	**23 800**	4 600	6 000
97311U2	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.0	**.040**	140 000	**31 500**	125 000	**28 100**	4 100	5 300
97312U2	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.0	**.040**	159 000	**35 700**	146 000	**32 800**	3 900	5 100
97313U2	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.0	**.040**	178 000	**40 000**	173 000	**38 900**	3 700	4 800
97314U2	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.0	**.040**	182 000	**40 900**	170 000	**38 200**	3 300	4 200
97315U2	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.0	**.040**	225 000	**50 600**	228 000	**51 300**	3 100	4 000
97316U2	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.0	**.08**	1.0	**.040**	234 000	**52 600**	240 000	**54 000**	2 900	3 800
97317U2	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.5	**.10**	1.0	**.040**	265 000	**59 600**	285 000	**64 100**	2 800	3 600
97318U2	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.5	**.10**	1.0	**.040**	276 000	**62 000**	300 000	**67 400**	2 600	3 400
97319U2	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.5	**.10**	1.0	**.040**	291 000	**65 400**	325 000	**73 100**	2 500	3 200
97320U2	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.5	**.10**	1.0	**.040**	312 000	**70 100**	365 000	**82 100**	2 400	3 100
97321U2	105	**4.1339**	225	**8.8583**	98	**3.8583**	2.5	**.10**	1.0	**.040**	332 000	**74 600**	400 000	**89 900**	2 300	3 000
97322U2	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.5	**.10**	1.0	**.040**	371 000	**83 400**	475 000	**107 000**	2 200	2 800
97324U2	120	**4.7244**	260	**10.2362**	110	**4.3307**	2.5	**.10**	1.0	**.040**	423 000	**95 100**	560 000	**126 000**	2 000	2 600
97326U2	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.0	**.12**	1.0	**.040**	468 000	**105 000**	640 000	**144 000**	1 800	2 400
97328U2	140	**5.5118**	300	**11.8110**	124	**4.8819**	3.0	**.12**	1.0	**.040**	507 000	**114 000**	735 000	**165 000**	1 800	2 200
97330U2	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.0	**.12**	1.0	**.040**	559 000	**126 000**	865 000	**194 000**	1 600	2 100
97332U2	160	**6.2992**	340	**13.3858**	136	**5.3543**	3.0	**.12**	1.0	**.040**	618 000	**139 000**	965 000	**217 000**	1 500	2 000
97334U2	170	**6.6929**	360	**14.1732**	144	**5.6693**	3.0	**.12**	1.0	**.040**	650 000	**146 000**	1 040 000	**234 000**	1 500	1 900
97336U2	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.0	**.12**	1.0	**.040**	689 000	**155 000**	1 160 000	**261 000**	1 400	1 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.32 and C_0 by 2.94.
3) Listed values are for machined brass cage. Values have been determined through historical application and practice.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

97200UP2 light series



This series consists of a matched set of 9200UPDT and 7200PDT flush ground bearings having a 40° contact angle. One-piece, inner ring land-guided, machined brass cages are standard for this series.

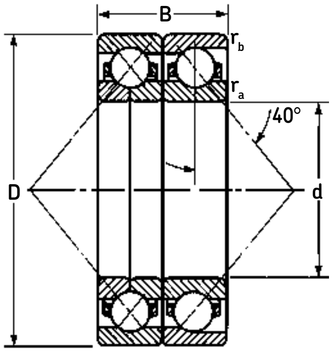
These bearings are mounted in pairs in applications where substantial thrust loads are present. This arrangement divides the thrust load in one direction while accommodating reversing thrust load. To increase thrust capacity in one direction, additional 7200PDT bearings may be mounted in tandem.

For proper mounting orientation refer to page 243.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	Basic radial load rating[2] Dynamic C[4] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
97207UP2	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.0	**.04**	.60	**.024**	47 500	**10 700**	39 000	**8 770**	6 300	8 500
97208UP2	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.0	**.04**	.60	**.024**	52 700	**11 800**	45 000	**10 100**	5 600	7 500
97209UP2	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.0	**.04**	.60	**.024**	62 400	**14 000**	55 000	**12 400**	5 300	7 000
97210UP2	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.0	**.04**	.60	**.024**	65 000	**14 600**	60 000	**13 500**	4 800	6 300
97211UP2	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.5	**.06**	1.00	**.040**	79 300	**17 800**	75 000	**16 900**	4 500	6 000
97212UP2	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.5	**.06**	1.00	**.040**	95 600	**21 500**	91 600	**20 600**	4 000	5 300
97213UP2	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.5	**.06**	1.00	**.040**	104 000	**23 400**	100 000	**22 500**	3 600	4 800
97214UP2	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.5	**.06**	1.00	**.040**	112 000	**25 200**	112 000	**25 200**	3 400	4 500
97215UP2	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.5	**.06**	1.00	**.040**	117 000	**26 300**	120 000	**27 000**	3 200	4 300
97216UP2	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.0	**.08**	1.00	**.040**	135 000	**30 300**	140 000	**31 500**	3 000	4 000
97217UP2	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.0	**.08**	1.00	**.040**	156 000	**35 100**	166 000	**37 300**	2 800	3 800
97218UP2	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.0	**.08**	1.00	**.040**	178 000	**40 000**	190 000	**42 700**	2 600	3 600
97219UP2	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.0	**.08**	1.00	**.040**	199 000	**44 700**	220 000	**49 500**	2 400	3 400
97220UP2	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.0	**.08**	1.00	**.040**	212 000	**47 700**	250 000	**56 200**	2 200	3 200
97221UP2	105	**4.1339**	190	**7.4803**	72	**2.8346**	2.0	**.08**	1.00	**.040**	229 000	**51 500**	260 000	**58 500**	2 000	3 000
97222UP2	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.0	**.08**	1.00	**.040**	251 000	**56 400**	310 000	**69 700**	1 900	2 800
97224UP2	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.0	**.08**	1.00	**.040**	270 000	**60 700**	325 000	**73 100**	1 700	2 400
97226UP2	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.5	**.10**	1.00	**.040**	302 000	**67 900**	390 000	**87 700**	1 700	2 400
97228UP2	140	**5.5118**	250	**9.8425**	84	**3.3071**	2.5	**.10**	1.00	**.040**	319 000	**71 700**	430 000	**96 700**	1 600	2 200
97230UP2	150	**5.9055**	270	**10.6299**	90	**3.5433**	2.5	**.10**	1.00	**.040**	351 000	**78 900**	520 000	**117 000**	1 500	2 000
97232UP2	160	**6.2992**	290	**11.4173**	96	**3.7795**	2.5	**.10**	1.00	**.040**	390 000	**87 700**	560 000	**126 000**	1 300	1 700
97234UP2	170	**6.6929**	310	**12.2047**	104	**4.0945**	3.0	**.12**	1.00	**.040**	436 000	**98 000**	655 000	**147 000**	1 200	1 600
97236UP2	180	**7.0866**	320	**12.5984**	104	**4.0945**	3.0	**.12**	1.00	**.040**	449 000	**101 000**	710 000	**160 000**	1 100	1 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.76 and C_0 by 3.86.
3) Listed values are for machined brass cage. Values have been determined through historical application and practice.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

97300UP2 medium series



This series consists of a matched set of 9300UPDT and 7300PDT flush ground bearings having a 40° contact angle. One-piece, inner ring land-guided, machined brass cages are standard for this series.

These bearings are mounted in pairs in applications where substantial thrust loads are present. This arrangement divides the thrust load in one direction while accommodating reversing thrust load. To increase thrust capacity in one direction, additional 7300PDT bearings may be mounted in tandem.

For proper mounting orientation refer to page 243.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Fillet radius[1] r_b mm	Fillet radius[1] r_b in.	Basic radial load rating[2] Dynamic C[4] N	Basic radial load rating[2] Dynamic C[4] lbf	Basic radial load rating[2] Static C_0 N	Basic radial load rating[2] Static C_0 lbf	Speed rating[3] Grease rpm	Speed rating[3] Oil rpm
97307UP2	35	**1.3780**	80	**3.1496**	42	**1.6535**	1.5	**.06**	1.0	**.040**	63 700	**14 300**	49 000	**11 000**	6 000	8 000
97308UP2	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.0	**.040**	76 100	**17 100**	61 000	**13 700**	5 300	7 000
97309UP2	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.0	**.040**	97 500	**21 900**	80 000	**18 000**	4 800	6 300
97310UP2	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.0	**.040**	112 000	**25 200**	104 000	**23 400**	4 300	5 600
97311UP2	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.0	**.040**	130 000	**29 200**	112 000	**25 200**	3 800	5 000
97312UP2	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.0	**.040**	148 000	**33 300**	129 000	**29 000**	3 600	4 800
97313UP2	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.0	**.040**	165 000	**37 100**	160 000	**36 000**	3 200	4 300
97314UP2	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.0	**.040**	190 000	**42 700**	186 000	**41 800**	3 000	4 000
97315UP2	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.0	**.040**	208 000	**46 800**	200 000	**45 000**	2 800	3 800
97316UP2	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.0	**.08**	1.0	**.040**	225 000	**50 600**	220 000	**49 500**	2 600	3 600
97317UP2	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.5	**.10**	1.0	**.040**	238 000	**53 500**	245 000	**55 100**	2 400	3 400
97318UP2	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.5	**.10**	1.0	**.040**	255 000	**57 300**	270 000	**60 700**	2 200	3 200
97319UP2	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.5	**.10**	1.0	**.040**	276 000	**62 000**	300 000	**67 400**	2 000	3 000
97320UP2	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.5	**.10**	1.0	**.040**	307 000	**69 000**	380 000	**85 400**	1 900	2 800
97321UP2	105	**4.1339**	225	**8.8583**	98	**3.8583**	2.5	**.10**	1.0	**.040**	325 000	**73 100**	390 000	**87 700**	1 800	2 600
97322UP2	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.5	**.10**	1.0	**.040**	345 000	**77 600**	455 000	**102 000**	1 700	2 400
97324UP2	120	**4.7244**	260	**10.2362**	110	**4.3307**	2.5	**.10**	1.0	**.040**	390 000	**87 700**	530 000	**119 000**	1 600	2 200
97326UP2	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.0	**.12**	1.0	**.040**	449 000	**101 000**	610 000	**137 000**	1 500	2 000
97328UP2	140	**5.5118**	300	**11.8110**	124	**4.8819**	3.0	**.12**	1.0	**.040**	488 000	**110 000**	695 000	**156 000**	1 400	1 900
97330UP2	150	**5.9055**	320	**12.5984**	130	**5.1181**	3.0	**.12**	1.0	**.040**	540 000	**121 000**	780 000	**175 000**	1 200	1 700
97332UP2	160	**6.2992**	340	**13.3858**	136	**5.3543**	3.0	**.12**	1.0	**.040**	553 000	**124 000**	850 000	**191 000**	1 200	1 600
97334UP2	170	**6.6929**	360	**14.1732**	144	**5.6693**	3.0	**.12**	1.0	**.040**	605 000	**136 000**	965 000	**217 000**	1 000	1 500
97336UP2	180	**7.0866**	380	**14.9606**	150	**5.9055**	3.0	**.12**	1.0	**.040**	650 000	**146 000**	1 100 000	**247 000**	950	1 400

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.76 and C_0 by 3.86.
3) Listed values are for machined brass cage.
Values have been determined through historical application and practice.
4) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

97000U2 series 29° angular contact ball bearings duplex

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 0.80$

$P = 0.39\ F_R + 0.76\ F_A$ when $F_A/F_R > 0.80$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Dynamic radial load rating

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = 1.0\ F_R + 0.66\ F_A$

P_0 is always $\geq F_R$

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

97000U2 series 29° angular contact ball bearings duplex

Dynamic equivalent radial load and life calculation examples

Bearing size: 97313U2
Speed: 1750 rpm
Basic dynamic radial load rating (C) = 40000

Case 1

Thrust load (F_A) = 5000

$F_A/F_R = 5000/0 = \infty$

Since $F_A/F_R > 0.80$,

$P = 0.39\ F_R + 0.76\ F_A = 0.76 \times 5000$

$P = 3800$

$C = 40000$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{40000}{3800}\right)^3 = 1166 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 1750}\left(\frac{40000}{3800}\right)^3$$

= 11108 Hrs

Case 2

Radial load (F_R) = 3000

Thrust load (F_A) = 5000

$F_A/F_R = 5000/3000 = 1.67$

Since $F_A/F_R > 0.80$,

$P = 0.39\ F_R + 0.76\ F_A = 0.39 \times 3000 + 0.76 \times 5000$

$P = 4970$

$C = 40000$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{40000}{4970}\right)^3 = 521 \times 10^6 \text{ Rev.}$$

or

$$\text{Life (L10}_h\text{)} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 1750}\left(\frac{40000}{4970}\right)^3$$

= 4965 Hrs

97000UP2 series 40° angular contact ball bearings duplex

Dynamic and static equivalent radial load and life rating

Dynamic equivalent radial load

$P = F_R$ when $F_A/F_R \leq 1.14$

$P = 0.35\ F_R + 0.57\ F_A$ when $F_A/F_R > 1.14$

P = Dynamic equivalent radial load

F_R = Radial load

F_A = Thrust load

Life rating

$$L10 = \left(\frac{C}{P}\right)^3 \text{ (millions of revolutions)}$$

or

$$L10_h = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 \text{ (hours)}$$

C = Dynamic radial load rating

P = Dynamic equivalent radial load

n = Speed in rpm

Static equivalent radial load

$P_0 = 1.0\ F_R + 0.52\ F_A$

P_0 is always ≥ FR

P_0 = Static equivalent radial load

F_R = Radial load

F_A = Thrust load

97000UP2 series 40° angular contact ball bearings duplex

Dynamic equivalent radial load and life calculation examples

Bearing size: 97314UP2
Speed: 1750 rpm
Basic dynamic radial load rating (C) = 42700

Case 1

Thrust load (F_A) = 5000

$F_A/F_R = 5000/0 = \infty$

Since $F_A/F_R > 1.14$,

$P = 0.35\ F_R + 0.57\ F_A = 0.57 \times 5000$

$P = 2850$

$C = 42700$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{42700}{2850}\right)^3 = 3363 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 1750}\left(\frac{42700}{2850}\right)^3$$

= 32030 Hrs

Case 2

Radial load (F_R) = 3000

Thrust load (F_A) = 5000

$F_A/F_R = 5000/3000 = 1.67$

Since $F_A/F_R > 1.14$,

$P = 0.35\ F_R + 0.57\ F_A = 0.35 \times 3000 + 0.57 \times 5000$

$P = 3900$

$C = 42700$

$$\text{Life (L10)} = \left(\frac{C}{P}\right)^3 = \left(\frac{42700}{3900}\right)^3 = 1312 \times 10^6 \text{ Rev.}$$

or

$$\text{Life }(L10_h) = \frac{10^6}{60n}\left(\frac{C}{P}\right)^3 = \frac{10^6}{60 \times 1750}\left(\frac{42700}{3900}\right)^3$$

= 12500 Hrs

Precision bearings
ABEC-5 and ABEC-7 tolerance grades

Precision ball bearings in tolerance grades ABEC-5 and ABEC-7 are recommended for applications where high speed and/or extreme running accuracy is required. These bearings have the same nominal external dimensions as equivalent size ABEC-1 grade bearings; however, the running characteristics and external dimensions are held to closer tolerances.

Standardization

Bearing envelope dimensions and tolerances shown in this catalog comply with standards established in the USA by the Annular Bearing Engineers Committee (ABEC) of the American Bearing Manufacturers Association (ABMA) (see Engineering section; page 229). These standards have also been approved by the American Standard Association (ASA) and the International Standards Organization (ISO). This assures the bearing user of all the advantages of dimensional standardization. However, dimensional interchangeability is not necessarily an indication of functional interchangeability. Other characteristics must also be considered such as cage type, internal clearance, contact angle, configuration of the bearing rings and other details.

In order to meet the running characteristic tolerances specified for precision bearings, it is necessary to assemble them with high precision balls where the size, sphericity and other surface characteristics are held to very close tolerances. Cages generally are of phenolic (Bakelite) composition, which is well-suited for high-speed operation.

Temperature

The bearings are manufactured from vacuum-processed 52100 steel that can operate satisfactorily to 250° F (121° C). This is well within the requirement of most machine tool applications.

Duplexed bearings

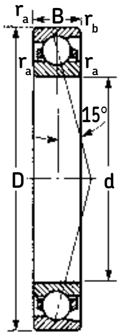
Precision ball bearings are also duplex ground so they can be used as a component in a pair of bearings or in a bearing set (see duplex bearings section; page 224). Duplex pairs (or sets of bearings) ordered as DB, DF, or DT (or in combinations), are tied together as they are to be mounted.

Packaging and identification

Bearings are thoroughly cleaned immediately prior to packaging and are usually coated with a lightweight oil compatible with most machine lubricants. Therefore, bearings can be used as received without being washed, with the oil serving as a rust inhibitor. Single-row bearings are packaged in hermetically sealed transparent bags and placed in distinctive boxes identified with the bearing number, tolerance grade and other important bearing data.

Series		Page
1900R	Extremely light, ABEC-7, single bearing	**194**
1900RD	Extremely light, ABEC-7, duplex set	**195**
100KR	Extra light, ABEC-7, single bearing	**196**
100KRD	Extra light, ABEC-7, duplex set	**197**
200R	Light, ABEC-7, single bearing	**198**
200RD	Light, ABEC-7, duplex set	**199**
300R	Medium, ABEC-7, single bearing	**200**
300RD	Medium, ABEC-7, duplex set	**201**
200S	Light, ABEC-5, woodworking bearings	**202**
300S	Medium, ABEC-5, woodworking bearings	**202**
XO-RBDJ	Ball screw support bearings	**203**

Precision 15° angular contact 1900R extremely light series single bearings



Precision 1900R series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring-centered phenolic cage designed to minimize centrifugal force.

Notes:

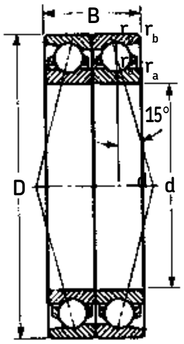
For recommended mounting fits refer to "Shaft and housing fits" in Engineering data section.

For equivalent load and life calculations see pages 122 and 123.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[2] N	lbf	Static C_0 N	lbf	Speed rating[3] Grease rpm	Oil rpm
1900R	10	.3937	22	.8661	6	.2362	.30	.012	.10	.004	110	.17	3 120	701	1 560	351	76 000	110 000
1901R	12	.4724	24	.9449	6	.2362	.30	.012	.10	.004	123	.19	3 250	731	1 800	405	69 000	100 000
1902R	15	.5906	28	1.1024	7	.2756	.30	.012	.10	.004	187	.29	4 880	1 100	2 700	607	55 000	84 000
1903R	17	.6693	30	1.1811	7	.2756	.30	.012	.10	.004	206	.32	5 400	1 210	3 000	674	51 000	78 000
1904R	20	.7874	37	1.4567	9	.3543	.30	.012	.15	.006	400	.62	9 360	2 100	5 850	1 320	41 000	62 000
1905R	25	.9843	42	1.6535	9	.3543	.30	.012	.15	.006	342	.53	7 610	1 710	5 300	1 190	37 000	53 000
1906R	30	1.1811	47	1.8504	9	.3543	.30	.012	.15	.006	452	.70	9 750	2 190	7 100	1 600	32 000	48 000
1907R	35	1.3780	55	2.1654	10	.3937	.64	.025	.15	.006	555	.86	11 200	2 520	9 000	2 020	25 000	39 000
1908R	40	1.5748	62	2.4409	12	.4724	.64	.025	.15	.006	722	1.12	14 300	3 210	11 600	2 600	23 000	36 000
1909R	45	1.7717	68	2.6772	12	.4724	.64	.025	.15	.006	806	1.25	15 100	3 400	13 400	3 010	21 000	31 000
1910R	50	1.9685	72	2.8346	12	.4724	.64	.025	.15	.006	1 070	1.66	19 500	4 380	17 300	3 900	20 000	28 000
1911R	55	2.1654	80	3.1496	13	.5118	1.00	.040	.30	.012	1 260	1.95	22 900	5 150	20 400	4 590	18 000	27 000
1912R	60	2.3622	85	3.3465	13	.5118	1.00	.040	.30	.012	1 390	2.15	24 200	5 440	22 800	5 130	17 000	25 000
1913R	65	2.5591	90	3.5433	13	.5118	1.00	.040	.30	.012	1 450	2.25	24 700	5 550	24 000	5 400	15 000	22 000
1914R	70	2.7559	100	3.9370	16	.6299	1.00	.040	.30	.012	1 990	3.09	33 200	7 460	32 500	7 300	14 000	21 000
1915R	75	2.9528	105	4.1339	16	.6299	1.00	.040	.30	.012	2 080	3.23	34 500	7 760	34 500	7 760	14 000	20 000
1916R	80	3.1496	110	4.3307	16	.6299	1.00	.040	.30	.012	2 180	3.38	34 500	7 760	36 000	8 100	13 000	19 000
1917R	85	3.3465	120	4.7244	18	.7087	1.00	.040	.60	.024	2 840	4.40	44 900	10 100	46 500	10 500	12 000	18 000
1918R	90	3.5433	125	4.9213	18	.7087	1.00	.040	.60	.024	3 400	5.27	52 700	11 800	56 000	12 600	12 000	17 000
1919R	95	3.7402	130	5.1181	18	.7087	1.00	.040	.60	.024	3 090	4.79	47 500	10 700	52 000	11 700	11 000	16 000
1920R	100	3.9370	140	5.5118	20	.7874	1.00	.040	.60	.024	3 870	6.00	58 500	13 200	64 000	14 400	10 000	15 000
1921R	105	4.1339	145	5.7087	20	.7874	1.00	.040	.60	.024	4 030	6.25	60 500	13 600	67 000	15 100	10 000	14 000
1922R	110	4.3307	150	5.9055	20	.7874	1.00	.040	.60	.024	3 820	5.93	55 300	12 400	64 000	14 400	9 200	13 000
1924R	120	4.7244	165	6.4961	22	.8661	1.00	.040	.60	.024	5 100	7.91	74 100	16 700	85 000	19 100	8 300	12 000
1926R	130	5.1181	180	7.0866	24	.9449	1.50	.060	.60	.024	6 300	9.77	90 400	20 500	106 000	23 800	7 800	11 000
1928R	140	5.5118	190	7.4803	24	.9449	1.50	.060	.60	.024	6 580	10.2	95 600	21 400	110 000	24 700	7 400	11 000
1930R	150	5.9055	210	8.2677	28	1.1024	2.00	.080	1.00	.040	9 090	14.1	125 000	28 200	150 000	33 700	6 400	9 500
1932R	160	6.2992	220	8.6614	28	1.1024	2.00	.080	1.00	.040	9 420	14.60	127 000	28 600	156 000	35 100	6 000	9 000
1934R	170	6.6929	230	9.0551	28	1.1024	2.00	.080	1.00	.040	10 200	15.80	133 000	29 800	170 000	38 300	5 500	8 400
1936R	180	7.0866	250	9.8425	33	1.2992	2.00	.080	1.00	.040	12 800	19.90	168 000	36 000	212 000	47 800	5 100	7 800
1938R	190	7.4803	260	10.2362	33	1.2992	2.00	.080	1.00	.040	13 400	20.70	174 000	39 100	224 000	50 400	5 100	7 800
1940R	200	7.8740	280	11.0236	38	1.4961	2.00	.080	1.00	.040	16 800	26.00	216 000	48 600	275 000	61 800	4 600	7 300

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 1900RD extremely light series duplex



Precision 1900RD series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring-centered phenolic cage designed to minimize centrifugal force.

Notes:

For recommended mounting fits refer to “Shaft and housing fits” in Engineering data section.

“D” indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

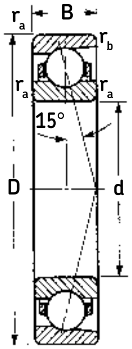
For equivalent load and life calculations see pages 124 and 125.

Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[2] N	Dynamic C lbf	Static C_0 N	Static C_0 lbf	Speed rating[3] Grease rpm	Oil rpm
1900RD	10	.3937	22	.8661	12	.4724	.30	.012	.10	.004	110	.17	5 070	1 140	3 100	697	61 000	88 000
1901RD	12	.4724	24	.9449	12	.4724	.30	.012	.10	.004	123	.19	5 270	1 180	3 550	798	55 000	80 000
1902RD	15	.5906	28	1.1024	14	.5512	.30	.012	.10	.004	187	.29	7 930	1 780	5 400	1 210	44 000	67 000
1903RD	17	.6693	30	1.1811	14	.5512	.30	.012	.10	.004	206	.32	8 710	1 960	6 100	1 370	41 000	62 000
1904RD	20	.7874	37	1.4567	18	.7087	.30	.012	.15	.006	400	.62	15 300	3 440	11 600	2 600	33 000	50 000
1905RD	25	.9843	42	1.6535	18	.7087	.30	.012	.15	.006	342	.53	12 400	2 790	10 800	2 430	30 000	42 000
1906RD	30	1.1811	47	1.8504	18	.7087	.30	.012	.15	.006	452	.70	15 900	3 580	14 300	3 210	26 000	38 000
1907RD	35	1.3780	55	2.1654	20	.7874	.64	.025	.15	.006	555	.86	18 200	4 090	18 000	4 050	20 000	31 000
1908RD	40	1.5748	62	2.4409	24	.9449	.64	.025	.15	.006	722	1.12	22 900	5 150	23 200	5 220	18 000	29 000
1909RD	45	1.7717	68	2.6772	24	.9449	.64	.025	.15	.006	806	1.25	24 700	5 550	26 500	5 960	17 000	25 000
1910RD	50	1.9685	72	2.8346	24	.9449	.64	.025	.15	.006	1 070	1.66	31 900	7 170	34 500	7 760	16 000	22 000
1911RD	55	2.1654	80	3.1496	26	1.0236	1.00	.040	.30	.012	1 260	1.95	37 100	8 340	40 500	9 100	14 000	22 000
1912RD	60	2.3622	85	3.3465	26	1.0236	1.00	.040	.30	.012	1 390	2.15	39 000	8 770	45 500	10 200	14 000	20 000
1913RD	65	2.5591	90	3.5433	26	1.0236	1.00	.040	.30	.012	1 450	2.25	39 700	8 920	48 000	10 800	12 000	18 000
1914RD	70	2.7559	100	3.9370	32	1.2598	1.00	.040	.30	.012	1 990	3.09	54 000	12 100	65 500	14 700	11 000	17 000
1915RD	75	2.9528	105	4.1339	32	1.2598	1.00	.040	.30	.012	2 080	3.23	55 900	12 600	68 000	15 300	11 000	16 000
1916RD	80	3.1496	110	4.3307	32	1.2598	1.00	.040	.30	.012	2 180	3.38	57 200	12 900	72 000	16 200	10 000	15 000
1917RD	85	3.3465	120	4.7244	36	1.4173	1.00	.040	.60	.024	2 840	4.40	74 100	16 700	93 000	20 900	9 600	14 000
1918RD	90	3.5433	125	4.9213	36	1.4173	1.00	.040	.60	.024	3 400	5.27	85 200	19 200	112 000	25 200	9 600	14 000
1919RD	95	3.7402	130	5.1181	36	1.4173	1.00	.040	.60	.024	3 090	4.79	76 100	17 100	104 000	23 400	8 800	13 000
1920RD	100	3.9370	140	5.5118	40	1.5748	1.00	.040	.60	.024	3 870	6.00	95 600	21 500	127 000	28 600	8 000	12 000
1921RD	105	4.1339	145	5.7087	40	1.5748	1.00	.040	.60	.024	4 030	6.25	97 500	21 900	134 000	30 100	8 000	11 000
1922RD	110	4.3307	150	5.9055	40	1.5748	1.00	.040	.60	.024	3 820	5.93	90 400	20 300	129 000	29 000	7 400	10 000
1924RD	120	4.7244	165	6.4961	44	1.7323	1.00	.040	.60	.024	5 100	7.91	121 000	27 200	170 000	38 200	6 600	9 600
1926RD	130	5.1181	180	7.0866	48	1.8898	1.50	.060	.60	.024	6 300	9.77	146 000	32 800	208 000	46 800	6 200	8 800
1928RD	140	5.5118	190	7.4803	48	1.8898	1.50	.060	.60	.024	6 580	10.20	156 000	35 100	220 000	49 500	5 900	8 800
1930RD	150	5.9055	210	8.2677	56	2.2047	2.00	.080	1.00	.040	9 090	14.10	203 000	45 600	300 000	67 400	5 100	7 600
1932RD	160	6.2992	220	8.6614	56	2.2047	2.00	.080	1.00	.040	9 420	14.60	208 000	46 800	315 000	70 800	4 800	7 200
1934RD	170	6.6929	230	9.0551	56	2.2047	2.00	.080	1.00	.040	10 200	15.80	216 000	48 600	340 000	76 400	4 400	6 700
1936RD	180	7.0866	250	9.8425	66	2.5984	2.00	.080	1.00	.040	12 800	19.90	276 000	62 000	425 000	95 600	4 100	6 200
1938RD	190	7.4803	260	10.2362	66	2.5984	2.00	.080	1.00	.040	13 400	20.70	281 000	63 200	440 000	98 900	4 100	6 200
1940RD	200	7.8740	280	11.0236	76	2.9921	2.00	.080	1.00	.040	16 800	26.00	351 000	78 900	550 000	124 000	3 700	5 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 100KR extra light series single bearings



Precision 100KR series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring-centered phenolic cage designed to minimize centrifugal force.

Notes:

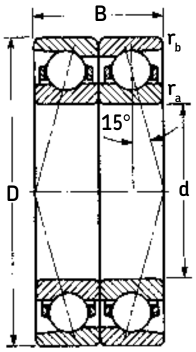
For recommended mounting fits refer to “Shaft and housing fits” in Engineering data section.

For equivalent load and life calculations see pages 122 and 123.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[2] N	lbf	Static C_0 N	lbf	Speed rating[3] Grease rpm	Oil rpm
100KR	10	**.3937**	26	**1.0236**	8	**.3150**	.30	**.012**	.10	**.004**	181	**.28**	4 940	**1 110**	2 280	**513**	69 000	100 000
101KR	12	**.4724**	28	**1.1024**	8	**.3150**	.30	**.012**	.10	**.004**	206	**.32**	5 530	**1 240**	2 650	**596**	60 000	90 000
102KR	15	**.5906**	32	**1.2598**	9	**.3543**	.30	**.012**	.10	**.004**	226	**.35**	6 050	**1 350**	3 150	**708**	51 000	78 000
103KR	17	**.6693**	35	**1.3780**	10	**.3937**	.30	**.012**	.10	**.004**	342	**.53**	8 520	**1 920**	4 650	**1 050**	44 000	67 000
104KR	20	**.7874**	42	**1.6535**	12	**.4724**	.64	**.025**	.30	**.012**	445	**.69**	10 800	**2 420**	6 200	**1 390**	39 000	56 000
105KR	25	**.9843**	47	**1.8504**	12	**.4724**	.64	**.025**	.30	**.012**	522	**.81**	12 100	**2 720**	7 650	**1 720**	35 000	50 000
106KR	30	**1.1811**	55	**2.1654**	13	**.5118**	1.00	**.040**	.30	**.012**	716	**1.11**	15 600	**3 500**	10 600	**2 380**	28 000	42 000
107KR	35	**1.3780**	62	**2.4409**	14	**.5512**	1.00	**.040**	.30	**.012**	884	**1.37**	18 600	**4 180**	13 200	**2 970**	23 000	36 000
108KR	40	**1.5748**	68	**2.6772**	15	**.5906**	1.00	**.040**	.30	**.012**	942	**1.46**	19 500	**4 380**	14 600	**3 280**	22 000	34 000
109KR	45	**1.7717**	75	**2.9528**	16	**.6299**	1.00	**.040**	.30	**.012**	1 220	**1.89**	24 200	**5 440**	19 000	**4 270**	21 000	31 000
110KR	50	**1.9685**	80	**3.1496**	16	**.6299**	1.00	**.040**	.30	**.012**	1 300	**2.01**	25 100	**5 640**	20 400	**4 590**	20 000	28 000
111KR	55	**2.1654**	90	**3.5433**	18	**.7087**	1.00	**.040**	.60	**.024**	1 810	**2.81**	33 800	**7 600**	28 000	**6 290**	17 000	25 000
112KR	60	**2.3622**	95	**3.7402**	18	**.7087**	1.00	**.040**	.60	**.024**	1 920	**2.97**	35 100	**7 890**	30 000	**6 740**	15 000	22 000
113KR	65	**2.5591**	100	**3.9370**	18	**.7087**	1.00	**.040**	.60	**.024**	2 030	**3.14**	35 800	**8 050**	32 500	**7 310**	14 000	21 000
114KR	70	**2.7559**	110	**4.3307**	20	**.7874**	1.00	**.040**	.60	**.024**	2 470	**3.83**	42 300	**9 510**	40 000	**8 990**	14 000	20 000
115KR	75	**2.9528**	115	**4.5276**	20	**.7874**	1.00	**.040**	.60	**.024**	2 590	**4.02**	43 600	**9 800**	42 500	**9 550**	13 000	19 000
116KR	80	**3.1496**	125	**4.9213**	22	**.8661**	1.00	**.040**	.60	**.024**	3 390	**5.25**	55 900	**12 600**	54 000	**12 100**	12 000	18 000
117KR	85	**3.3465**	130	**5.1181**	22	**.8661**	1.00	**.040**	.60	**.024**	3 550	**5.50**	57 200	**12 900**	57 000	**12 800**	12 000	17 000
118KR	90	**3.5433**	140	**5.5118**	24	**.9449**	1.50	**.060**	.60	**.024**	4 280	**6.64**	68 900	**15 500**	68 000	**15 300**	11 000	16 000
119KR	95	**3.7402**	145	**5.7087**	24	**.9449**	1.50	**.060**	.60	**.024**	5 040	**7.81**	83 200	**18 700**	80 000	**18 000**	10 000	15 000
120KR	100	**3.9370**	150	**5.9055**	24	**.9449**	1.50	**.060**	.60	**.024**	4 700	**7.28**	71 500	**16 100**	76 500	**17 200**	10 000	14 000
121KR	105	**4.1339**	160	**6.2992**	26	**1.0236**	2.00	**.080**	1.00	**.040**	5 540	**8.59**	85 200	**19 200**	90 000	**20 200**	9 200	13 000
122KR	110	**4.3307**	170	**6.6929**	28	**1.1024**	2.00	**.080**	1.00	**.040**	6 400	**9.93**	99 500	**22 400**	102 000	**23 000**	8 700	13 000
124KR	120	**4.7244**	180	**7.0866**	28	**1.1024**	2.00	**.080**	1.00	**.040**	6 710	**10.40**	101 000	**22 600**	110 000	**24 700**	7 800	11 000
126KR	130	**5.1181**	200	**7.8740**	33	**1.2992**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	138 000	**31 000**	150 000	**33 700**	7 400	11 000
128KR	140	**5.5118**	210	**8.2677**	33	**1.2992**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	135 000	**30 300**	153 000	**34 400**	6 900	10 000
130KR	150	**5.9055**	225	**8.8583**	35	**1.3780**	2.00	**.080**	1.00	**.040**	10 800	**16.80**	156 000	**35 000**	176 000	**39 600**	6 000	9 000
132KR	160	**6.2992**	240	**9.4488**	38	**1.4961**	2.00	**.080**	1.00	**.040**	12 400	**19.30**	178 000	**40 000**	204 000	**45 900**	5 500	8 400
134KR	170	**6.6929**	260	**10.2362**	42	**1.6535**	2.00	**.080**	1.00	**.040**	15 300	**23.70**	212 000	**47 700**	245 000	**55 100**	5 100	7 800
136KR	180	**7.0866**	280	**11.0236**	46	**1.8110**	2.00	**.080**	1.00	**.040**	17 900	**27.80**	234 000	**52 600**	290 000	**65 200**	4 600	7 300
138KR	190	**7.4803**	290	**11.4173**	46	**1.8110**	2.00	**.080**	1.00	**.040**	18 800	**29.10**	242 000	**54 400**	305 000	**68 600**	4 600	7 300
140KR	200	**7.8740**	310	**12.2047**	51	**2.0079**	2.00	**.080**	1.00	**.040**	22 200	**34.40**	276 000	**62 000**	355 000	**79 800**	4 400	6 700
144KR	220	**8.6614**	340	**13.3858**	56	**2.2047**	2.50	**.100**	1.00	**.040**	30 400	**47.20**	345 000	**77 600**	480 000	**108 000**	4 100	6 200
148KR	240	**9.4488**	360	**14.1732**	56	**2.2047**	2.50	**.100**	1.00	**.040**	31 900	**49.50**	351 000	**78 900**	510 000	**115 000**	3 900	5 600

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 100KRD extra light series duplex



Precision 100KRD series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring-centered phenolic cage designed to minimize centrifugal force.

Notes:

For recommended mounting fits refer to "Shaft and housing fits" in Engineering data section.

"D" indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

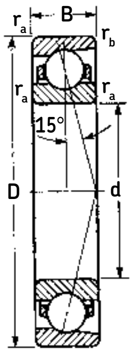
For equivalent load and life calculations see pages 124 and 125.

Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	r_a in.	r_b mm	r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[2] N	Dynamic lbf	Static C_0 N	Static lbf	Speed rating[3] Grease rpm	Oil rpm
100KRD	10	**.3937**	26	**1.0236**	16	**.6299**	.30	**.012**	.10	**.004**	181	**.28**	8.060	**1 810**	4 550	**1 020**	55 000	80 000
101KRD	12	**.4724**	28	**1.1024**	16	**.6299**	.30	**.012**	.10	**.004**	206	**.32**	8 840	**1 990**	5 300	**1 190**	48 000	72 000
102KRD	15	**.5906**	32	**1.2598**	18	**.7087**	.30	**.012**	.10	**.004**	226	**.35**	9 750	**2 190**	6 300	**1 420**	41 000	62 000
103KRD	17	**.6693**	35	**1.3780**	20	**.7874**	.30	**.012**	.10	**.004**	342	**.53**	13 800	**3 100**	9 300	**2 090**	35 000	54 000
104KRD	20	**.7874**	42	**1.6535**	24	**.9449**	.64	**.025**	.30	**.012**	445	**.69**	17 400	**3 910**	12 500	**2 810**	31 000	45 000
105KRD	25	**.9843**	47	**1.8504**	24	**.9449**	.64	**.025**	.30	**.012**	522	**.81**	19 500	**4 380**	15 300	**3 440**	28 000	40 000
106KRD	30	**1.1811**	55	**2.1654**	26	**1.0236**	1.00	**.040**	.30	**.012**	716	**1.11**	25 500	**5 730**	21 200	**4 760**	22 000	34 000
107KRD	35	**1.3780**	62	**2.4409**	28	**1.1024**	1.00	**.040**	.30	**.012**	884	**1.37**	30 200	**6 790**	26 500	**5 960**	18 000	29 000
108KRD	40	**1.5748**	68	**2.6772**	30	**1.1811**	1.00	**.040**	.30	**.012**	942	**1.46**	31 900	**7 170**	29 000	**6 520**	18 000	27 000
109KRD	45	**1.7717**	75	**2.9528**	32	**1.2598**	1.00	**.040**	.30	**.012**	1 220	**1.89**	39 000	**8 770**	37 500	**8 430**	17 000	25 000
110KRD	50	**1.9685**	80	**3.1496**	32	**1.2598**	1.00	**.040**	.30	**.012**	1 300	**2.01**	40 300	**9 060**	40 500	**9 100**	16 000	22 000
111KRD	55	**2.1654**	90	**3.5433**	36	**1.4173**	1.00	**.040**	.60	**.024**	1 810	**2.81**	55 300	**12 400**	56 000	**12 600**	14 000	20 000
112KRD	60	**2.3622**	95	**3.7402**	36	**1.4173**	1.00	**.040**	.60	**.024**	1 920	**2.97**	55 900	**12 600**	61 000	**13 700**	12 000	18 000
113KRD	65	**2.5591**	100	**3.9370**	36	**1.4173**	1.00	**.040**	.60	**.024**	2 030	**3.14**	58 500	**13 200**	64 000	**14 400**	11 000	17 000
114KRD	70	**2.7559**	110	**4.3307**	40	**1.5748**	1.00	**.040**	.60	**.024**	2 470	**3.83**	68 900	**15 500**	80 000	**18 000**	11 000	16 000
115KRD	75	**2.9528**	115	**4.5276**	40	**1.5748**	1.00	**.040**	.60	**.024**	2 590	**4.02**	70 200	**15 800**	85 000	**19 100**	10 000	15 000
116KRD	80	**3.1496**	125	**4.9213**	44	**1.7323**	1.00	**.040**	.60	**.024**	3 390	**5.25**	90 400	**20 300**	110 000	**24 700**	9 600	14 000
117KRD	85	**3.3465**	130	**5.1181**	44	**1.7323**	1.00	**.040**	.60	**.024**	3 550	**5.50**	92 300	**20 700**	116 000	**26 100**	9 600	14 000
118KRD	90	**3.5433**	140	**5.5118**	48	**1.8898**	1.50	**.060**	.60	**.024**	4 280	**6.64**	111 000	**25 000**	137 000	**30 800**	8 800	13 000
119KRD	95	**3.7402**	145	**5.7087**	48	**1.8898**	1.50	**.060**	.60	**.024**	5 040	**7.81**	135 000	**30 300**	160 000	**36 000**	8 000	12 000
120KRD	100	**3.9370**	150	**5.9055**	48	**1.8898**	1.50	**.060**	.60	**.024**	4 700	**7.28**	117 000	**26 300**	153 000	**34 400**	8 000	11 000
121KRD	105	**4.1339**	160	**6.2992**	52	**2.0472**	2.00	**.080**	1.00	**.040**	5 540	**8.59**	138 000	**31 000**	180 000	**40 500**	7 400	10 000
122KRD	110	**4.3307**	170	**6.6929**	56	**2.2047**	2.00	**.080**	1.00	**.040**	6 400	**9.93**	163 000	**36 600**	204 000	**45 900**	7 000	10 000
124KRD	120	**4.7244**	180	**7.0866**	56	**2.2047**	2.00	**.080**	1.00	**.040**	6 710	**10.40**	163 000	**36 600**	220 000	**49 500**	6 200	8 800
126KRD	130	**5.1181**	200	**7.8740**	66	**2.5984**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	225 000	**50 000**	300 000	**67 400**	5 900	8 800
128KRD	140	**5.5118**	210	**8.2677**	66	**2.5984**	2.00	**.080**	1.00	**.040**	9 350	**14.50**	221 000	**49 700**	305 000	**68 600**	5 500	8 000
130KRD	150	**5.9055**	225	**8.8583**	70	**2.7559**	2.00	**.080**	1.00	**.040**	10 800	**16.80**	255 000	**57 300**	355 000	**79 800**	4 800	7 200
132KRD	160	**6.2992**	240	**9.4488**	76	**2.9921**	2.00	**.080**	1.00	**.040**	12 400	**19.30**	286 000	**64 300**	405 000	**91 000**	4 400	6 700
134KRD	170	**6.6929**	260	**10.2362**	84	**3.3071**	2.00	**.080**	1.00	**.040**	15 300	**23.70**	345 000	**77 600**	490 000	**110 000**	4 100	6 200
136KRD	180	**7.0866**	280	**11.0236**	92	**3.6220**	2.00	**.080**	1.00	**.040**	17 900	**27.80**	377 000	**84 800**	570 000	**128 000**	3 700	5 800
138KRD	190	**7.4803**	290	**11.4173**	92	**3.6220**	2.00	**.080**	1.00	**.040**	18 800	**29.10**	390 000	**87 700**	610 000	**137 000**	3 700	5 800
140KRD	200	**7.8740**	310	**12.2047**	102	**4.0157**	2.00	**.080**	1.00	**.040**	22 200	**34.40**	442 000	**99 400**	710 000	**160 000**	3 500	5 400
144KRD	220	**8.6614**	340	**13.3858**	112	**4.4094**	2.50	**.100**	1.00	**.040**	30 400	**47.20**	559 000	**126 000**	965 000	**217 000**	3 300	5 000
148KRD	240	**9.4488**	360	**14.1732**	112	**4.4094**	2.50	**.100**	1.00	**.040**	31 900	**49.50**	572 000	**129 000**	1 020 000	**228 000**	3 100	4 500

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 200R light series single bearings



Precision 200R series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring centered phenolic cage designed to minimize centrifugal force.

Notes:

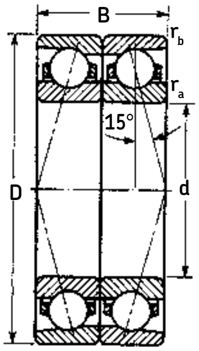
For recommended mounting fits refer to “Shaft and housing fits” in Engineering data section.

For equivalent load and life calculations see pages 122 and 123.

	Bore		Outside diameter		Width		Fillet radius[1]						Basic radial load rating				Speed rating[3]	
													Dynamic		Static			
MRC bearing number	d		D		B		r_a		r_b		ZD^2		C[2]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
200R	10	**.3937**	30	**1.1811**	9	**.3543**	.64	**.025**	.30	**.012**	284	**.44**	7 280	**1 640**	3 200	**719**	55 000	84 000
201R	12	**.4724**	32	**1.2598**	10	**.3937**	.64	**.025**	.30	**.012**	323	**.50**	8 190	**1 840**	3 900	**877**	51 000	78 000
202R	15	**.5906**	35	**1.3780**	11	**.4331**	.64	**.025**	.30	**.012**	406	**.63**	9 750	**2 190**	5 100	**1 150**	44 000	67 000
203R	17	**.6693**	40	**1.5748**	12	**.4724**	.64	**.025**	.30	**.012**	510	**.79**	12 100	**2 730**	6 550	**1 470**	39 000	56 000
204R	20	**.7874**	47	**1.8504**	14	**.5512**	1.00	**.040**	.60	**.024**	562	**.87**	13 300	**2 990**	7 800	**1 750**	35 000	50 000
205R	25	**.9843**	52	**2.0472**	15	**.5906**	1.00	**.040**	.60	**.024**	693	**1.07**	15 900	**3 570**	9 650	**2 170**	28 000	42 000
206R	30	**1.1811**	62	**2.4409**	16	**.6299**	1.00	**.040**	.60	**.024**	884	**1.37**	19 000	**4 270**	12 900	**2 910**	23 000	36 000
207R	35	**1.3780**	72	**2.8346**	17	**.6693**	1.00	**.040**	.60	**.024**	1 270	**1.97**	26 000	**5 850**	18 600	**4 180**	21 000	31 000
208R	40	**1.5748**	80	**3.1496**	18	**.7087**	1.00	**.040**	.60	**.024**	1 730	**2.68**	34 500	**7 760**	25 000	**5 620**	20 000	28 000
209R	45	**1.7717**	85	**3.3465**	19	**.7480**	1.00	**.040**	.60	**.024**	1 850	**2.87**	35 800	**8 050**	27 500	**6 180**	17 000	25 000
210R	50	**1.9685**	90	**3.5433**	20	**.7874**	1.00	**.040**	.60	**.024**	1 970	**3.06**	37 700	**8 480**	30 000	**6 740**	16 000	24 000
211R	55	**2.1654**	100	**3.9370**	21	**.8268**	1.50	**.060**	1.00	**.040**	2 860	**4.43**	54 000	**12 100**	41 500	**9 330**	14 000	21 000
212R	60	**2.3622**	110	**4.3307**	22	**.8661**	1.50	**.060**	1.00	**.040**	3 260	**5.06**	59 200	**13 300**	49 000	**11 000**	14 000	20 000
213R	65	**2.5591**	120	**4.7244**	23	**.9055**	1.50	**.060**	1.00	**.040**	3 780	**5.86**	58 500	**13 200**	55 000	**12 400**	12 000	18 000
214R	70	**2.7559**	125	**4.9213**	24	**.9449**	1.50	**.060**	1.00	**.040**	4 030	**6.25**	71 500	**16 100**	60 000	**13 500**	12 000	17 000
215R	75	**2.9528**	130	**5.1181**	25	**.9843**	1.50	**.060**	1.00	**.040**	4 880	**7.56**	85 200	**19 200**	72 000	**16 200**	11 000	16 000
216R	80	**3.1496**	140	**5.5118**	26	**1.0236**	2.00	**.080**	1.00	**.040**	5 180	**8.04**	90 400	**20 300**	78 000	**17 500**	10 000	15 000
217R	85	**3.3465**	150	**5.9055**	28	**1.1024**	2.00	**.080**	1.00	**.040**	6 170	**9.56**	104 000	**23 400**	93 000	**20 900**	10 000	14 000
218R	90	**3.5433**	160	**6.2992**	30	**1.1811**	2.00	**.080**	1.00	**.040**	7 410	**11.50**	124 000	**27 900**	108 000	**24 300**	8 700	13 000
219R	95	**3.7402**	170	**6.6929**	32	**1.2598**	2.00	**.080**	1.00	**.040**	7 900	**12.30**	133 000	**29 900**	118 000	**26 500**	8 300	12 000
220R	100	**3.9370**	180	**7.0866**	34	**1.3386**	2.00	**.080**	1.00	**.040**	9 070	**14.10**	146 000	**32 800**	134 000	**30 100**	7 800	11 000
221R	105	**4.1339**	190	**7.4803**	36	**1.4173**	2.00	**.080**	1.00	**.040**	10 300	**16.00**	168 000	**37 800**	153 000	**34 400**	7 400	11 000
222R	110	**4.3307**	200	**7.8740**	38	**1.4961**	2.00	**.080**	1.00	**.040**	11 700	**18.10**	182 000	**40 900**	170 000	**38 200**	6 900	10 000
224R	120	**4.7244**	215	**8.4646**	40	**1.5748**	2.00	**.080**	1.00	**.040**	13 000	**20.20**	199 000	**44 700**	193 000	**43 300**	6 400	9 500
226R	130	**5.1181**	230	**9.0551**	40	**1.5748**	2.50	**.100**	1.00	**.040**	15 500	**24.00**	221 000	**49 600**	232 000	**52 200**	6 000	9 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33\frac{1}{3}$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 200RD light series duplex



Precision 200RD series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring centered phenolic cage designed to minimize centrifugal force.

Notes:

For recommended mounting fits refer to “Shaft and Housing Fits” in Engineering Data Section.

“D” indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

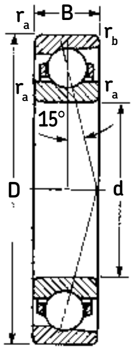
For equivalent load and life calculations see pages 124 and 125.

Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Fillet radius[1] r_b mm	Fillet radius[1] r_b in.	ZD^2 mm	ZD^2 in.	Basic radial load rating Dynamic C[2] N	Basic radial load rating Dynamic C[2] lbf	Basic radial load rating Static C_0 N	Basic radial load rating Static C_0 lbf	Speed rating[3] Grease rpm	Speed rating[3] Oil rpm
200RD	10	**.3937**	30	**1.1811**	18	**.7087**	.64	**.025**	.30	**.012**	284	**.44**	11 900	**2 680**	6 400	**1 440**	44 000	67 000
201RD	12	**.4724**	32	**1.2598**	20	**.7874**	.64	**.025**	.30	**.012**	323	**.50**	13 300	**2 990**	7 800	**1 750**	41 000	62 000
202RD	15	**.5906**	35	**1.3780**	22	**.8661**	.64	**.025**	.30	**.012**	406	**.63**	15 900	**3 570**	10 200	**2 290**	35 000	54 000
203RD	17	**.6693**	40	**1.5748**	24	**.9449**	.64	**.025**	.30	**.012**	510	**.79**	19 900	**4 470**	13 200	**2 970**	31 000	45 000
204RD	20	**.7874**	47	**1.8504**	28	**1.1024**	1.00	**.040**	.60	**.024**	562	**.87**	21 600	**4 860**	15 600	**3 510**	28 000	40 000
205RD	25	**.9843**	52	**2.0472**	30	**1.1811**	1.00	**.040**	.60	**.024**	693	**1.07**	26 000	**5 850**	19 300	**4 340**	22 000	34 000
206RD	30	**1.1811**	62	**2.4409**	32	**1.2598**	1.00	**.040**	.60	**.024**	884	**1.37**	30 700	**6 900**	26 000	**5 850**	18 000	29 000
207RD	35	**1.3780**	72	**2.8346**	34	**1.3386**	1.00	**.040**	.60	**.024**	1 270	**1.97**	42 300	**9 570**	37 500	**8 430**	17 000	25 000
208RD	40	**1.5748**	80	**3.1496**	36	**1.4173**	1.00	**.040**	.60	**.024**	1 730	**2.68**	55 900	**12 600**	50 000	**11 200**	16 000	22 000
209RD	45	**1.7717**	85	**3.3465**	38	**1.4961**	1.00	**.040**	.60	**.024**	1 850	**2.87**	58 500	**13 200**	55 000	**12 400**	14 000	20 000
210RD	50	**1.9685**	90	**3.5433**	40	**1.5748**	1.00	**.040**	.60	**.024**	1 970	**3.06**	60 500	**13 600**	60 000	**13 500**	13 000	19 000
211RD	55	**2.1654**	100	**3.9370**	42	**1.6535**	1.50	**.060**	1.00	**.040**	2 860	**4.43**	87 100	**19 600**	83 000	**18 700**	11 000	17 000
212RD	60	**2.3622**	110	**4.3307**	44	**1.7323**	1.50	**.060**	1.00	**.040**	3 260	**5.06**	95 600	**21 500**	98 000	**22 000**	11 000	16 000
213RD	65	**2.5591**	120	**4.7244**	46	**1.8110**	1.50	**.060**	1.00	**.040**	3 780	**5.86**	95 600	**21 500**	110 000	**24 700**	9 600	14 000
214RD	70	**2.7559**	125	**4.9213**	48	**1.8898**	1.50	**.060**	1.00	**.040**	4 030	**6.25**	117 000	**26 300**	120 000	**27 000**	9 600	14 000
215RD	75	**2.9528**	130	**5.1181**	50	**1.9685**	1.50	**.060**	1.00	**.040**	4 880	**7.56**	138 000	**31 000**	148 000	**32 100**	8 800	13 000
216RD	80	**3.1496**	140	**5.5118**	52	**2.0472**	2.00	**.080**	1.00	**.040**	5 180	**8.04**	153 000	**34 400**	156 000	**35 100**	8 000	12 000
217RD	85	**3.3465**	150	**5.9055**	56	**2.2047**	2.00	**.080**	1.00	**.040**	6 170	**9.56**	168 000	**37 800**	186 000	**41 800**	8 000	11 000
218RD	90	**3.5433**	160	**6.2992**	60	**2.3622**	2.00	**.080**	1.00	**.040**	7 410	**11.50**	203 000	**45 600**	216 000	**48 600**	7 000	10 000
219RD	95	**3.7402**	170	**6.6929**	64	**2.5197**	2.00	**.080**	1.00	**.040**	7 900	**12.30**	216 000	**48 600**	236 000	**53 100**	6 600	9 600
220RD	100	**3.9370**	180	**7.0866**	68	**2.6772**	2.00	**.080**	1.00	**.040**	9 070	**14.10**	238 000	**53 500**	270 000	**60 700**	6 200	8 800
221RD	105	**4.1339**	190	**7.4803**	72	**2.8346**	2.00	**.080**	1.00	**.040**	10 300	**16.00**	270 000	**60 700**	305 000	**68 600**	5 900	8 800
222RD	110	**4.3307**	200	**7.8740**	76	**2.9921**	2.00	**.080**	1.00	**.040**	11 700	**18.10**	296 000	**66 500**	340 000	**76 400**	5 500	8 000
224RD	120	**4.7244**	215	**8.4646**	80	**3.1496**	2.00	**.080**	1.00	**.040**	13 000	**20.20**	325 000	**73 100**	390 000	**87 700**	5 100	7 600
226RD	130	**5.1181**	230	**9.0551**	80	**3.1496**	2.50	**.100**	1.00	**.040**	15 500	**24.00**	358 000	**80 500**	465 000	**105 000**	4 800	7 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 300R medium series single bearings



Precision 300R series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring centered phenolic cage designed to minimize centrifugal force.

Notes:

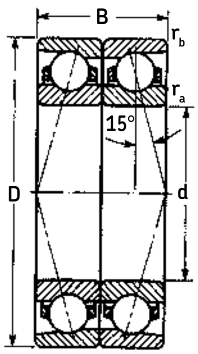
For recommended mounting fits refer to “Shaft and housing fits” in Engineering data section.

For equivalent load and life calculations see pages 122 and 123.

	Bore		Outside diameter		Width		Fillet radius[1]						Basic radial load rating				Speed rating[3]	
													Dynamic		Static			
MRC bearing number	d		D		B		r_a		r_b		ZD^2		C[2]		C_0		Grease	Oil
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	N	lbf	N	lbf	rpm	rpm
300R	10	**.3937**	35	**1.3780**	11	**.4331**	1.0	**.04**	.60	**.024**	439	**.68**	10 500	**2 360**	4 550	**1 020**	46 000	73 000
301R	12	**.4724**	37	**1.4567**	12	**.4724**	1.0	**.04**	.60	**.024**	439	**.68**	10 600	**2 380**	4 900	**1 100**	44 000	67 000
302R	15	**.5906**	42	**1.6535**	13	**.5118**	1.0	**.04**	.60	**.024**	510	**.79**	12 100	**2 720**	6 550	**1 470**	39 000	56 000
303R	17	**.6693**	47	**1.8504**	14	**.5512**	1.0	**.04**	.60	**.024**	632	**.98**	14 800	**3 330**	8 150	**1 830**	37 000	53 000
304R	20	**.7874**	52	**2.0472**	15	**.5906**	1.0	**.04**	.60	**.024**	909	**1.41**	20 300	**4 560**	11 400	**2 560**	30 000	45 000
305R	25	**.9843**	62	**2.4409**	17	**.6693**	1.0	**.04**	.60	**.024**	1 090	**1.69**	23 400	**5 260**	15 300	**3 440**	25 000	39 000
306R	30	**1.1811**	72	**2.8346**	19	**.7480**	1.0	**.04**	.60	**.024**	1 480	**2.30**	31 200	**7 010**	20 000	**4 500**	21 000	31 000
307R	35	**1.3780**	80	**3.1496**	21	**.8268**	1.5	**.06**	1.00	**.040**	1 940	**3.00**	39 700	**8 920**	26 000	**5 850**	20 000	28 000
308R	40	**1.5748**	90	**3.5433**	23	**.9055**	1.5	**.06**	1.00	**.040**	2 450	**3.80**	48 800	**11 000**	33 500	**7 530**	17 000	25 000
309R	45	**1.7717**	100	**3.9370**	25	**.9843**	1.5	**.06**	1.00	**.040**	3 030	**4.69**	58 500	**13 200**	40 500	**9 100**	15 000	22 000
310R	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.0	**.08**	1.00	**.040**	3 990	**6.19**	76 100	**17 100**	52 000	**11 700**	14 000	21 000
311R	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.0	**.08**	1.00	**.040**	4 690	**7.26**	88 400	**19 900**	61 000	**13 700**	13 000	19 000
312R	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.0	**.08**	1.00	**.040**	5 430	**8.42**	101 000	**22 700**	71 000	**16 000**	12 000	17 000
313R	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.08**	1.00	**.040**	5 930	**9.19**	108 000	**24 300**	80 000	**18 000**	11 000	16 000
314R	70	**2.7559**	150	**5.9055**	35	**1.3780**	2.0	**.08**	1.00	**.040**	6 770	**10.50**	121 000	**27 200**	93 000	**20 900**	10 000	15 000
315R	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.0	**.08**	1.00	**.040**	8 390	**13.00**	146 000	**32 800**	114 000	**25 600**	9 900	14 000
316R	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.0	**.08**	1.00	**.040**	9 480	**14.70**	159 000	**35 700**	129 000	**29 000**	8 700	13 000
317R	85	**3.3465**	180	**7.0866**	41	**1.6142**	2.5	**.10**	1.00	**.040**	10 600	**16.50**	174 000	**39 100**	146 000	**32 800**	8 300	12 000
318R	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.5	**.10**	1.00	**.040**	11 800	**18.30**	186 000	**41 800**	160 000	**36 000**	7 800	11 000
319R	95	**3.7402**	200	**7.8740**	45	**1.7717**	2.5	**.10**	1.00	**.040**	13 100	**20.30**	199 000	**44 700**	180 000	**40 500**	7 400	11 000
320R	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**.10**	1.00	**.040**	14 400	**22.40**	212 000	**47 700**	200 000	**45 000**	6 900	10 000
321R	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.5	**.10**	1.00	**.040**	15 900	**24.60**	229 000	**51 500**	204 000	**45 900**	6 400	9 500
322R	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**.10**	1.00	**.040**	18 800	**29.20**	255 000	**57 300**	255 000	**57 300**	6 000	9 000
324R	120	**4.7244**	260	**10.2362**	55	**2.1654**	2.5	**.10**	1.00	**.040**	22 100	**34.30**	265 000	**59 600**	300 000	**67 400**	5 800	8 400
326R	130	**5.1181**	280	**11.0236**	58	**2.2835**	3.0	**.12**	1.00	**.040**	25 700	**39.80**	296 000	**66 500**	345 000	**77 600**	5 300	7 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^1/3$ rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

Precision 15° angular contact 300RD medium series duplex



Precision 300RD series angular contact ball bearings are manufactured to meet dimensional and running accuracy to ABEC-7 tolerances. They are supplied with an inner ring centered phenolic cage designed to minimize centrifugal force.

Notes:

For recommended mounting fits refer to “Shaft and housing fits” in Engineering data section.

“D” indicates a duplex ground half pair matched with an identical half pair and is followed by an additional suffix letter to describe the type of duplex. See pages 240 and 241 for suffix description.

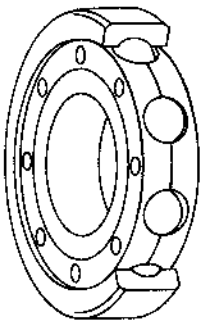
For equivalent load and life calculations see pages 124 and 125.

Use these values for back-to-back (DB) or face-to-face (DF) mounting arrangements.

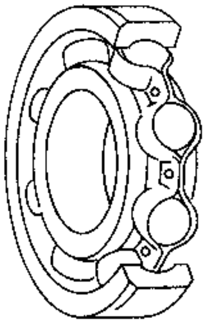
MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[2)] N	lbf	Static C_0 N	lbf	Speed rating[3)] Grease rpm	Oil rpm
300RD	10	**.3937**	35	**1.3780**	22	**.8661**	1.0	**.04**	.60	**.024**	439	**.68**	17 200	**3 870**	9 150	**2 060**	37 000	58 000
301RD	12	**.4724**	37	**1.4567**	24	**.9449**	1.0	**.04**	.60	**.024**	439	**.68**	17 200	**3 870**	9 800	**2 200**	35 000	54 000
302RD	15	**.5906**	42	**1.6535**	26	**1.0236**	1.0	**.04**	.60	**.024**	510	**.79**	19 900	**4 470**	13 200	**2 970**	31 000	45 000
303RD	17	**.6693**	47	**1.8504**	28	**1.1024**	1.0	**.04**	.60	**.024**	632	**.98**	24 200	**5 440**	16 300	**3 660**	30 000	42 000
304RD	20	**.7874**	52	**2.0472**	30	**1.1811**	1.0	**.04**	.60	**.024**	909	**1.41**	33 200	**7 460**	22 800	**5 130**	24 000	36 000
305RD	25	**.9843**	62	**2.4409**	34	**1.3386**	1.0	**.04**	.60	**.024**	1 090	**1.69**	37 700	**8 480**	30 500	**6 860**	20 000	31 000
306RD	30	**1.1811**	72	**2.8346**	38	**1.4961**	1.0	**.04**	.60	**.024**	1 480	**2.30**	50 700	**11 400**	40 000	**8 990**	17 000	25 000
307RD	35	**1.3780**	80	**3.1496**	42	**1.6535**	1.5	**.06**	1.00	**.040**	1 940	**3.00**	65 000	**14 600**	52 000	**11 700**	16 000	22 000
308RD	40	**1.5748**	90	**3.5433**	46	**1.8110**	1.5	**.06**	1.00	**.040**	2 450	**3.80**	79 300	**17 800**	67 000	**15 100**	14 000	20 000
309RD	45	**1.7717**	100	**3.9370**	50	**1.9685**	1.5	**.06**	1.00	**.040**	3 030	**4.69**	95 600	**21 500**	81 500	**18 300**	12 000	18 000
310RD	50	**1.9685**	110	**4.3307**	54	**2.1260**	2.0	**.08**	1.00	**.040**	3 990	**6.19**	124 000	**27 900**	104 000	**23 400**	11 000	17 000
311RD	55	**2.1654**	120	**4.7244**	58	**2.2835**	2.0	**.08**	1.00	**.040**	4 690	**7.26**	143 000	**32 100**	122 000	**27 400**	10 000	15 000
312RD	60	**2.3622**	130	**5.1181**	62	**2.4409**	2.0	**.08**	1.00	**.040**	5 430	**8.42**	165 000	**37 100**	143 000	**32 100**	9 600	14 000
313RD	65	**2.5591**	140	**5.5118**	66	**2.5984**	2.0	**.08**	1.00	**.040**	5 930	**9.19**	174 000	**39 100**	160 000	**36 000**	8 800	13 000
314RD	70	**2.7559**	150	**5.9055**	70	**2.7559**	2.0	**.08**	1.00	**.040**	6 770	**10.50**	195 000	**43 800**	186 000	**41 800**	8 000	12 000
315RD	75	**2.9528**	160	**6.2992**	74	**2.9134**	2.0	**.08**	1.00	**.040**	8 390	**13.00**	238 000	**53 500**	228 000	**51 300**	8 000	11 000
316RD	80	**3.1496**	170	**6.6929**	78	**3.0709**	2.0	**.08**	1.00	**.040**	9 480	**14.70**	260 000	**58 500**	260 000	**58 500**	7 000	10 000
317RD	85	**3.3465**	180	**7.0866**	82	**3.2283**	2.5	**.10**	1.00	**.040**	10 600	**16.50**	281 000	**63 200**	290 000	**65 200**	6 600	9 600
318RD	90	**3.5433**	190	**7.4803**	86	**3.3858**	2.5	**.10**	1.00	**.040**	11 800	**18.30**	302 000	**67 900**	320 000	**71 900**	6 200	8 800
319RD	95	**3.7402**	200	**7.8740**	90	**3.5433**	2.5	**.10**	1.00	**.040**	13 100	**20.30**	325 000	**73 100**	360 000	**80 900**	5 900	8 800
320RD	100	**3.9370**	215	**8.4646**	94	**3.7008**	2.5	**.10**	1.00	**.040**	14 400	**22.40**	345 000	**77 600**	400 000	**89 900**	5 500	8 000
321RD	105	**4.1339**	225	**8.8583**	98	**3.8583**	2.5	**.10**	1.00	**.040**	15 900	**24.60**	371 000	**83 400**	405 000	**91 000**	5 100	7 600
322RD	110	**4.3307**	240	**9.4488**	100	**3.9370**	2.5	**.10**	1.00	**.040**	18 800	**29.20**	416 000	**93 500**	510 000	**115 000**	4 800	7 200
324RD	120	**4.7244**	260	**10.2362**	110	**4.3307**	2.5	**.10**	1.00	**.040**	22 100	**34.30**	436 000	**98 000**	600 000	**135 000**	4 600	6 700
326RD	130	**5.1181**	280	**11.0236**	116	**4.5669**	3.0	**.12**	1.00	**.040**	25 700	**39.80**	475 000	**107 000**	695 000	**156 000**	4 200	6 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Rating for one million revolutions or 500 hours at $33^{1}/_{3}$rpm.
3) Values have been determined through historical application and practice. For a more complete explanation, see page 272.

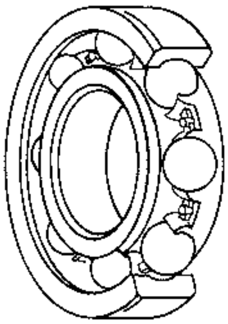
MRC ABEC-5 high precision deep groove ball bearings for woodworking machinery



Bakelite



Brass



Polyamide

General information

Ball bearings manufactured specifically for the woodworking industry often carry special specifications in order to meet the requirements of both high speed and accuracy. As a result of actively participating in this market for many years, MRC has designed a line of deep groove ball bearings that meet the special needs of the woodworking industry. They are high precision bearings with carefully controlled internal characteristics, providing very good shaft rigidity and precise control of axial and radial runout.

The bearings are available with Bakelite (phenolic), pressed brass, or glass reinforced polyamide cages, as illustrated at left.

Bearing identification

Example of marking on MRC bearing box: **207S-BRS#5 C2**

Identification of marking

2 07 S BRS #5 C2

Series — 2

Bore size — 07

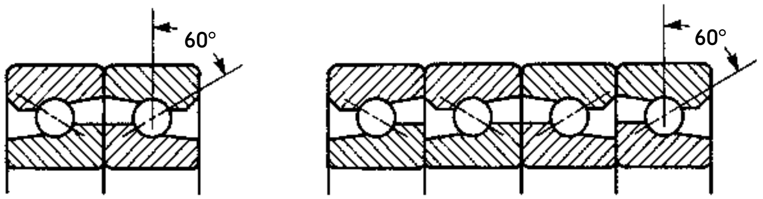
Single-row deep groove — S

Cage material — BRS
- **BRS = brass**
- **BKE = Bakelite**
- **NYL = polyamide**

Precision class ABEC-5 — #5

Internal radial clearance — C2
- **C2 = tight**
- **C0 = standard**
- **C3 = loose**

Ball screw support bearings



Duplex DF

Quadruplex DFDT

The MRC ball screw support bearing is a single-row angular contact nonseparable bearing with one heavy race shoulder and one counterbored race shoulder on the outer ring. The inner ring is similar in design having a counterbored race shoulder.

Construction and ring design permit a greater number of balls than the standard angular contact types, and result in a very high thrust load-carrying capacity. The 60° initial contact angle provides maximum axial rigidity. As heavy thrust must be taken in both directions, these angular contact bearings are mounted in duplex pairs. For even stiffer screw support, the bearings can be mounted in quadruple sets.

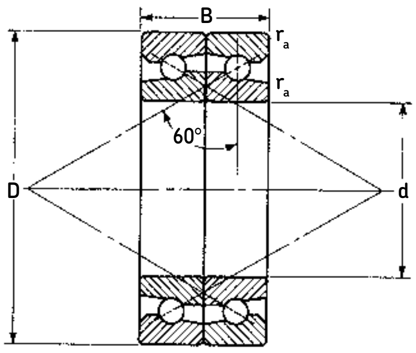
These bearings are made in ABEC-7 tolerance grade only. Inner and outer rings and balls are of AISI 52100 steel. Retainers are a ball-riding type of molded polyamide composition.

These ball screw support bearings are designed for use in numerically controlled machine tools where standard angular contact bearings or roller bearings cannot deliver the rigidity levels required. The 60° contact angle contributes to maximum axial rigidity and gives very stiff screw support to maintain the accuracy of the ball screw.

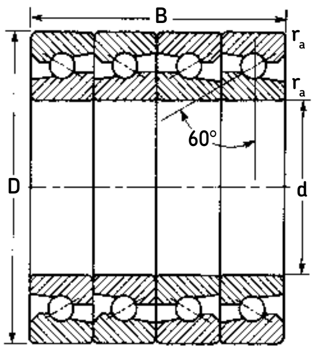
Cage types and materials

One-piece molded polyamide, ball-riding cages are supplied with ball screw support bearings.

Ball screw support bearings



Duplex sets

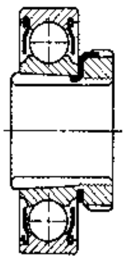


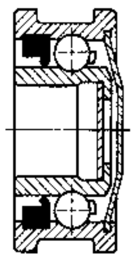
Quadruplex sets

MRC bearing number	Bore d mm	Bore d in.	Outside diameter D mm	Outside diameter D in.	Width B mm	Width B in.	Fillet radius[1] r_a mm	Fillet radius[1] r_a in.	Lateral eccentricity Max mm	Lateral eccentricity Max in.	Basic radial load rating[2] Dynamic $C^{3)}$ N	Basic radial load rating[2] Dynamic $C^{3)}$ lbf	Basic radial load rating[2] Static C_0 N	Basic radial load rating[2] Static C_0 lbf
J078DF	20.000	**.7874**	47.000	**1.8504**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	12 100	**2 720**	10 000	**2 250**
J093DF	23.838	**.9385**	62.000	**2.4409**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	13 800	**3 100**	13 700	**3 080**
J098DF	25.000	**.9843**	62.000	**2.4409**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	13 800	**3 100**	13 700	**3 080**
J150DF	38.100	**1.5000**	72.000	**2.8346**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	14 600	**3 280**	15 300	**3 440**
J175DF	44.475	**1.7510**	76.200	**3.0000**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	15 100	**3 390**	16 600	**3 730**
J225DF	57.150	**2.2500**	90.000	**3.5433**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	16 300	**3 660**	20 000	**4 500**
J300DF	76.200	**3.0000**	110.000	**4.3307**	31.750	**1.2500**	.80	**.031**	.003	**.0001**	17 800	**4 000**	25 500	**5 730**
J400DF	101.600	**4.0000**	145.000	**5.7087**	44.450	**1.7500**	1.00	**.040**	.003	**.0001**	36 400	**8 180**	52 000	**11 700**
Quadruplex sets														
J078DFDT	20.000	**.7874**	47.000	**1.8504**	63.500	**2.5000**	.80	**.031**	.003	**.0001**	19 500	**4 380**	20 000	**4 500**
J093DFDT	23.838	**.9385**	62.000	**2.4409**	63.500	**2.5000**	.80	**.031**	.003	**.0001**	22 500	**5 060**	26 500	**5 960**
J098DFDT	25.000	**.9843**	62.000	**2.4409**	63.500	**2.5000**	.80	**.031**	.003	**.0001**	22 500	**5 060**	26 500	**5 960**
J150DFDT	38.100	**1.5000**	72.000	**2.8346**	63.500	**2.5000**	.80	**.031**	.003	**0001**	23 800	**5 350**	30 500	**6 860**
J175DFDT	44.475	**1.7510**	76.200	**3.0000**	63.500	**2.5000**	.80	**.031**	.003	**.0001**	24 700	**5 550**	33 500	**7 530**
J225DFDT	57.150	**2.2500**	90.000	**3.5433**	63.500	**2.5000**	.80	**.031**	.003	**.0001**	26 500	**5 960**	40 000	**8 990**
J300DFDT	76.200	**3.0000**	110.000	**4.3307**	63.500	**2.5000**	.80	**.031**	.003	**.0001**	29 100	**6 540**	51 000	**11 500**
J400DFDT	101.600	**4.0000**	145.000	**5.7087**	88.900	**3.5000**	1.00	**.040**	.003	**.0001**	59 200	**13 300**	104 000	**23 400**

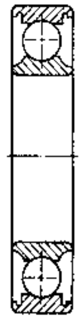
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) For thrust rating multiply C by 1.70 and C_0 by 4.00.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.

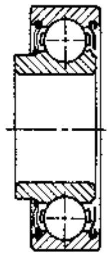
Specialty bearings

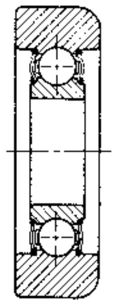

Adapter

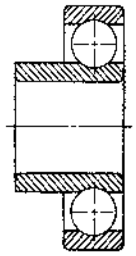

Conveyor


Dynamometer


Electric motor quality


Felt seal replacement


Mast guide


Wide inner ring

In addition to our standard line of bearing products, MRC also has the capability of supplying several nonstandard or specialty bearings. The bearings shown above and described on the following pages are a few examples of our specialty bearings. If you need information about a bearing type not shown please contact our engineering department.

The following are brief descriptions of our specialty bearings.

Adapter

Adapter bearings have a 1:12 tapered bore and are used with either an adapter sleeve or directly on a tapered shaft. MRC does not furnish adapter sleeves.

Conveyor

Conveyor bearings may be mounted directly into a conveyor roll or designed with O.D. slots for bracket mounting. They are equipped with closures for protection and lubricant retention.

Dynamometer

Dynamometer bearings are designed to minimize temperature, noise and vibration. Included are special tolerances and an inner ring land guided phenolic composition cage.

Electric motor quality

Electric motor quality bearings are designed to provide quiet and smooth operation in electric motors. They are available in various configurations including open and single or double sealed or shielded types.

Felt seal replacement

Felt seal replacement bearings incorporate synthetic rubber seals and are a direct replacement for the felt seal type.

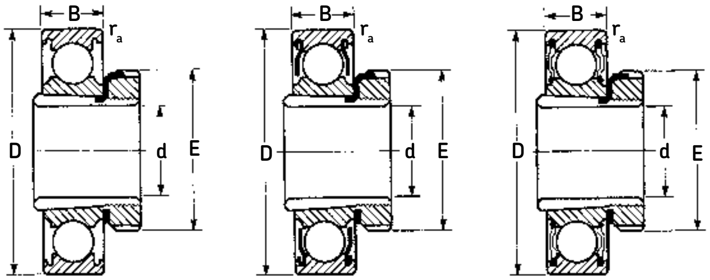
Mast guide

Mast guide bearings consist of a family of special bearings designed to meet the rigorous demands of industrial truck service. For protection they are equipped with synthetic rubber or polypropylene seals.

Wide inner ring

Wide inner ring bearings are used in electric motors. The wide inner ring permits the bearing to be mounted without using a lock nut on the shaft.

Adapter-type bearings tapered bore



SX | SFFX Two shields | SZZX Two seals

Adapter-type bearings, when used with adapter sleeves, are designed for mounting on inch size shafting without machining the shaft. The tapered sleeve is drawn into the tapered bore of the bearing as the nut is tightened. Soft steel sleeve adapts to the shaft and grips it tightly. Tapered bore of bearing is 1:12 (included angle 4° 46´19″). Adapter sleeve designation includes nut and lock washer. (MRC does not supply adapter sleeves.) For mounting instructions see page 76.

Note: Adapter and nut are not furnished with bearings.

Shaft diameter d in inches		MRC bearing number	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1)] r_a mm	in.	Adapter sleeve	ZD^2 mm	in.	Basic radial load rating Dynamic C[3)] N	lbf	Static C_0 N	lbf	Speed rating[2)] Open and shielded Grease rpm	Oil rpm	Single and double sealed Grease rpm
15/16	**1**	**206SFFX**	62	**2.4409**	16	**.6299**	1.0	**.04**	SNW6	819	**1.27**	19 500	**4 380**	10 000	**2 250**	10 000	13 000	—
15/16	**1**	**206SZZX**	62	**2.4409**	16	**.6299**	1.0	**.04**	SNW6	819	**1.27**	19 500	**4 380**	10 000	**2 250**	—	—	7 500
1 1/8	**1 3/16**	**207SFFX**	72	**2.8346**	17	**.6693**	1.0	**.04**	SNW7	1 140	**1.76**	27 000	**6 070**	15 300	**3 440**	9 000	11 000	—
1 1/8	**1 3/16**	**207SZZX**	72	**2.8346**	17	**.6693**	1.0	**.04**	SNW7	1 140	**1.76**	27 000	**6 070**	15 300	**3 440**	—	—	6 300
	1 7/16	**209SZZX**	85	**3.3465**	19	**.7480**	1.0	**.04**	SNW9	1 640	**2.54**	36 400	**8 180**	22 800	**5 130**	—	—	5 000
	1 3/4	**210SX**	90	**3.5433**	20	**.7874**	1.0	**.04**	SNW10	1 610	**2.50**	35 100	**7 890**	23 200	**5 210**	7 000	8 500	4 800
	1 15/16	**211SX**	100	**3.9370**	21	**.8268**	1.5	**.06**	SNW11	2 040	**3.16**	43 600	**9 800**	30 000	**6 740**	6 300	7 500	4 300
	2 1/16	**212SZZX**	110	**4.3307**	22	**.8661**	1.5	**.06**	SNW12	2 520	**3.91**	47 500	**10 700**	32 500	**7 310**	—	—	4 000
	2 7/16	**215SZZX**	130	**5.1181**	25	**.9843**	1.5	**.06**	SNW15	3 350	**5.20**	66 300	**14 900**	49 000	**11 000**	—	—	3 200
	3	**217SZZX**	150	**5.9055**	28	**1.1024**	2.0	**.08**	SNW17	4 260	**6.60**	83 200	**18 700**	64 000	**14 400**	—	—	2 800

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.

Dynamometer bearings

For several years, MRC has supplied specially designed bearings for dynamometer applications. These bearings are manufactured with the following characteristics.

- ABEC-5 inner ring tolerances.
- Inner ring eccentricity value, not to exceed 0.0005″, marked on the inner ring face at the location of maximum lateral runout.
- Special internal radial clearance.
- Special “E” grade balls.
- High speed, lightweight, inner ring land-guided phenolic (Bakelite) separators.

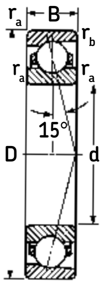
These bearings were developed to minimize operating temperatures, noise and vibration in dynamometer applications. To achieve best results, the value of eccentricity marked on the inner ring face should be aligned 180° opposite the high point of eccentricity measured at the shaft journal. If the bearings are grease lubricated, they should be carefully hand packed prior to installation to make sure that grease is worked into the close running clearance between the O.D. of the inner ring and the I.D. of the separator.

Dynamometer bearing identification

3 16 R DM - BKE

- **Series (300)** — 3
- **Bore diameter code (80 mm)** — 16
- **“R” type, single-row, maximum capacity** — R
- **Special dynamometer quality features** — DM
- **Phenolic (Bakelite) separator** — BKE

300RDM series



300RDM series dynamometer bearings are made with bore diameters ranging from 35 mm to 160 mm. These bearings are recommended for high speed dynamometers or any application involving moderate to heavy radial loads, moderate thrust loads in one direction, or for combinations of both.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B mm	in.	Fillet radius[1] r_a mm	in.	r_b mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Grease rpm	Oil rpm
307RDM[4]	35	**1.3780**	80	**3.1496**	21	**.8268**	1.5	**.06**	1.0	**.040**	1 940	**3.00**	39 000	**8 770**	26 000	**5 850**	19 500	28 000
309RDM[4]	45	**1.7717**	100	**3.9370**	25	**.9843**	1.5	**.06**	1.0	**.040**	3 030	**4.69**	58 500	**13 200**	40 500	**9 100**	15 400	22 400
310RDM[4]	50	**1.9685**	110	**4.3307**	27	**1.0630**	2.0	**.08**	1.0	**.040**	4 350	**6.75**	80 600	**18 100**	57 000	**12 800**	14 500	21 000
311RDM[4]	55	**2.1654**	120	**4.7244**	29	**1.1417**	2.0	**.08**	1.0	**.040**	5 110	**7.92**	93 600	**21 000**	67 000	**15 100**	12 900	18 700
312RDM[4]	60	**2.3622**	130	**5.1181**	31	**1.2205**	2.0	**.08**	1.0	**.040**	5 930	**9.19**	108 000	**24 300**	78 000	**17 500**	11 500	16 800
313RDM[4]	65	**2.5591**	140	**5.5118**	33	**1.2992**	2.0	**.08**	1.0	**.040**	6 900	**10.70**	121 000	**27 200**	93 000	**20 900**	11 000	15 700
315RDM	75	**2.9528**	160	**6.2992**	37	**1.4567**	2.0	**.08**	1.0	**.040**	9 050	**14.00**	153 000	**34 400**	122 000	**27 400**	9 900	14 000
316RDM	80	**3.1496**	170	**6.6929**	39	**1.5354**	2.0	**.08**	1.0	**.040**	9 480	**14.70**	159 000	**35 700**	129 000	**29 000**	8 700	12 600
318RDM	90	**3.5433**	190	**7.4803**	43	**1.6929**	2.5	**.10**	1.0	**.040**	11 800	**18.30**	185 000	**41 600**	160 000	**36 000**	7 800	11 200
320RDM	100	**3.9370**	215	**8.4646**	47	**1.8504**	2.5	**.10**	1.0	**.040**	14 400	**22.40**	212 000	**47 700**	200 000	**45 000**	6 900	10 100
321RDM[4]	105	**4.1339**	225	**8.8583**	49	**1.9291**	2.5	**.10**	1.0	**.040**	15 900	**24.60**	229 000	**51 500**	204 000	**45 900**	6 400	9 500
322RDM[4]	110	**4.3307**	240	**9.4488**	50	**1.9685**	2.5	**.10**	1.0	**.040**	18 800	**29.20**	255 000	**57 300**	255 000	**57 300**	6 000	9 000
324RDM[4]	120	**4.7244**	260	**10.2352**	55	**2.1654**	2.5	**.10**	1.0	**.040**	22 100	**34.30**	265 000	**59 600**	300 000	**67 400**	6 000	8 400
326RDM[4]	130	**5.1181**	280	**11.0236**	58	**2.2835**	3.0	**.12**	1.0	**.040**	25 700	**39.80**	296 000	**66 500**	345 000	**77 600**	5 300	7 800
328RDM[4]	140	**5.5118**	300	**11.8110**	62	**2.4409**	3.0	**.12**	1.0	**.040**	29 500	**45.70**	351 000	**78 900**	400 000	**89 900**	4 800	7 300
330RDM[4]	150	**5.9055**	320	**12.5984**	65	**2.5591**	3.0	**.12**	1.0	**.040**	33 900	**52.60**	390 000	**87 700**	475 000	**107 000**	4 600	6 700
332RDM[4]	160	**6.2992**	340	**13.3853**	68	**2.6772**	3.0	**.12**	1.0	**.040**	38 400	**59.60**	423 000	**95 100**	530 000	**119 000**	4 100	6 200

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for inner ring land guided, phenolic composition cage.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
4) Typically non-stocked sizes, please check availability before designing into equipment.

ABMA cross reference

MRC manufactures its deep groove ball bearings to meet the high demands for quiet and smooth running bearings for the electric motor market. MRC boxes are clearly labeled with the letters EMQ to identify them as being Electric Motor Quality.

Many electric motor specification plates identify the bearings to be used in the motor with an American Bearing Manufacturers Association (ABMA) number. For your convenience, an ABMA identification code chart is provided along with a list of popular ABMA numbers and their corresponding MRC part number. MRC EMQ bearings are packaged with a premium quality polyurea grease having an NLGI no. 2 rating.

ABMA identification code (ABMA Standard 20, 1987)

The ABMA (American Bearing Manufacturers Association) method of identification is arranged in five sections. An abbreviated explanation of each section is provided below. This information will allow identification of most general purpose bearings. If additional assistance is required please contact MRC.

Schematic arrangement of radial bearings

<table>
<tr><th colspan="10">Radial ball and roller bearings</th></tr>
<tr><td colspan="3">Basic number</td><td colspan="7">Supplementary number</td></tr>
<tr><td colspan="3">Section 1</td><td colspan="3">Section 2</td><td colspan="2">Section 3</td><td>Section 4</td><td>Section 5</td></tr>
<tr><td colspan="3">Type and boundary dimensions</td><td colspan="3">Modification of design</td><td colspan="2">Internal fit and tolerances</td><td rowspan="3">Lubricants and preservatives</td><td rowspan="3">Special requirements</td></tr>
<tr><td rowspan="2">Bore</td><td rowspan="2">Type</td><td rowspan="2">Outside diameter and width</td><td rowspan="2">Cage and separators</td><td>Shields and seals</td><td>Bearing rings</td><td rowspan="2">Internal fit</td><td rowspan="2">Tolerances</td></tr>
<tr><td colspan="2">Duplex mounting modification</td></tr>
<tr><td>0000</td><td>AAA</td><td>00</td><td>A</td><td>AA</td><td>A</td><td>0</td><td>0</td><td>A</td><td>000</td></tr>
</table>

Section 1

Bore - Bore diameter in mm

Type

BC	-S	BD	5000	BS	1200E
BL	-M	BE	5000M	BY	9000H
BH	-R	BG	5000C	BZ	9000U
BA	7000	BF	5000M*	BIC	R (INCH)
BT	7000P	BK	5000C**	BIH	XLS

Outside diameter and width

02 = 200	19 = 1900
03 = 300	32 = 5200
04 = 400	33 = 5300
10 = 100	34 = 5400

Section 2

Cage

J = Pressed steel
Y = Pressed brass
K = Machined bronze, land guided
D = Non-metallic, land guided
T = Non-metallic, ball guided
V = No cage
X = Any cage acceptable

Shields and seals

P = Permanently fastened shield
D = Removable contact seal
H = Labyrinth seal
G = Contact seal, any type
X = Spacer used when no closure required

Bearing ring modification

G = Snap-ring in normal position
C = Snap-ring in opposite position
N = Snap-ring groove, less snap-ring
A = Snap-ring groove in opposite position, less snap-ring

Duplex mounting

D = Universally ground single bearing (DU)
R = DB pair
U = DF pair
T = DT pair

Section 3

Internal fit

0 = Normal (ST)
2 = Tight (TI)
3 = Loose (LO)
4 = Extra loose (XL)
5 = Greater than symbol 4

Duplex bearings

7 = Light preload
8 = Medium preload
9 = Heavy preload

Tolerance

0 = ABEC-1
6 = ABEC-3
5 = ABEC-5
4 = ABEC-7
2 = ABEC-9

Section 4

Lubricant

X = Manufacturers standard
A = Specific lube to satisfy a particular condition

Section 5

Special requirements

See following page

*Radial type, 0° contact angle substitute 5000M.
**Radial type, 0° contact angle substitute 5000C.

ABMA identification code (ABMA Standard 20, 1987)

Section 5

Special requirements

08 = High point of inner ring eccentricity marked on face
09 = High point of outer ring eccentricity marked on face
10 = High points of inner and outer ring eccentricities marked on faces
11 = Surfaces of all steel bearing parts coated by black iron oxide process
16 = Bore of inner ring copper plated, .0003 inches thick per side
17 = Bore of inner ring and outside surface of outer ring copper plated, .0003 inches thick per side
19 = Width tolerance for assembled bearing from thrust face of inner ring to opposite face of outer ring under applied endplay gauging load 0 to -.005 inches
20 = Rings, rolling elements and cages made of stainless steel
25 = Inner and outer rings to be chrome plated
26 = Stabilize for size change of less than 0.010% at 300° F after 2500 hours
28 = Stabilize for size change of less than 0.015% at 390° F after 2500 hours
29 = Stabilize for size change of less than 0.015% at 480° F after 2500 hours
30 = Stabilize for size change of less than 0.015% at 570° F after 2500 hours
31 = Stabilize for size change of less than 0.015% at 660° F after 2500 hours
100 = Government requirements not otherwise coded. Detailed information must be obtained from the appropriate government activity.

ABMA identification code examples

210SFFG
50BC02JPPG30X

50 = Bore in mm
BC = Type S
02 = 200 Series
J = Pressed steel cage
PP = Two shields
G = Snap-ring
3 = Loose fit (LO)
0 = ABEC-1
X = Standard lube

113KRDB
65BH10DXXR74

65 = Bore in mm
BH = Type R
10 = 100 series
D = Phenolic cage
XX = Spacers
R = DB pair
7 = Light preload
4 = ABEC-7

5307CFG
35BG03JPXG00

35 = Bore in mm
BG = Type 5000C
03 = 300 series
J = Pressed steel cage
P = Shield
X = Spacer
G = Snap-ring
0 = Normal fit (ST)
0 = ABEC-1

318SG
90BC03KXXN4026

90 = Bore in mm
BC = Type S
03 = 300 series
K = Machined bronze cage
XX = Spacers
N = Snap-ring groove, less snap-ring
4 = Extra loose fit (XL)
0 = ABEC-1
26 = Stabilize for operation at 300° F

7205DU
25BA02DXXD0

25 = Bore in mm
BA = Type 7000
02 = 200 series
D = Phenolic cage
XX = Spacers
D = DU, half-pair
0 = ABEC-1

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
8BIC00X30	R8
8BIC10XD30	R8Z
8BIC10XDD30	R8ZZ
8BIC10XP30	R8F
8BIC10XPP30	R8FF
10BIC10X30	R10
10BIC10XD30	R10Z
10BIC10XDD30	R10ZZ
10BIC10XP30	R10F
10BIC10XPP30	R10FF
12BIC10X30	R12
12BIC10XD30	R12Z
12BIC10XDD30	R12ZZ
12BIC10XP30	R12F
12BIC10XPP30	R12FF
14BIC10X30	R14
14BIC10XD30	R14Z
14BIC10XDD30	R14ZZ
14BIC10XP30	R14F
14BIC10XPP30	R14FF
15BC02X30	202S
15BC02XD30	202SZ
15BC02XDD30	202SZZ
15BC02XDDG30	202SZZG
15BC02XDXG30	202SZG
15BC02XP30	202SF
15BC02XPP30	202SFF
15BC02XPPG30	202SFFG
15BC02XPXG30	202SFG

ABMA Number	Bearing size
15BC02XXXG30	202SG
15BC03X30	302S
15BC03XD30	302SZ
15BC03XDD30	302SZZ
15BC03XDDG30	302SZZG
15BC03XDXG30	302SZG
15BC03XP30	302SF
15BC03XPP30	302SFF
15BC03XPPG30	302SFFG
15BC03XPXG30	302SFG
15BC03XXXG30	302SG
15BC10X30	102KS
15BC10XD30	102KSZ
15BC10XDD30	102KSZZ
15BC10XDDG30	102KSZZG
15BC10XDXG30	102KSZG
15BC10XPP30	102KSFF
15BC10XP30	102KSF
15BC10XPPG30	102KSFFG
15BC10XPXG30	102KSFG
15BC10XXXG30	102KSG
15BC19X30	1902S
15BC19XD30	1902SZ
15BC19XDD30	1902SZZ
15BC19XP30	1902SF
15BC19XPP30	1902SFF
15BC32XDD30	202SZZC
15BC32XDDG30	202SZZCG

ABMA Number	Bearing size
15BC32XPP30	202SFFC
15BC32XPPG30	202SFFCG
15BC33XDD30	302SZZC
15BC33XDDG30	302SZZCG
15BC33XPP30	302SFFC
15BC33XPPG30	302SFFCG
16BIC10X30	R16
16BIC10XD30	R16Z
16BIC10XDD30	R16ZZ
16BIC10XP30	R16F
16BIC10XPP30	R16FF
17BC02X30	203S
17BC02XD30	203SZ
17BC02XDD30	203SZZ
17BC02XDDG30	203SZZG
17BC02XDXG30	203SZG
17BC02XP30	203SF
17BC02XPP30	203SFF
17BC02XPXG30	203SFG
17BC02XPPG30	203SFFG
17BC02XXXG30	203SG
17BC03X30	303S
17BC03XD30	303SZ
17BC03XDD30	303SZZ
17BC03XDDG30	303SZZG
17BC03XDXG30	303SZG
17BC03XP30	303SF
17BC03XPP30	303SFF

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
17BC03XPPG30	303SFFG
17BC03XPXG30	303SFG
17BC03XXXG30	303SG
17BC04X30	403S
17BC04XD30	403SZ
17BC04XDD30	403SZZ
17BC04XP30	403SF
17BC04XPP30	403SFF
17BC10X30	103KS
17BC10XD30	103KSZ
17BC10XDD30	103KSZZ
17BC10XDDG30	103KSZZG
17BC10XDXG30	103KSZG
17BC10XP30	103KSF
17BC10XPP30	103KSFF
17BC10XPPG30	103KSFFG
17BC10XPXG30	103KSFG
17BC10XXXG30	103KSG
17BC19X30	1903S
17BC19XD30	1903SZ
17BC19XDD30	1903SZZ
17BC19XP30	1903SF
17BC19XPP30	1903SFF
17BC32XDD30	203SZZC
17BC32XDDG30	203SZZCG
17BC32XPP30	203SFFC
17BC32XPPG30	203SFFCG
17BC33XDD30	303SZZC

ABMA Number	Bearing size
17BC33XDDG30	303SZZCG
17BC33XPP30	303SFFC
17BC33XPPG30	303SFFCG
18BIC10X30	R18
18BIC10XD30	R18Z
18BIC10XDD30	R18ZZ
18BIC10XP30	R18F
18BIC10XPP30	R18FF
20BC02X30	204S
20BC02XD30	204SZ
20BC02XDD30	204SZZ
20BC02XDDG30	204SZZG
20BC02XDXG30	204SZG
20BC02XP30	204SF
20BC02XPP30	204SFF
20BC02XPPG30	204SFFG
20BC02XPXG30	204SFG
20BC02XXXG30	204SG
20BC03X30	304S
20BC03XD30	304SZ
20BC03XDD30	304SZZ
20BC03XDDG30	304SZZG
20BC03XDXG30	304SZG
20BC03XP30	304SF
20BC03XPP30	304SFF
20BC03XPPG30	304SFFG
20BC03XPXG30	304SFG
20BC03XXXG30	304SG

ABMA Number	Bearing size
20BC04X30	404S
20BC04XD30	404SZ
20BC04XDD30	404SZZ
20BC04XP30	404SF
20BC04XPP30	404SFF
20BC10X30	104KS
20BC10XD30	104KSZ
20BC10XDD30	104KSZZ
20BC10XDDG30	104KSZZG
20BC10XDXG30	104KSZG
20BC10XP30	104KSF
20BC10XPP30	104KSFF
20BC10XPPG30	104KSFFG
20BC10XPXG30	104KSFG
20BC10XXXG30	104KSG
20BC19X30	1904S
20BC19XD30	1904SZ
20BC19XDD30	1904SZZ
20BC19XP30	1904SF
20BC19XPP30	1904SFF
20BC32XDD30	204SZZC
20BC32XDDG30	204SZZCG
20BC32XPP30	204SFFC
20BC32XPPG30	204SFFCG
20BC33XDD30	304SZZC
20BC33XDDG30	304SZZCG
20BC33XPP30	304SFFC
20BC33XPPG30	304SFFCG

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
20BIC10X30	R20
20BIC10XD30	R20Z
20BIC10XDD30	R20ZZ
20BIC10XP30	R20F
20BIC10XPP30	R20FF
24BIC10X30	R24
24BIC10XD30	R24Z
24BIC10XDD30	R24ZZ
24BIC10XP30	R24F
24BIC10XPP30	R24FF
25BC02X30	205S
25BC02XD30	205SZ
25BC02XDD30	205SZZ
25BC02XDDG30	205SZZG
25BC02XDXG30	205SZG
25BC02XP30	205SF
25BC02XPP30	205SFF
25BC02XPPG30	205SFFG
25BC02XPXG30	205SFG
25BC02XXXG30	205SG
25BC03X30	305S
25BC03XD30	305SZ
25BC03XDD30	305SZZ
25BC03XDDG30	305SZZG
25BC03XDXG30	305SZG
25BC03XP30	305SF
25BC03XPP30	305SFF
25BC03XPPG30	305SFFG

ABMA Number	Bearing size
25BC03XPXG30	305SFG
25BC03XXXG30	305SG
25BC04X30	405S
25BC04XD30	405SZ
25BC04XDD30	405SZZ
25BC04XP30	405SF
25BC04XPP30	405SFF
25BC10X30	105KS
25BC10XD30	105KSZ
25BC10XDD30	105KSZZ
25BC10XDDG30	105KSZZG
25BC10XDXG30	105KSZG
25BC10XP30	105KSF
25BC10XPP30	105KSFF
25BC10XPPG30	105KSFFG
25BC10XPXG30	105KSFG
25BC10XXXG30	105KSG
25BC19X30	1905S
25BC19XD30	1905SZ
25BC19XDD30	1905SZZ
25BC19XP30	1905SF
25BC19XPP30	1905SFF
25BC32XDD30	205SZZC
25BC32XDDG30	205SZZCG
25BC32XPP30	205SFFC
25BC32XPPG30	205SFFCG
25BC33XDD30	305SZZC
25BC33XDDG30	305SZZCG

ABMA Number	Bearing size
25BC33XPP30	305SFFC
25BC33XPPG30	305SFFCG
30BC02X30	206S
30BC02XD30	206SZ
30BC02XDD30	206SZZ
30BC02XDDG30	206SZZG
30BC02XDXG30	206SZG
30BC02XP30	206SF
30BC02XPP30	206SFF
30BC02XPPG30	206SFFG
30BC02XPXG30	206SFG
30BC02XXXG30	206SG
30BC03X30	306S
30BC03XD30	306SZ
30BC03XDD30	306SZZ
30BC03XDDG30	306SZZG
30BC03XDXG30	306SZG
30BC03XP30	306SF
30BC03XPP30	306SFF
30BC03XPPG30	306SFFG
30BC03XPXG30	306SFG
30BC03XXXG30	306SG
30BC04X30	406S
30BC04XD30	406SZ
30BC04XDD30	406SZZ
30BC04XP30	406SF
30BC04XPP30	406SFF
30BC10X30	106KS

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
30BC10XD30	106KSZ
30BC10XDD30	106KSZZ
30BC10XDDG30	106KSZZG
30BC10XDXG30	106KSZG
30BC10XP30	106KSF
30BC10XPP30	106KSFF
30BC10XPPG30	106KSFFG
30BC10XPXG30	106KSFG
30BC10XXXG30	106KSG
30BC19X30	1906S
30BC19XD30	1906SZ
30BC19XDD30	1906SZZ
30BC19XP30	1906SF
30BC19XPP30	1906SFF
30BC32XDD30	206SZZC
30BC32XDDG30	206SZZCG
30BC32XPP30	206SFFC
30BC32XPPG30	206SFFCG
30BC33XDD30	306SZZC
30BC33XDDG30	306SZZCG
30BC33XPP30	306SFFC
30BC33XPPG30	306SFFCG
35BC02X30	207S
35BC02XD30	207SZ
35BC02XDD30	207SZZ
35BC02XDDG30	207SZZG
35BC02XDXG30	207SZG
35BC02XP30	207SF

ABMA Number	Bearing size
35BC02XPP30	207SFF
35BC02XPPG30	207SFFG
35BC02XPXG30	207SFG
35BC02XXXG30	207SG
35BC03X30	307S
35BC03XD30	307SZ
35BC03XDD30	307SZZ
35BC03XDDG30	307SZZG
35BC03XDXG30	307SZG
35BC03XP30	307SF
35BC03XPP30	307SFF
35BC03XPPG30	307SFFG
35BC03XPXG30	307SFG
35BC03XXXG30	307SG
35BC04X30	407S
35BC04XD30	407SZ
35BC04XDD30	407SZZ
35BC04XP30	407SF
35BC04XPP30	407SFF
35BC10X30	107KS
35BC10XD30	107KSZ
35BC10XDD30	107KSZZ
35BC10XDDG30	107KSZZG
35BC10XDXG30	107KSZG
35BC10XP30	107KSF
35BC10XPP30	107KSFF
35BC10XPPG30	107KSFFG
35BC10XPXG30	107KSFG

ABMA Number	Bearing size
35BC10XXXG30	107KSG
35BC19X30	1907S
35BC19XD30	1907SZ
35BC19XDD30	1907SZZ
35BC19XP30	1907SF
35BC19XPP30	1907SFF
35BC32XDD30	207SZZC
35BC32XDDG30	207SZZCG
35BC32XPP30	207SFFC
35BC32XPPG30	207SFFCG
35BC33XDD30	307SZZC
35BC33XDDG30	307SZZCG
35BC33XPP30	307SFFC
35BC33XPPG30	307SFFCG
40BC02X30	208S
40BC02XD30	208SZ
40BC02XDD30	208SZZ
40BC02XDDG30	208SZZG
40BC02XDXG30	208SZG
40BC02XP30	208SF
40BC02XPP30	208SFF
40BC02XPPG30	208SFFG
40BC02XPXG30	208SFG
40BC02XXXG30	208SG
40BC03X30	308S
40BC03XD30	308SZ
40BC03XDD30	308SZZ

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
40BC03XDDG30	308SZZG
40BC03XDXG30	308SZG
40BC03XP30	308SF
40BC03XPP30	308SFF
40BC03XPPG30	308SFFG
40BC03XPXG30	308SFG
40BC03XXXG30	308SG
40BC04X30	408S
40BC04XD30	408SZ
40BC04XDD30	408SZZ
40BC04XP30	408SF
40BC04XPP30	408SFF
40BC10X30	108KS
40BC10XD30	108KSZ
40BC10XDD30	108KSZZ
40BC10XDDG30	108KSZZG
40BC10XDXG30	108KSZG
40BC10XP30	108KSF
40BC10XPP30	108KSFF
40BC10XPPG30	108KSFFG
40BC10XPXG30	108KSFG
40BC10XXXG30	108KSG
40BC19X30	1908S
40BC19XD30	1908SZ
40BC19XDD30	1908SZZ
40BC19XP30	1908SF
40BC19XPP30	1908SFF
40BC32XDD30	208SZZC

ABMA Number	Bearing size
40BC32XDDG30	208SZZCG
40BC32XPP30	208SFFC
40BC32XPPG30	208SFFCG
40BC33XDD30	308SZZC
40BC33XDDG30	308SZZCG
40BC33XPP30	308SFFC
40BC33XPPG30	308SFFCG
45BC02X30	209S
45BC02XD30	209SZ
45BC02XDD30	209SZZ
45BC02XDDG30	209SZZG
45BC02XDXG30	209SZG
45BC02XP30	209SF
45BC02XPP30	209SFF
45BC02XPPG30	209SFFG
45BC02XPXG30	209SFG
45BC02XXXG30	209SG
45BC03X30	309S
45BC03XD30	309SZ
45BC03XDD30	309SZZ
45BC03XDDG30	309SZZG
45BC03XDXG30	309SZG
45BC03XP30	309SF
45BC03XPP30	309SFF
45BC03XPPG30	309SFFG
45BC03XPXG30	309SFG
45BC03XXXG30	309SG
45BC04X30	409S

ABMA Number	Bearing size
45BC04XD30	409SZ
45BC04XDD30	409SZZ
45BC04XP30	409SF
45BC04XPP30	409SFF
45BC10X30	109KS
45BC10XD30	109KSZ
45BC10XDD30	109KSZZ
45BC10XDDG30	109KSZZG
45BC10XDXG30	109KSZG
45BC10XP30	109KSF
45BC10XPP30	109KSFF
45BC10XPPG30	109KSFFG
45BC10XPXG30	109KSFG
45BC10XXXG30	109KSG
45BC19X30	1909S
45BC19XD30	1909SZ
45BC19XDD30	1909SZZ
45BC19XP30	1909SF
45BC19XPP30	1909SFF
45BC32XDD30	209SZZC
45BC32XDDG30	209SZZCG
45BC32XPP30	209SFFC
45BC32XPPG30	209SFFCG
45BC33XDD30	309SZZC
45BC33XDDG30	309SZZCG
45BC33XPP30	309SFFC
45BC33XPPG30	309SFFCG
50BC02X30	210S

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
50BC02XD30	210SZ
50BC02XDD30	210SZZ
50BC02XDDG30	210SZZG
50BC02XDXG30	210SZG
50BC02XP30	210SF
50BC02XPP30	210SFF
50BC02XPPG30	210SFFG
50BC02XPXG30	210SFG
50BC02XXXG30	210SG
50BC03X30	310S
50BC03XD30	310SZ
50BC03XDD30	310SZZ
50BC03XDDG30	310SZZG
50BC03XDXG30	310SZG
50BC03XP30	310SF
50BC03XPP30	310SFF
50BC03XPPG30	310SFFG
50BC03XPXG30	310SFG
50BC03XXXG30	310SG
50BC04X30	410S
50BC04XD30	410SZ
50BC04XDD30	410SZZ
50BC04XP30	410SF
50BC04XPP30	410SFF
50BC10X30	110KS
50BC10XD30	110KSZ
50BC10XDD30	110KSZZ
50BC10XDDG30	110KSZZG

ABMA Number	Bearing size
50BC10XDXG30	110KSZG
50BC10XP30	110KSF
50BC10XPP30	110KSFF
50BC10XPPG30	110KSFFG
50BC10XPXG30	110KSFG
50BC10XXXG30	110KSG
50BC19X30	1910S
50BC19XD30	1910SZ
50BC19XDD30	1910SZZ
50BC19XP30	1910SF
50BC19XPP30	1910SFF
50BC32XDD30	210SZZC
50BC32XDDG30	210SZZCG
50BC32XPP30	210SFFC
50BC32XSPPG30	210SFFCG
50BC33XDD30	310SZZC
50BC33XDDG30	310SZZCG
50BC33XPP30	310SFFC
50BC33XPPG30	310SFFCG
55BC02X30	211S
55BC02XD30	211SZ
55BC02XDD30	211SZZ
55BC02XDDG30	211SZZG
55BC02XDXG30	211SZG
55BC02XP30	211SF
55BC02XPP30	211SFF
55BC02XPPG30	211SFFG
55BC02XPXG30	211SFG

ABMA Number	Bearing size
55BC02XXXG30	211SG
55BC03X30	311S
55BC03XD30	311SZ
55BC03XDD30	311SZZ
55BC03XDDG30	311SZZG
55BC03XDXG30	311SZG
55BC03PP30	311SFF
55BC03XP30	311SF
55BC03XPPG30	311SFFG
55BC03XPXG30	311SFG
55BC03XXXG30	311SG
55BC04X30	411S
55BC04XD30	411SZ
55BC04XDD30	411SZZ
55BC04XP30	411SF
55BC04XPP30	411SFF
55BC10X30	111KS
55BC10XD30	111KSZ
55BC10XDD30	111KSZZ
55BC10XDDG30	111KSZZG
55BC10XDXG30	111KSZG
55BC10XP30	111KSF
55BC10XPP30	111KSFF
55BC10XPPG30	111KSFFG
55BC10XPXG30	111KSFG
55BC10XXXG30	111KSG
55BC19X30	1911S
55BC19XD30	1911SZ

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
55BC19XDD30	1911SZZ
55BC19XP30	1911SF
55BC19XPP30	1911SFF
55BC32XDD30	211SZZC
55BC32XDDG30	211SZZCG
55BC32XPP30	211SFFC
55BC32XPPG30	211SFFCG
55BC33XDD30	311SZZC
55BC33XDDG30	311SZZCG
55BC33XPP30	311SFFC
55BC33XPPG30	311SFFCG
60BC02X30	212S
60BC02XD30	212SZ
60BC02XDD30	212SZZ
60BC02XDDG30	212SZZG
60BC02XDXG30	212SZG
60BC02XP30	212SF
60BC02XPP30	212SFF
60BC02XPPG30	212SFFG
60BC02XPXG30	212SFG
60BC02XXXG30	212SG
60BC03X30	312S
60BC03XD30	312SZ
60BC03XDD30	312SZZ
60BC03XDDG30	312SZZG
60BC03XDXG30	312SZG
60BC03XP30	312SF
60BC03XPP30	312SFF

ABMA Number	Bearing size
60BC03XPPG30	312SFFG
60BC03XPXG30	312SFG
60BC03XXXG30	312SG
60BC04X30	412S
60BC04XD30	412SZ
60BC04XDD30	412SZZ
60BC04XP30	412SF
60BC04XPP30	412SFF
60BC10X30	112KS
60BC10XD30	112KSZ
60BC10XDD30	112KSZZ
60BC10XDDG30	112KSZZG
60BC10XDXG30	112KSZG
60BC10XP30	112KSF
60BC10XPP30	112KSFF
60BC10XPPG30	112KSFFG
60BC10XPXG30	112KSFG
60BC10XXXG30	112KSG
60BC19X30	1912S
60BC19XD30	1912SZ
60BC19XDD30	1912SZZ
60BC19XP30	1912SF
60BC19XPP30	1912SFF
60BC32XDD30	212SZZC
60BC32XDDG30	212SZZCG
60BC32XPP30	212SFFC
60BC32XPPG30	212SFFCG
60BC33XDD30	312SZZC

ABMA Number	Bearing size
60BC33XDDG30	312SZZCG
60BC33XPP30	312SFFC
60BC33XPPG30	312SFFCG
65BC02X30	213S
65BC02XD30	213SZ
65BC02XDD30	213SZZ
65BC02XDDG30	213SZZG
65BC02XDXG30	213SZG
65BC02XP30	213SF
65BC02XPP30	213SFF
65BC02XPPG30	213SFFG
65BC02XPXG30	213SFG
65BC02XXXG30	213SG
65BC03X30	313S
65BC03XD30	313SZ
65BC03XDD30	313SZZ
65BC03XDDG30	313SZZG
65BC03XDXG30	313SZG
65BC03XP30	313SF
65BC03XPP30	313SFF
65BC03XPPG30	313SFFG
65BC03XPXG30	313SFG
65BC03XXXG30	313SG
65BC04X30	413S
65BC04XD30	413SZ
65BC04XDD30	413SZZ
65BC04XP30	413SF
65BC04XPP30	413SFF

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
65BC10X30	113KS
65BC10XD30	113KSZ
65BC10XDD30	113KSZZ
65BC10XDDG30	113KSZZG
65BC10XDXG30	113KSZG
65BC10XP30	113KSF
65BC10XPP30	113KSFF
65BC10XPPG30	113KSFFG
65BC10XPXG30	113KSFG
65BC10XXXG30	113KSG
65BC19X30	1913S
65BC19XD30	1913SZ
65BC19XDD30	1913SZZ
65BC19XP30	1913SF
65BC19XPP30	1913SFF
65BC32XDD30	213SZZC
65BC32XDDG30	213SZZCG
65BC32XPP30	213SFFC
65BC32XPPG30	213SFFCG
65BC33XDD30	313SZZC
65BC33XDDG30	313SZZCG
65BC33XPP30	313SFFC
65BC33XPPG30	313SFFCG
70BC02X30	214S
70BC02XD30	214SZ
70BC02XDD30	214SZZ
70BC02XDDG30	214SZZG
70BC02XDXG30	214SZG

ABMA Number	Bearing size
70BC02XP30	214SF
70BC02XPP30	214SFF
70BC02XPPG30	214SFFG
70BC02XPXG30	214SFG
70BC02XXXG30	214SG
70BC03X30	314S
70BC03XD30	314SZ
70BC03XDD30	314SZZ
70BC03XDDG30	314SZZG
70BC03XDXG30	314SZG
70BC03XP30	314SF
70BC03XPP30	314SFF
70BC03XPPG30	314SFFG
70BC03XPXG30	314SFG
70BC03XXXG30	314SG
70BC04X30	414S
70BC04XD30	414SZ
70BC04XDD30	414SZZ
70BC04XP30	414SF
70BC04XPP30	414SFF
70BC10X30	114KS
70BC10XD30	114KSZ
70BC10XDD30	114KSZZ
70BC10XDDG30	114KSZZG
70BC10XDXG30	114KSZG
70BC10XP30	114KSF
70BC10XPP30	114KSFF
70BC10XPPG30	114KSFFG

ABMA Number	Bearing size
70BC10XPXG30	114KSFG
70BC10XXXG30	114KSG
70BC19X30	1914S
70BC19XD30	1914SZ
70BC19XDD30	1914SZZ
70BC19XP30	1914SF
70BC19XPP30	1914SFF
70BC32XDD30	214SZZC
70BC32XDDG30	214SZZCG
70BC32XPP30	214SFFC
70BC32XPPG30	214SFFCG
70BC33XDD30	314SZZC
70BC33XDDG30	314SZZCG
70BC33XPP30	314SFFC
70BC33XPPG30	314SFFCG
75BC02X30	215S
75BC02XD30	215SZ
75BC02XDD30	215SZZ
75BC02XDDG30	215SZZG
75BC02XDXG30	215SZG
75BC02XP30	215SF
75BC02XPP30	215SFF
75BC02XPPG30	215SFFG
75BC02XPXG30	215SFG
75BC02XXXG30	215SG
75BC03X30	315S
75BC03XD30	315SZ
75BC03XDD30	315SZZ

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
75BC03XDDG30	315SZZG
75BC03XDXG30	315SZG
75BC03XP30	315SF
75BC03XPP30	315SFF
75BC03XPPG30	315SFFG
75BC03XPXG30	315SFG
75BC03XXXG30	315SG
75BC04X30	415S
75BC04XD30	415SZ
75BC04XDD30	415SZZ
75BC04XP30	415SF
75BC04XPP30	415SFF
75BC10X30	115KS
75BC10XD30	115KSZ
75BC10XDD30	115KSZZ
75BC10XDDG30	115KSZZG
75BC10XDXG30	115KSZG
75BC10XP30	115KSF
75BC10XPP30	115KSFF
75BC10XPPG30	115KSFFG
75BC10XPXG30	115KSFG
75BC10XXXG30	115KSG
75BC19X30	1915S
75BC19XD30	1915SZ
75BC19XDD30	1915SZZ
75BC19XP30	1915SF
75BC19XPP30	1915SFF
75BC32XDD30	215SZZC

ABMA Number	Bearing size
75BC32XDDG30	215SZZCG
75BC32XPP30	215SFFC
75BC32XPPG30	215SFFCG
75BC33XDD30	315SZZC
75BC33XDDG30	315SZZCG
75BC33XPP30	315SFFC
75BC33XPPG30	315SFFCG
80BC02X30	216S
80BC02XD30	216SZ
80BC02XDD30	216SZZ
80BC02XDDG30	216SZZG
80BC02XDXG30	216SZG
80BC02XP30	216SF
80BC02XPP30	216SFF
80BC02XPPG30	216SFFG
80BC02XPXG30	216SFG
80BC02XXXG30	216SG
80BC03X30	316S
80BC03XD30	316SZ
80BC03XDD30	316SZZ
80BC03XDDG30	316SZZG
80BC03XDXG30	316SZG
80BC03XP30	316SF
80BC03XPP30	316SFF
80BC03XPPG30	316SFFG
80BC03XPXG30	316SFG
80BC03XXXG30	316SG
80BC04X30	416S

ABMA Number	Bearing size
80BC04XD30	416SZ
80BC04XDD30	416SZZ
80BC04XP30	416SF
80BC04XPP30	416SFF
80BC10X30	116KS
80BC10XD30	116KSZ
80BC10XDD30	116KSZZ
80BC10XDDG30	116KSZZG
80BC10XDXG30	116KSZG
80BC10XP30	116KSF
80BC10XPP30	116KSFF
80BC10XPPG30	116KSFFG
80BC10XPXG30	116KSFG
80BC10XXXG30	116KSG
80BC19X30	1916S
80BC19XD30	1916SZ
80BC19XDD30	1916SZZ
80BC19XP30	1916SF
80BC19XPP30	1916SFF
80BC32XDD30	216SZZC
80BC32XDDG30	216SZZCG
80BC32XPP30	216SFFC
80BC32XPPG30	216SFFCG
80BC33XDD30	316SZZC
80BC33XDDG30	316SZZCG
80BC33XPP30	316SFFC
80BC33XPPG30	316SFFCG
85BC02X30	217S

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
85BC02XD30	217SZ
85BC02XDD30	217SZZ
85BC02XDDG30	217SZZG
85BC02XDXG30	217SZG
85BC02XP30	217SF
85BC02XPP30	217SFF
85BC02XPPG30	217SFFG
85BC02XPXG30	217SFG
85BC02XXXG30	217SG
85BC03X30	317S
85BC03XD30	317SZ
85BC03XDD30	317SZZ
85BC03XDDG30	317SZZG
85BC03XDXG30	317SZG
85BC03XP30	317SF
85BC03XPP30	317SFF
85BC03XPPG30	317SFFG
85BC03XPXG30	317SFG
85BC03XXXG30	317SG
85BC04X30	417S
85BC04XD30	417SZ
85BC04XDD30	417SZZ
85BC04XP30	417SF
85BC04XPP30	417SFF
85BC10X30	117KS
85BC10XD30	117KSZ
85BC10XDD30	117KSZZ
85BC10XDDG30	117KSZZG

ABMA Number	Bearing size
85BC10XDXG30	117KSZG
85BC10XP30	117KSF
85BC10XPP30	117KSFF
85BC10XPPG30	117KSFFG
85BC10XPXG30	117KSFG
85BC10XXXG30	117KSG
85BC19X30	1917S
85BC19XD30	1917SZ
85BC19XDD30	1917SZZ
85BC19XP30	1917SF
85BC19XPP30	1917SFF
85BC32XDD30	217SZZC
85BC32XDDG30	217SZZCG
85BC32XPP30	217SFFC
85BC32XPPG30	217SFFCG
85BC33XDD30	317SZZC
85BC33XDDG30	317SZZCG
85BC33XPP30	317SFFC
85BC33XPPG30	317SFFCG
90BC02X30	218S
90BC02XD30	218SZ
90BC02XDD30	218SZZ
90BC02XDDG30	218SZZG
90BC02XDXG30	218SZG
90BC02XP30	218SF
90BC02XPP30	218SFF
90BC02XPPG30	218SFFG
90BC02XPXG30	218SFG

ABMA Number	Bearing size
90BC02XXXG30	218SG
90BC03X30	318S
90BC03XD30	318SZ
90BC03XDD30	318SZZ
90BC03XDDG30	318SZZG
90BC03XDXG30	318SZG
90BC03XP30	318SF
90BC03XPP30	318SFF
90BC03XPPG30	318SFFG
90BC03XPXG30	318SFG
90BC03XXXG30	318SG
90BC04X30	418S
90BC04XD30	418SZ
90BC04XDD30	418SZZ
90BC04XP30	418SF
90BC04XPP30	418SFF
90BC10X30	118KS
90BC10XD30	118KSZ
90BC10XDD30	118KSZZ
90BC10XDDG30	118KSZZG
90BC10XDXG30	118KSZG
90BC10XP30	118KSF
90BC10XPP30	118KSFF
90BC10XPPG30	118KSFFG
90BC10XPXG30	118KSFG
90BC10XXXG30	118KSG
90BC19X30	1918S
90BC19XD30	1918SZ

ABMA numbers and MRC equivalent

ABMA Number	Bearing size
90BC19XDD30	1918SZZ
90BC19XP30	1918SF
90BC19XPP30	1918SFF
90BC32XDD30	218SZZC
90BC32XDDG30	218SZZCG
90BC32XPP30	218SFFC
90BC32XPPG30	218SFFCG
90BC33XDD30	318SZZC
90BC33XDDG30	318SZZCG
90BC33XPP30	318SFFC
90BC33XPPG30	318SFFCG
95BC02X30	219S
95BC02XD30	219SZ
95BC02XDD30	219SZZ
95BC02XDDG30	219SZZG
95BC02XDXG30	219SZG
95BC02XP30	219SF
95BC02XPP30	219SFF
95BC02XPPG30	219SFFG
95BC02XPXG30	219SFG
95BC02XXXG30	219SG
95BC03X30	319S
95BC03XD30	319SZ
95BC03XDD30	319SZZ
95BC03XDDG30	319SZZG
95BC03XDXG30	319SZG
95BC03XP30	319SF
95BC03XPP30	319SFF

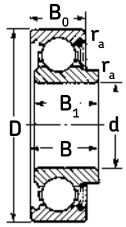
ABMA Number	Bearing size
95BC03XPPG30	319SFFG
95BC03XPXG30	319SFG
95BC03XXXG30	319SG
95BC04X30	419S
95BC04XD30	419SZ
95BC04XDD30	419SZZ
95BC04XP30	419SF
95BC04XPP30	419SFF
95BC10X30	119KS
95BC10XD30	119KSZ
95BC10XDD30	119KSZZ
95BC10XDDG30	119KSZZG
95BC10XDXG30	119KSZG
95BC10XP30	119KSF
95BC10XPP30	119KSFF
95BC10XPPG30	119KSFFG
95BC10XPXG30	119KSFG
95BC10XXXG30	119KSG
95BC19X30	1919S
95BC19XD30	1919SZ
95BC19XDD30	1919SZZ
95BC19XP30	1919SF
95BC19XPP30	1919SFF
95BC32XDD30	219SZZC
95BC32XDDG30	219SZZCG
95BC32XPP30	219SFFC
95BC32XPPG30	219SFFCG
95BC33XDD30	319SZZC

ABMA Number	Bearing size
95BC33XDDG30	319SZZCG
95BC33XPP30	319SFFC
95BC33XPPG30	319SFFCG
100BC02X30	220S
100BC02XD30	220SZ
100BC02XDD30	220SZZ
100BC02XDDG30	220SZZG
100BC02XDXG30	220SZG
100BC02XP30	220SF
100BC02XPP30	220SFF
100BC02XPPG30	220SFFG
100BC02XPXG30	220SFG
100BC02XXXG30	220SG
100BC03X30	320S
100BC03XD30	320SZ
100BC03XDD30	320SZZ
100BC03XDDG30	320SZZG
100BC03XDXG30	320SZG
100BC03XP30	320SF
100BC03XPP30	320SFF
100BC03XPPG30	320SFFG
100BC03XPXG30	320SFG
100BC03XXXG30	320SG
100BC04X30	420S
100BC04XD30	420SZ
100BC04XDD30	420SZZ
100BC04XP30	420SF
100BC04XPP30	420SFF

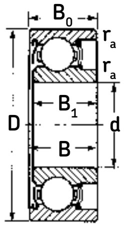
ABMA numbers and MRC equivalent

ABMA Number	Bearing size
100BC10X30	120KS
100BC10XD30	120KSZ
100BC10XDD30	120KSZZ
100BC10XDDG30	120KSZZG
100BC10XDXG30	120KSZG
100BC10XP30	120KSF
100BC10XPP30	120KSFF
100BC10XPPG30	120KSFFG
100BC10XPXG30	120KSFG
100BC10XXXG30	120KSG
100BC19X30	1920S
100BC19XD30	1920SZ
100BC19XDD30	1920SZZ
100BC19XP30	1920SF
100BC19XPP30	1920SFF
100BC32XDD30	220SZZC
100BC32XDDG30	220SZZCG
100BC32XPP30	220SFFC
100BC32XPPG30	220SFFCG
100BC33XDD30	320SZZC
100BC33XDDG30	320SZZCG
100BC33XPP30	320SFFC
100BC33XPPG30	320SFFCG

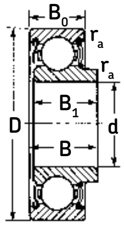
Felt seal replacement bearings basic dimensions



8000
One seal



WC87000
Shield and seal



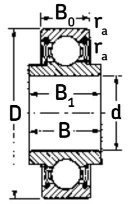
87000
Shield and seal

MRC felt seal replacement bearings have synthetic rubber seals.

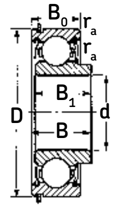
MRC bearing number	Old MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B_0 mm	in.	B_1 mm	in.	B mm	in.	Fillet radius[1] r_a mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Single and double sealed grease rpm
8008	38FS1	8	**.3150**	24	**.9449**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 430	**321**	23 000
8013	201FS2	13	**.5118**	32	**1.2598**	10.0	**.394**	12.2	**.480**	12.7	**.500**	.64	**.025**	245	**.38**	6 890	**1 550**	3 050	**686**	15 000
8014	202FS1	14	**.5512**	35	**1.3780**	11.0	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	284	**.44**	7 610	**1 710**	3 650	**821**	13 000
8016	202FS3	16	**.6299**	35	**1.3780**	11.0	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	284	**.44**	7 610	**1 710**	3 650	**821**	13 000
8026	205FS3	26	**1.0236**	52	**2.0472**	15.0	**.591**	15.2	**.600**	15.9	**.625**	1.00	**.040**	568	**.88**	14 000	**3 150**	8 000	**1 800**	8 500
8038	38FS	8	**.3150**	22	**.8661**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 370	**308**	23 000
8500	200FS	10	**.3937**	30	**1.1811**	9.0	**.354**	12.2	**.480**	12.7	**.500**	.64	**.025**	155	**.24**	5 070	**1 140**	2 400	**540**	17 000
8501	201FS	12	**.4724**	32	**1.2598**	10.0	**.394**	12.2	**.480**	12.7	**.500**	.64	**.025**	245	**.38**	6 760	**1 520**	3 050	**685**	15 000
8502	202FS	15	**.5906**	35	**1.3780**	11.0	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	277	**.43**	7 610	**1 710**	3 750	**843**	13 000
8503	203FS	17	**.6693**	40	**1.5748**	12.0	**.472**	13.7	**.538**	14.3	**.563**	.64	**.025**	361	**.56**	9 560	**2 150**	4 800	**1 080**	12 000
8504	204FS	20	**.7874**	47	**1.8504**	14.0	**.551**	15.2	**.600**	15.9	**.625**	1.00	**.040**	503	**.78**	13 000	**2 920**	6 700	**1 510**	10 000
8505	205FS	25	**.9843**	52	**2.0472**	15.0	**.591**	15.2	**.600**	15.9	**.625**	1.00	**.040**	568	**.88**	14 000	**3 150**	8 000	**1 800**	8 500
8506	206FS	30	**1.1811**	62	**2.4409**	16.0	**.630**	19.0	**.748**	20.0	**.787**	1.00	**.040**	813	**1.26**	19 500	**4 380**	11 400	**2 560**	7 500
8507	207FS	35	**1.3780**	72	**2.8346**	17.0	**.669**	20.0	**.787**	21.0	**.827**	1.00	**.040**	1 109	**1.72**	25 500	**5 730**	15 300	**3 440**	6 300
8508	208FS	40	**1.5748**	80	**3.1496**	21.0	**.827**	24.0	**.945**	24.0	**.945**	1.00	**.040**	1 320	**2.05**	29 100	**6 540**	18 000	**4 050**	5 600
8605	305FS	25	**.9843**	62	**2.4409**	17.0	**.669**	21.0	**.827**	21.0	**.827**	1.00	**.040**	632	**.98**	15 900	**3 570**	8 000	**1 800**	7 500
WC87008	38FSF2	8	**.3150**	24	**.9449**	10.3	**.406**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 430	**321**	23 000
WC87016	—	16	**.6299**	35	**1.3780**	12.7	**.500**	12.2	**.480**	12.7	**.500**	.64	**.025**	284	**.44**	7 610	**1 710**	3 750	**843**	13 000
WC87500	200FSF1	10	**.3937**	30	**1.1811**	12.7	**.500**	12.2	**.480**	12.7	**.500**	.64	**.025**	155	**.24**	5 070	**1 140**	2 400	**540**	17 000
WC87501	201FSF1	12	**.4724**	32	**1.2598**	12.7	**.500**	12.2	**.480**	12.7	**.500**	.64	**.025**	245	**.38**	6 890	**1 550**	2 400	**540**	15 000
WC87502	202FSF1	15	**.5906**	35	**1.3780**	12.7	**.500**	12.2	**.480**	12.7	**.500**	.64	**.025**	277	**.43**	7 610	**1 710**	3 750	**843**	13 000
WC87503	203FSF1	17	**.6693**	40	**1.5748**	14.3	**.563**	13.7	**.538**	14.3	**.563**	.64	**.025**	361	**.56**	9 560	**2 150**	4 800	**1 080**	12 000
WC87504	204FSF1	20	**.7874**	47	**1.8504**	15.9	**.625**	15.2	**.600**	15.9	**.625**	1.00	**.040**	503	**.78**	13 000	**2 920**	6 700	**1 510**	10 000
87007	37FSF1	7	**.2756**	24	**.9449**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 430	**321**	23 000
87008	38FSF1	8	**.3150**	24	**.9449**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 430	**321**	23 000
87013	201FSF3	13	**.5118**	32	**1.2598**	10.0	**.394**	12.2	**.480**	12.7	**.500**	.64	**.025**	245	**.38**	6 890	**1 550**	3 050	**686**	15 000
87014	—	14	**.5512**	35	**1.3780**	11.0	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	284	**.44**	7 610	**1 710**	3 650	**821**	13 000
87016	202FSF4	16	**.6299**	35	**1.3780**	11.0	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	284	**.44**	7 610	**1 710**	3 750	**843**	13 000
87026	—	26	**1.0236**	52	**2.0472**	15.0	**.591**	15.2	**.600**	15.9	**.625**	1.00	**.040**	568	**.88**	14 000	**3 150**	8 000	**1 800**	8 500
87036	36FSF	6	**.2362**	19	**.7480**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	97	**.15**	2 810	**632**	1 080	**243**	26 000
87037	37FSF	7	**.2756**	22	**.8661**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 340	**301**	23 000
87038	38FSF	8	**.3150**	22	**.8661**	8.0	**.315**	9.8	**.386**	10.3	**.406**	.30	**.012**	110	**.17**	3 320	**746**	1 370	**308**	23 000
87500	200FSF	10	**.3937**	30	**1.1811**	9.0	**.354**	12.2	**.480**	12.7	**.500**	.64	**.025**	155	**.24**	5 070	**1 140**	2 400	**540**	17 000
87501	201FSF	12	**.4724**	32	**1.2598**	10.0	**.394**	12.2	**.480**	12.7	**.500**	.64	**.025**	245	**.38**	8 190	**1 840**	3 650	**821**	15 000
87502	202FSF	15	**.5906**	35	**1.3780**	11.0	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	277	**.43**	7 610	**1 710**	3 750	**843**	13 000
87503	203FSF	17	**.6693**	40	**1.5748**	12.0	**.472**	13.7	**.538**	14.3	**.563**	.64	**.025**	361	**.56**	9 560	**2 150**	4 800	**1 080**	12 000
87504	204FSF	20	**.7874**	47	**1.8504**	14.0	**.551**	15.2	**.600**	15.9	**.625**	1.00	**.040**	503	**.78**	13 000	**2 920**	6 700	**1 510**	10 000
87505	205FSF	25	**.9843**	52	**2.0472**	15.0	**.591**	15.2	**.600**	15.9	**.625**	1.00	**.040**	568	**.88**	14 000	**3 150**	8 000	**1 800**	8 500
87506	206FSF	30	**1.1811**	62	**2.4409**	16.0	**.630**	19.0	**.748**	20.0	**.787**	1.00	**.040**	813	**1.26**	19 500	**4 380**	11 400	**2 560**	7 500
87507	207FSF	35	**1.3780**	72	**2.8346**	17.0	**.669**	20.0	**.787**	21.0	**.827**	1.00	**.040**	1 110	**1.72**	25 500	**5 730**	15 300	**3 440**	6 300
87508	208FSF	40	**1.5748**	80	**3.1496**	21.0	**.827**	24.0	**.945**	24.0	**.945**	1.00	**.040**	1 320	**2.05**	29 100	**6 540**	18 000	**4 050**	5 000

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.

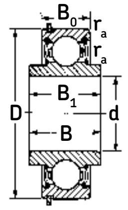
Felt seal replacement bearings basic dimensions



88000
Two seals



487000[4)]
Shield, seal and snap-ring



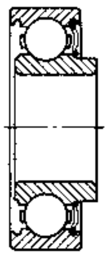
488000
Two seals and snap-ring

MRC felt seal replacement bearings have synthetic rubber seals.

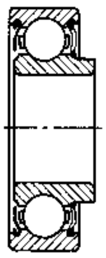
MRC bearing number	Old MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	B_0 mm	in.	Width B_1 mm	in.	B mm	in.	Fillet radius[1)] r_a mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3)] N	lbf	Static C_0 N	lbf	Speed rating[2)] Single and double sealed grease rpm
88007	—	7	**.2756**	24	**.9449**	8	**.315**	12.6	**.497**	12.6	**.497**	.30	**.012**	110	**.17**	3 320	**746**	1 430	**321**	23 000
88008	38FFS2	8	**.3150**	24	**.9449**	8	**.315**	12.6	**.497**	12.6	**.497**	.30	**.012**	110	**.17**	3 320	**746**	1 430	**321**	23 000
88009	—	9	**.3543**	30	**1.1811**	9	**.354**	16.4	**.646**	16.4	**.646**	.64	**.025**	155	**.24**	4 620	**1 040**	2 040	**459**	17 000
88011	—	11	**.4331**	32	**1.2598**	10	**.394**	15.4	**.606**	15.4	**.606**	.64	**.025**	245	**.38**	6 760	**1 520**	3 000	**674**	15 000
88013	201FFS2	13	**.5118**	32	**1.2598**	10	**.394**	15.4	**.606**	15.4	**.606**	.64	**.025**	245	**.38**	6 890	**1 550**	3 050	**686**	15 000
88016	202FFS5	16	**.6299**	35	**1.3780**	11	**.433**	14.4	**.567**	14.4	**.567**	.64	**.025**	284	**.44**	7 610	**1 710**	3 750	**843**	13 000
88500	200FFS	10	**.3937**	30	**1.1811**	9	**.354**	16.4	**.646**	16.4	**.646**	.64	**.025**	155	**.24**	5 070	**1 140**	2 400	**540**	17 000
88501	201FFS	12	**.4724**	32	**1.2598**	10	**.394**	15.4	**.606**	15.4	**.606**	.64	**.025**	245	**.38**	6 760	**1 520**	3 050	**685**	15 000
88502	202FFS	15	**.5906**	35	**1.3780**	11	**.433**	14.4	**.567**	14.4	**.567**	.64	**.025**	277	**.43**	7 610	**1 710**	3 750	**843**	13 000
88503	203FFS	17	**.6693**	40	**1.5748**	12	**.472**	16.6	**.654**	16.6	**.654**	.64	**.025**	361	**.56**	9 560	**2 150**	4 800	**1 080**	12 000
88504	204FFS	20	**.7874**	47	**1.8504**	14	**.551**	17.8	**.699**	17.8	**.699**	1.00	**.040**	503	**.78**	13 000	**2 920**	6 700	**1 510**	10 000
88505	205FFS	25	**.9843**	52	**2.0472**	15	**.591**	16.7	**.659**	16.7	**.659**	1.00	**.040**	568	**.88**	14 000	**3 150**	8 000	**1 800**	8 500
88506	206FFS	30	**1.1811**	62	**2.4409**	16	**.630**	24.0	**.945**	24.0	**.945**	1.00	**.040**	813	**1.26**	19 500	**4 380**	11 400	**2 560**	7 500
88507	207FFS	35	**1.3780**	72	**2.8346**	17	**.669**	25.0	**.984**	25.0	**.984**	1.00	**.040**	1 110	**1.72**	25 500	**5 730**	15 300	**3 440**	6 300
88508	208FFS	40	**1.5748**	80	**3.1496**	21	**.827**	27.0	**1.063**	27.0	**1.063**	1.00	**.040**	1 320	**2.05**	29 100	**6 540**	18 000	**4 050**	5 600
487502	G202FSF	15	**.5906**	35	**1.3780**	11	**.433**	12.2	**.480**	12.7	**.500**	.64	**.025**	277	**.43**	7 610	**1 710**	3 750	**843**	13 000
487503	G203FSF	17	**.6693**	40	**1.5748**	12	**.472**	13.7	**.538**	14.3	**.563**	.64	**.025**	361	**.56**	9 560	**2 150**	4 800	**1 080**	12 000
487508	G208FSF	40	**1.5748**	80	**3.1496**	21	**.827**	24.0	**.945**	24.0	**.945**	1.00	**.040**	1 320	**2.05**	29 100	**6 540**	18 000	**4 050**	5 600
488016	202FFS2G	16	**.6299**	35	**1.3780**	11	**.433**	14.4	**.567**	14.4	**.567**	.64	**.025**	284	**.44**	7 610	**1 710**	3 750	**843**	13 000
488502	202FFSG	15	**.5906**	35	**1.3780**	11	**.433**	14.4	**.567**	14.4	**.567**	.64	**.025**	277	**.43**	7 610	**1 710**	3 750	**843**	13 000
488503	203FFSG	17	**.6693**	40	**1.5748**	12	**.472**	16.6	**.654**	16.6	**.654**	.64	**.025**	361	**.56**	9 560	**2 150**	4 800	**1 080**	12 000
488504	204FFSG	20	**.7874**	47	**1.8504**	14	**.551**	17.8	**.699**	17.8	**.699**	1.00	**.040**	503	**.78**	13 000	**2 920**	6 700	**1 510**	10 000
488505	205FFSG	25	**.9843**	52	**2.0472**	15	**.591**	16.7	**.659**	16.7	**.659**	1.00	**.040**	568	**.88**	14 000	**3 150**	8 000	**1 800**	8 500
488506	206FFSG	30	**1.1811**	62	**2.4409**	16	**.630**	24.0	**.945**	24.0	**.945**	1.00	**.040**	813	**1.26**	19 500	**4 380**	11 400	**2 560**	7 500
488507	207FFSG	35	**1.3780**	72	**2.8346**	17	**.669**	25.0	**.984**	25.0	**.984**	1.00	**.040**	1 110	**1.72**	25 500	**5 730**	15 300	**3 440**	6 300
488508	208FFSG	40	**1.5748**	80	**3.1496**	21	**.827**	27.0	**1.063**	27.0	**1.063**	1.00	**.040**	1 320	**2.05**	29 100	**6 540**	18 000	**4 050**	5 600

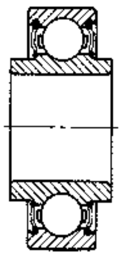
1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at $33^1/_3$ rpm.
4) Add suffix "V" when snap-ring is on seal side

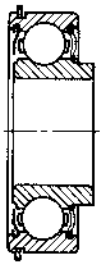
Felt seal replacement bearings interchange

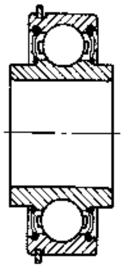

8000
One seal


WC87000
Shield and seal


87000
Shield and seal


88000
Two seals


487000
Shield, seal
and snap-ring


488000
Two seals
and snap-ring

MRC felt seal replacement bearings have synthetic rubber seals.

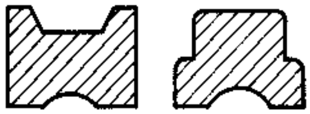
MRC bearing number	Basic interchange		
	BCA	FAF	NDH NTN
8008	—	38KVL	8008
8013	8013	—	8013
8014	—	202KL4	8014
8016	8016	202KL3	8016
8026	8026	—	8026
8038	—	38KL	8038
8500	8500	200KL	8500
8501	8501	201KL	8501
8502	8502	202KL	8502
8503	8503	203KL	8503
8504	8504	204KL	8504
8505	8505	205KL	8505
8506	8506	206KL	8506
8507	8507	207KL	8507
8508	8508	—	8508
8605	8605	—	8605
WC87008	—	38KVTD	WC87008
WC87016	—	202KTD3	WC87016
WC87500	WC87500	200KTD	WC87500
WC87501	WC87501	201KTD	WC87501
WC87502	WC87502	202KTD	WC87502
WC87503	WC87503	203KTD8	WC87503
WC87504	WC87504	—	WC87504
87007	—	37KVLD	87007
87008	87008	38KVLD	87008
87013	87013	201KLD2	87013

MRC bearing number	Basic interchange		
	BCA	FAF	NDH NTN
87014	—	—	87014
87016	87016	202KLD3	87016
87026	—	—	87026
87036	—	36KLD	87036
87037	—	37KLD	87037
87038	—	38KLD	87038
87500	87500	200KLD	87500
87501	87501	201KLD	87501
87502	87502	202KLD	87502
87503	87503	203KLD	87503
87504	87504	204KLD	87504
87505	87505	205KLD	87505
87506	87506	206KLD	87506
87507	87507	207KLD	87507
87508	—	—	87508
88007	—	—	88007
88008	38KVLL2	88008	—
88009	—	—	88009
88011	—	—	88011
88013	88013	201KLL3	88013
88016	88016	202KLL3	88016
88500	88500	200KLL2	88500
88501	88501	201KLL2	88501
88502	88502	202KLL2	88502
88503	88503	203KLL2	88503
88504	88504	204KLL2	88504

MRC bearing number	Basic interchange		
	BCA	FAF	NDH NTN
88505	88505	205KLL2	88505
88506	88506	205KLL	88506
88507	—	207KLL	88507
88508	88508	—	88508
487502	—	—	487502
487503	—	—	487503
487508	—	—	487508
488016	—	—	488016
488502	—	—	488502
488503	—	—	488503
488504	—	—	488504
488505	—	—	488505
488506	—	—	488506
488507	—	—	488507
488508	—	—	488508

Industrial truck mast guide bearings

Mast guide type



Chain sheave type

Outer ring design

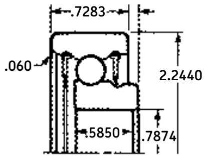
Industrial truck mast guide ball bearings are a family of special bearings tailored to meet the requirements of the industrial truck industry. These bearings must be able to accommodate heavy radial loads, withstand heavy shock loads, and handle overturning moments produced by combined radial and thrust loads.

Special lubricants are selected to meet the rigorous demands of industrial truck service. To retain the lubricant and protect the bearing from adverse environmental conditions, the bearings are equipped with either synthetic rubber or polypropylene seals.

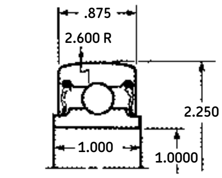
MRC bearing number [1)]	Basic interchange					
	SKF	BCA	Hoover / NSK	McGill	NDH	Split
204SZZ27	BNTB316574	—	—	—	—	—
205SZZ29	—	—	—	—	—	—
207SZZ20	—	—	—	—	—	—
207SZZ31	—	—	—	—	—	—
208SZZ15	—	MG207FFH	—	BB1705	—	TB104
305SZZ3	—	MG305DD	X421	BB849	ZMG605ATY1Z8	—
305SZZ6	—	MG305DDA	—	—	—	—
306SZZ5	361885	MG306DD	X555	—	—	—
307SZZ4	—	—	—	—	—	—
307SZZ9	—	MG307FFK	X549RS	—	—	—
307SZZ10	360858C	MG307FF	X3762S	BB816	Z99607BTY1Z8	—
307SZZ14	—	—	—	—	—	—
307SZZ18	—	—	—	—	—	—
307SZZ19	—	—	—	—	—	—
308SZZ4	—	—	—	—	—	—
308SZZ5	362480	EX4989	—	BB1747	—	—
308SZZ6	—	—	—	—	—	—
309SZZ1	—	MG309DD	—	BB850	—	—
309SZZ4	—	MG309DDA	X501RS	BB1652	ZMG609XRY1Z8	—
309SZZ5	—	—	—	—	—	—
309SZZ9	—	—	—	—	—	—
309SZZ12	—	—	—	—	—	—
311SZZ1	—	—	—	BB16493	—	—
311SZZ2	—	—	—	—	—	—
311SZZ5	—	—	—	—	—	—

[1)] Check availability before designing into new equipment.

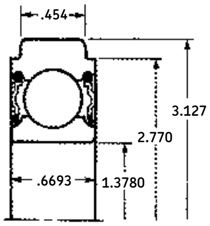
Mast guide bearings



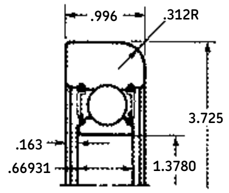
204SZZ27



205SZZ29



207SZZ20



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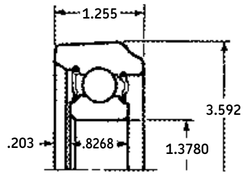
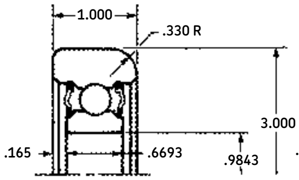
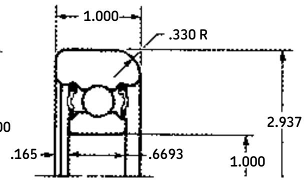


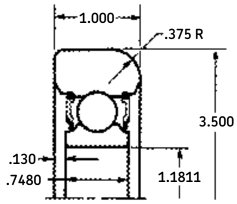
208SZZ15



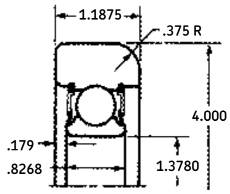
305SZZ3



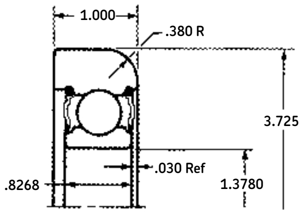
305SZZ6



306SZZ5



307SZZ4



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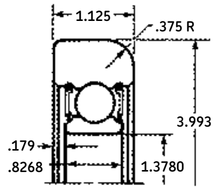

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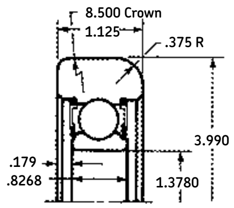
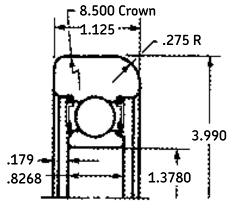
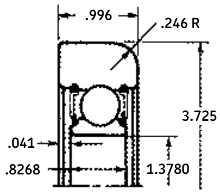


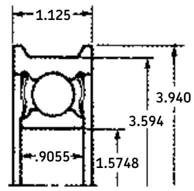
307SZZ14



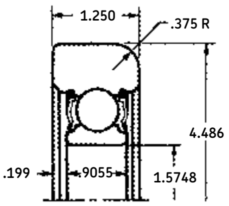
307SZZ18



307SZZ19



308SZZ4



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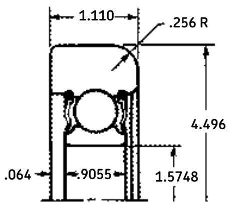

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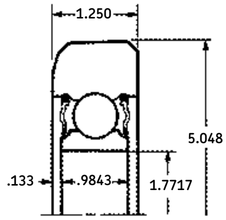

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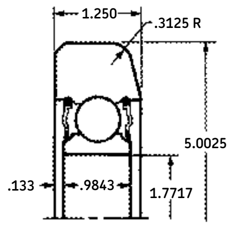

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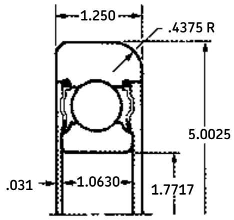

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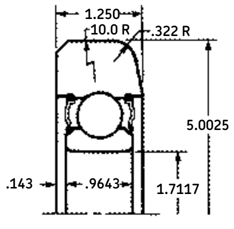

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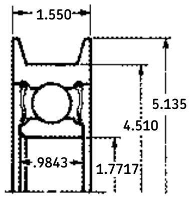

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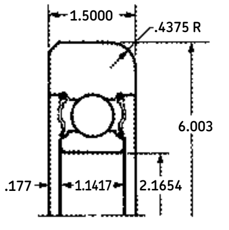

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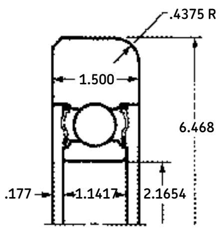

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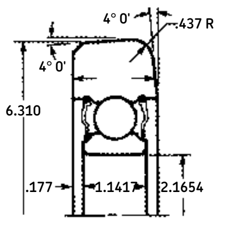


311SZZ5

Mast guide bearings

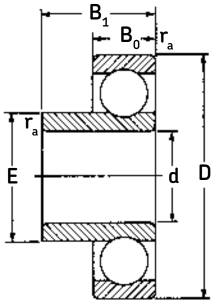
Original equipment manufacturers part number reference guide

Original equipment part number	MRC bearing number
Allis Chamers	
1001732	208-SZZ-15
1002841-02	5309-BZZ-1
1005603	309-SZZ-4
4756413	5206-BKFF-1
4769905	5306-BZZ-1
4774102	5108-BZZ-1
4797550	5209-BZZ-1
4798050	5210-BZZ-1
4803599	5109-BZZ-2
4803665	5109-BZZ-1
4812920	307-SZZ-9
4817265	207-SZZ-20
4820659	309-SZZ-4
4832744	311-SZZ-2
4842106	5209-BZZ-2
4859065	5109-BZZ-3
4863104	5309-RZZ-1
48206693	309-SZZ-4
71005603	309-SZZ-4
8612154	311-SZZ-5
American Manufacturing Co.	
305-SZZ-3	305-SZZ-3
305-SZZ-6	305-SZZ-6
307-SZZ-10	307-SZZ-10
309-SZZ-4	309-SZZ-4
Arrow Fork Lift	
35A11111	307-SZZ-8
305-SZZ-3	305-SZZ-3
306-SZZ-5	306-SZZ-5
307-SZZ-10	307-SZZ-10
309-SZZ-1	309-SZZ-1
309-SZZ-4	309-SZZ-4
5108-BZZ-1	5108-BZZ-1
5208-BTZ-1	5208-BTZ-1
185531	208-SZZ-16
746623	305-SZZ-3
789401	308-SZZ-1
4812920	307-SZZ-9
Baker Material Handling	
102916	206-SZZ-16
104744	309-SZZ-4
105475	306-SZZ-5
105476	204-SZZ-20
120891	307-SZZ-10
504001	307-SZZ-10
504002	309-SZZ-4
Barrett Electronics	
A10650	5306-BZZ-1
A27690-2	307-SZZ-10

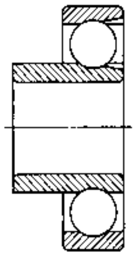
Original equipment part number	MRC bearing number
Caterpillar Tractor	
091132	307-SZZ-14
308918	305-SZZ-3
314046	309-SZZ-9
314047	309-SZZ-1
346114	308-SZZ-4
371202	307-SZZ-18
Clark Equipment	
342957	307-SZZ-10
665619	208-SZZ-9
738752-J	309-SZZ-1
746623	305-SZZ-3
746624	307-SZZ-10
996829	307-SZZ-10
1654614	309-SZZ-4
1695854	306-SZZ-5
1697663	311-SZZ-1
1764714	5316-SZZ-1
2306335	307-SZZ-11
2306336	305-SZZ-7
2326653	308-SZZ-5
2357128	309-SZZ-12
2357723	308-SZZ-6
2359625	204-SZZ-27
2359446	5309-BZZ-2
2359447	5307-BZZ-1
Criterion Engineering Ltd.	
205-SZZ-29	205-SZZ-29
305-SZZ-6	305-SZZ-6
309-SZZ-4	309-SZZ-4
Crown Controls	
74020-B	305-SZZ-3
74668-1	307-SZZ-10
79943	309-SZZ-4
Dyna-Power Corporation	
R1	307-SZZ-10
Eaton Corporation	
260100-18-001-00	307-SZZ-16
Fiat-Allis	
74820659	309-SZZ-4
74832744	311-SZZ-2
Hyster	
87905	307-SZZ-10
89219	5205-BKZZ-1
129002	5206-BKZZ-1
143493	5208-BKT-1
185530	208-SZZ-15
185531	208-SZZ-16
186711	5208-BTT-2
193557	5208-BTZ-1
212956	307-SZZ-10
231020	5207-BKZZ-1

Original equipment part number	MRC bearing number
K-D Manufacturing Co.	
R2	309-SZZ-4
R-186	5309-RZZ-1
R 5182	308-SZZ-4
307-SZZ-10	307-SZZ-10
309-SZZ-1	309-SZZ-1
Knickerbocker Co.	
30451	307-SZZ-10
30487	305-SZZ-3
30719	309-SZZ-4
Massey Ferguson	
311-SZZ-1	311-SZZ-1
672896M1	309-SZZ-1
Pettibone Corporation	
31486	206-SZZ-16
F11201	307-SZZ-10
Pettibone-Mercury	
30076	206-SZZ-16
33569	309-SZZ-4
33799	307-SZZ-10
Petti-Mulliken	
F11205	307-SZZ-10
P45900	309-SZZ-4
Raymond	
449033	309-SZZ-4
Schreck	
31-42014	307-SZZ-10
31-42015	309-SZZ-4
31-43450	305-SZZ-3
Taylor Machine Works	
309-SZZ-1	309-SZZ-1
Towmotor Corporation: see Caterpillar Tractor	
White Farm Equipment	
20-3004059	309-SZZ-5
White Material Handling	
35A11111	307-SZZ-8
35A12631	307-SZZ-10
Wiggins Lift Co.	
307-SZZ-10	307-SZZ-10
309-SZZ-1	309-SZZ-1
309-SZZ-4	309-SZZ-4
311-SZZ-1	311-SZZ-1
311-SZZ-2	311-SZZ-2

Wide inner ring medium series



SWI
300SWI Non-filling
notch type



WI
300WI Filling
notch type

To determine bearing life, refer to page 47 for SWI, and page 68 for WI.

MRC bearing number	Bore d mm	in.	Outside diameter D mm	in.	Width B_0 mm	in.	B_1 mm	in.	E mm	in.	Fillet radius[1] r_a mm	in.	ZD^2 mm	in.	Basic radial load rating Dynamic C[3] N	lbf	Static C_0 N	lbf	Speed rating[2] Grease rpm	Oil rpm
305SWI	25	**.9843**	62	**2.4409**	17	**.6693**	25.40	**1**	38.1	**1.499**	1.0	**.04**	850	**1.32**	20 800	**4 680**	11 200	**2 520**	11 000	14 000
306SWI	30	**1.1811**	72	**2.8346**	19	**.7480**	30.16	**1 3/6**	43.1	**1.698**	1.0	**.04**	1 290	**2.00**	29 600	**6 650**	16 600	**3 730**	9 000	11 000
307SWI	35	**1.3780**	80	**3.1496**	21	**.8268**	34.93	**1 3/8**	48.7	**1.917**	1.5	**.06**	1 630	**2.53**	36 400	**8 180**	20 800	**4 680**	8 500	10 000
309SWI	45	**1.7717**	100	**3.9370**	25	**.9843**	39.69	**1 9/16**	61.1	**2.405**	1.5	**.06**	2 440	**3.78**	52 700	**11 900**	31 500	**7 080**	6 700	8 000
310SWI	50	**1.9685**	110	**4.3307**	27	**1.0630**	44.45	**1 3/4**	67.5	**2.659**	2.0	**.08**	2 900	**4.50**	61 800	**13 900**	38 000	**8 540**	6 300	7 500
311SWI	55	**2.1654**	120	**4.7244**	29	**1.1417**	49.21	**1 15/16**	74.0	**2.915**	2.0	**.08**	3 410	**5.28**	71 500	**16 100**	45 000	**10 100**	5 600	6 700
313SWI	65	**2.5591**	140	**5.5118**	33	**1.2992**	58.74	**2 5/16**	85.1	**3.350**	2.0	**.08**	4 540	**7.03**	92 300	**20 800**	60 000	**13 500**	4 800	5 600
315SWI	75	**2.9528**	160	**6.2992**	37	**1.4567**	68.26	**2 11/16**	98.9	**3.895**	2.0	**.08**	6 530	**10.1**	121 000	**27 200**	85 000	**19 100**	4 300	5 000
318SWI	90	**3.5433**	190	**7.4803**	43	**1.6929**	73.03	**2 7/8**	121.0	**4.750**	2.5	**.10**	7 280	**11.3**	133 000	**29 900**	98 000	**22 000**	3 400	4 000
320SWI	100	**3.9370**	215	**8.4646**	47	**1.8504**	82.55	**3 1/4**	132.0	**5.210**	2.5	**.10**	11 600	**18.0**	182 000	**40 900**	150 000	**33 700**	3 000	3 600
308WI[4]	40	**1.5748**	90	**3.5433**	23	**.9055**	36.51	**1 7/16**	54.8	**2.159**	1.5	**.06**	2 770	**4.30**	46 800	**10 500**	36 000	**8 090**	6 200	7 500
311WI	55	**2.1654**	120	**4.7244**	29	**1.1417**	44.45	**1 3/4**	72.7	**2.863**	2.0	**.08**	4 690	**7.26**	74 800	**16 800**	61 000	**13 700**	4 600	5 600
312WI[4]	60	**2.3622**	130	**5.1181**	31	**1.2205**	53.98	**2 1/8**	79.1	**3.114**	2.0	**.08**	5 430	**8.42**	91 300	**20 500**	78 000	**17 500**	4 300	5 300
314WI[4]	70	**2.7559**	150	**5.9055**	35	**1.3780**	63.50	**2 1/2**	94.5	**3.719**	2.0	**.08**	7 740	**12.0**	114 000	**25 600**	102 000	**22 900**	3 700	4 500
315WI[4]	75	**2.9528**	160	**6.2992**	37	**1.4567**	68.26	**2 11/16**	101.0	**3.976**	2.0	**.08**	8 740	**13.6**	125 000	**28 000**	116 000	**26 000**	3 500	4 300
316WI[4]	80	**3.1496**	170	**6.6929**	39	**1.5354**	68.26	**2 11/16**	109.0	**4.282**	2.0	**.08**	9 470	**14.7**	138 000	**31 000**	129 000	**29 000**	3 300	4 000
318WI[4]	90	**3.5433**	190	**7.4803**	43	**1.6929**	73.03	**2 7/8**	121.0	**4.750**	2.5	**.10**	12 100	**18.8**	157 000	**35 300**	160 000	**36 000**	2 800	3 400

1) Fillet radius indicates maximum fillet radius on shaft or in housing which bearing corner will clear.
2) Listed values are for pressed steel or polyamide cage, ABEC-1.
The values have been determined through historical application and practice. For a more complete explanation, see page 272.
3) Rating for one million revolutions or 500 hours at 33 1/3 rpm.
4) Check availability before designing into new equipment.

Engineering data

Section 3-Engineering data

Table of contents

page

Duplex bearings

An MRC duplex bearing is specifically manufactured with a controlled relationship between the axial location of the inner and outer ring faces. Duplex bearings are ordinarily supplied as half pairs unless they are high precision machine tool bearings that typically come in pairs. Combinations of three or more bearings are also available.

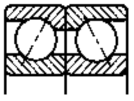
MRC duplex bearings may be used to advantage in applications where:

1. Axial and radial deflections must be held to a minimum
2. Maximum radial capacity is required
3. Heavy single direction or reversing thrust loads must be supported
4. Axial shaft location must be maintained under reversing thrust loads
5. Moment loading is present

Standard methods of mounting

Duplex bearings can be mounted in three different ways to suit different loading conditions and requirements for rigidity. The three different positions bear the identification symbols “DB,” “DF,” and “DT”.

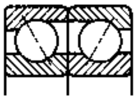
DB—Back-to-back



The sketch above shows the back-to-back (DB) position where the two halves are placed so that the contact angle lines of the two bearings diverge inwardly. For all MRC duplex bearings, this means that the marked faces of the outer rings are adjacent. 7000 series and type R bearings have the low shoulder sides of the outer rings facing outward.

A DB pair may be used to carry: (1) heavy radial loads; (2) combined radial and thrust loads; (3) reversing thrust loads; (4) moment loads. Due to its construction, the DB pair has great angular rigidity and may be used in applications where it is necessary to restrict misalignment or shaft deflection. DB pairs are axially clamped on the shaft but may float in the housing to provide for thermal expansion.

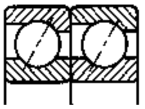
DF—Face-to-face



This sketch shows the face-to-face (DF) position, where the two halves are placed so that the contact angle lines of the two bearings converge inwardly. For all MRC duplex bearings, this means that the unmarked faces of the outer rings are together. On all angular contact and type R bearings, the low shoulder sides of the outer rings will be adjacent.

The DF position may be used to advantage where the duplex pair carries: (1) a heavy radial load; (2) a combined radial and thrust load; (3) a reversing thrust load. This mounting arrangement allows the bearings to handle a small amount of misalignment. DF pairs are axially clamped in the housing and on the shaft.

DT—Tandem



This illustration shows the tandem mounting arrangement, where the two halves are placed so that the contact angle lines are parallel. For all MRC duplex bearings, this means that the stamped face of one bearing is in contact with the unstamped face of the other bearing.

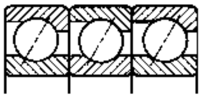
The DT mounting is used to carry extremely high thrust loads in one direction where high speeds or space limitations prevent the use of a larger bearing.

Duplex bearings

Special methods of mounting

The three methods of mounting duplex pairs—DB, DF, and DT—are basic. However, other combinations may frequently be used to advantage. A few of these combinations are shown below.

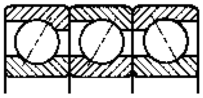
Duplex stack of three bearings (1½ pair) mounted in tandem



This arrangement shows three bearings mounted in the tandem relationship and will provide greater thrust load carrying capacity, since three bearings are sharing the thrust load.

Additional thrust carrying capacity may be obtained by increasing the number of bearings in the stack.

Duplex arrangement of a DT pair mounted in DB relationship with a single bearing

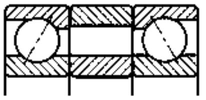


An arrangement such as this will provide extremely high load-carrying capacity in the direction of the heavy outer ring shoulder of the two tandem mounted bearings as well as considerable reversing thrust. If the thrust load in both directions is equal in magnitude and duration, an arrangement of four bearings could be used in which a DT pair would be mounted in DB relationship to another DT pair. The set would have the suffix DTDB.

Duplex arrangement of a DT mounted in DF relationship with a single bearing

This arrangement provides the same capabilities as the DB mounting except the bearings are mounted in a DF relationship. The set would have the suffix DTDF.

DB pair separated by spacers



It is sometimes desirable to separate duplex bearings by equal length spacers mounted between the two inner rings and the two outer rings. This mounting arrangement is desirable when the pair is subjected to a heavy moment load, when it is necessary to minimize shaft deflection, or when the bearings are running too hot next to each other. Care should be taken to make certain that these spacers are parallel and equal in length.

Single bearings (half pair)—DU, DS, DE

MRC bearings with controlled axial relationship of faces are available as single bearings (half pair). These are ordinarily specified when the customer uses duplex bearings in a number of different mounting arrangements and wishes to simplify the problem of stocking prearranged pairs. Single duplex bearings are ground for universal mounting and may be matched with any other bearing from a carton having identical markings.

Type DU bearings have flush ground faces and when mounted in pairs and clamped, have neither preload nor endplay.

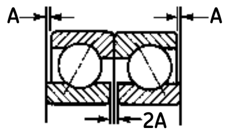
Type DS bearings are furnished with preload and are also identified on the bearing with the designation DL, DM, DH or DX for light, medium, heavy, or special preload respectively.

Type DE bearings are furnished with endplay as clamped and are also identified on the bearing with the designation CA, CB, CC or CX for specific endplay values with CX calling for special endplay.

Duplex bearings

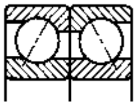
Before clamping

Preloaded bearings



Preloaded duplex pairs are made from single bearings having inner and outer rings of equal width but in which the stamped face of the outer ring protrudes beyond the face of the inner. The sketches show this relationship for a DB pair. "A" is known as the bearing offset.

Clamped



When the inner and outer rings are clamped together an elastic deformation takes place in the contact between the balls and races. Since the deflection rate of a bearing decreases with increasing load, it is possible to eliminate the major portion of the potential deflection of a bearing under load through preloading.

In order to suit the customers' application requirements, MRC bearings are available with light, medium, heavy or special preload. Please consult our Technical Services Department for the proper selection of preload.

Endplay

Duplex pairs with endplay are made from single bearings having inner and outer rings of equal width but in which the face of the inner protrudes beyond the stamped face of the outer. Endplay in duplex pairs is desirable where there is misalignment, high operating temperatures or when the bearings are mounted with a heavy press fit on the shaft and/or in the housing.

Interchangeability

Types DU, DS and DE (single bearings) may be mounted in the DB, DF, or DT relationship. However, these bearings should not be used with bearings from any other box unless the markings on both boxes are identical.

In the case of making replacements for bearings which have been installed and run, we recommend that both bearings be replaced. This avoids the dangers involved in attempting to match two bearings, one of which has unknown internal characteristics.

Shaft and housing fitting practices

The control of the axial location of inner and outer ring faces found in all duplex bearings is dependent upon the internal clearance in the bearing. A change in internal clearance will result in a change in the flushness or offset of the faces.

In mounting a duplex pair, it is particularly important that excessive press fits on the shaft or in the housing be avoided. Otherwise, the individual bearings in the set will be axially preloaded against each other which might result in excessive heating and early failure. In those cases where heavy press fits are imperative, duplex sets with endplay should be used.

Refer to page 238 for mounting recommendations.

Packaging

Types DB, DF, and DT duplex pairs are ordinarily supplied wired together in the same relationship as they are to be used. The pair is then packaged together and the carton is stamped with the appropriate symbol.

Types DU, DS, and DE (single bearings) are typically packed separately. If special packaging is required, please consult MRC's Application Engineering group.

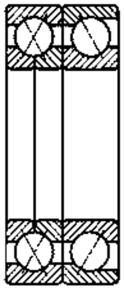
Duplex bearings

97000U and 97000UP series

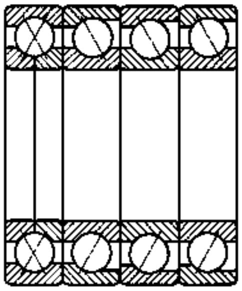
The 97000U series consists of a matched set of 9000UDT (split inner ring) and 7000DT flush ground bearings having a 29° contact angle. The 97000UP series consists of a matched set of 9000UPDT (split inner ring) and 7000PDT flush ground bearings having a 40° contact angle.

Typical mountings

The bearings are usually mounted in pairs. This arrangement divides the thrust load in one direction while accommodating reversing thrust load. To increase thrust capacity in one direction it is possible to mount additional bearings in tandem. The number of bearings in the set will be identified by a number at the end of the bearing designation. For example, a set of three bearings (triplex) is identified as the 97000U3 and a set of four (quadruplex) as the 97000U4. Numbers 2 through 9 only will apply. Numbers 10 and higher indicate some special characteristic. Illustration of typical mountings are shown below.



97000U2

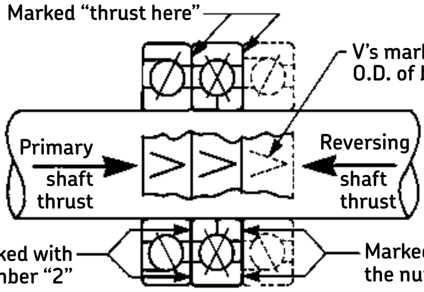


98000U4

Mounting orientation

Caution: To obtain proper load distribution, it is necessary to orient mating bearing ring faces, and the inner ring halves of the split ring bearing (9000UDT), according to the illustration below. The counterbored outer ring bearing (7000DT) can be mounted either at side (A) or side (B) of the split ring bearing as shown.

In addition, each bearing in the set will be marked with a "V" etched on the outer ring surface with the apex pointing in the main shaft thrust direction.



Notes:

The numbers "1" and "2" marked on the bearing with the split inner ring, are to keep the proper relationship between the inner rings and the outer ring.

The counterbore bearing(s) can be mounted on either side (A) or (B) (above or below) the split bearing, provided that the "V" 's marked on the O.D. of bearings are pointed in the direction of the "primary shaft thrust".

Bearing identification marking

The box and bearings will be marked according to the following example.

Bearing size: 97314UP2

Box: 97314UP2-BRZ 0001

BRZ=Machined bronze cage

0001=MRC specification code suffix

Bearing: All bearings in the set will be marked

97314UP2 0001

Previous marking: The bearing set was identified on the box as 9314UPDT/7314PDT; and on the bearings as 9314UPDT and 7314PDT.

ABEC-1 ABMA/ISO tolerances for single-row, double-row, and duplex bearings

Tolerances in inches (shaded) and millimeters

Inner ring

Bore diameter (mm)		Over incl	2.5 10	10 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250
Bore diameter	+.0000		–.0003	–.0003	–.0004	–.00045	–.0006	–.0008	–.0010	–.0010	–.0012
			–.008	–.008	–.010	–.012	–.015	–.020	–.025	–.025	–.030
Bore out-of-round (Max)		1800, 1900 series	.0004	.0004	.0005	.0006	.00075	.0010	.0012	.0012	.0015
			.010	.010	.013	.015	.019	.025	.031	.031	.038
		100 series	.0003	.0003	.0004	.00045	.00075	.0010	.0012	.0012	.0015
			.008	.008	.010	.012	.019	.025	.031	.031	.038
		200 300 400 series	.00025	.00025	.0003	.00035	.00045	.0006	.00075	.00075	.0009
			.006	.006	.008	.009	.011	.015	.019	.019	.023
Radial runout (Max)			.0004	.0004	.0005	.0006	.0008	.0010	.0012	.0012	.0016
			.010	.010	.013	.015	.020	.025	.030	.030	.040
Width variation (Max)			.0006	.0008	.0008	.0008	.0010	.0010	.0012	.0012	.0012
			.015	.020	.020	.020	.025	.025	.030	.030	.030
Side runout with bore (Max)			.0008	.0008	.0008	.0008	.0010	.0010	.0012	.0012	.0012
			.020	.020	.020	.020	.025	.025	.030	.030	.030
Raceway runout with side (Max)			.0008	.0008	.0008	.0008	.0010	.0010	.0012	.0012	.0016
			.020	.020	.020	.020	.025	.025	.030	.030	.040
Ring width single bearing	+.0000		–.0047	–.0047	–.0047	–.0047	–.0059	–.0079	–.0098	–.0098	–.0118
			–.120	–.120	–.120	–.120	–.150	–.200	–.250	–.250	–.300
Ring width duplex bearing	+.0000		–.0098	–.0098	–.0098	–.0098	–.0150	–.0150	–.0197	–.0197	–.0197
			–.250	–.250	–.250	–.250	–.380	–.380	–.500	–.500	–.500

Outer ring

Outside diameter (mm)		Over incl	6 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250	250 315	315 400
Outside diameter	+.0000		–.0003	–.00035	–.00045	–.0005	–.0006	–.0007	–.0010	–.0012	–.0014	–.0016
			–.008	–.009	–.011	–.013	–.015	–.018	–.025	–.030	–.035	–.040
Outside diameter out-of-round (Max)		1800, 1900 series	.0004	.00045	.00055	.00065	.00075	.0009	.0012	.0015	.0017	.0020
			.010	.012	.014	.016	.019	.023	.031	.038	.044	.050
		100 series	.0003	.00035	.00045	.0005	.00075	.0009	.0012	.0015	.0017	.0020
			.008	.009	.011	.013	.019	.023	.031	.038	.044	.050
		200, 300, 400 series	.00025	.0003	.0003	.0004	.00045	.00055	.00075	.0009	.0010	.0012
			.006	.007	.008	.010	.011	.014	.019	.023	.026	.030
		100, 200, 300, 400 series shielded* and sealed	.0004	.00045	.00065	.0008	.0010	.0012	.0015	—	—	—
			.010	.012	.016	.020	.026	.030	.038	—	—	—
Radial runout (Max)			.0006	.0006	.0008	.0010	.0014	.0016	.0018	.0020	.0024	.0028
			.015	.015	.020	.025	.035	.040	.045	.050	.060	.070
Width variation (Max)			Identical to inner ring of same bearing									
Outside diameter runout with side (Max)			.0008	.0008	.0008	.0010	.0010	.0012	.0012	.0012	.0014	.0016
			.020	.020	.020	.025	.025	.030	.030	.030	.035	.040
Raceway runout with side (Max)			.0012	.0012	.0012	.0012	.0014	.0016	.0020	.0024	.0028	.0031
			.030	.030	.030	.030	.035	.040	.050	.060	.070	.080
Ring width single bearing			Identical to inner ring of same bearing									
Ring width duplex bearing												

*No values established for 1800 and 1900 series.

ABEC-3 ABMA/ISO tolerances for single-row, double-row, and duplex bearings

Tolerances in inches (shaded) and millimeters

Inner ring

Bore diameter (mm)		Over incl	2.5 10	10 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250
Bore diameter	+.0000		–.0003	–.0003	–.0003	–.00045	–.0005	–.0006	–.0007	–.0007	–.00085
			–.007	–.007	–.008	–.010	–.012	–.015	–.018	–.018	–.022
Bore out-of-round (Max)		1800, 1900 series	.00035	.00035	.0004	.0005	.0006	.00075	.0009	.0009	.0011
			.009	.009	.010	.013	.015	.019	.023	.023	.028
		100 series	.0003	.0003	.0003	.0004	.0006	.00075	.0009	.0009	.0011
			.007	.007	.008	.010	.015	.019	.023	.023	.028
		200, 300, 400 series	.0002	.0002	.00025	.0003	.00035	.00045	.00055	.00055	.00065
			.005	.005	.006	.008	.009	.011	.014	.014	.017
Radial runout (Max)			.00025	.0003	.0003	.0004	.0004	.0005	.0007	.0007	.0008
			.006	.007	.008	.010	.010	.013	.018	.018	.020
Width variation (Max)			.0006	.0008	.0008	.0008	.0010	.0010	.0012	.0012	.0012
			.015	.020	.020	.020	.025	.025	.030	.030	.030
Side runout with bore (Max)			.0004	.0004	.0004	.0004	.0005	.0005	.0006	.0006	.0006
			.010	.010	.010	.010	.013	.013	.015	.015	.015
Raceway runout with side (Max)			.0006	.0006	.0006	.0006	.0007	.0007	.0009	.0009	.0009
			.015	.015	.015	.015	.018	.018	.023	.023	.023
Ring width single bearing	+.0000		–.0047	–.0047	–.0047	–.0047	–.0059	–.0079	–.0098	–.0098	–.0118
			–.120	–.120	–.120	–.120	–.150	–.200	–.250	–.250	–.300
Ring width duplex bearing	+.0000		–.0098	–.0098	–.0098	–.0098	–.0150	–.0150	–.0197	–.0197	–.0197
			–.250	–.250	–.250	–.250	–.380	–.380	–.500	–.500	–.500

Outer ring

Outside diameter (mm)		Over incl	6 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250	250 315	315 400
Outside diameter	+.0000		–.0003	–.0003	–.0004	–.0004	–.0005	–.0006	–.0007	–.0008	–.0010	–.0011
			–.007	–.008	–.009	–.011	–.013	–.015	–.018	–.020	–.025	–.028
Outside diameter out-of-round (Max)		1800, 1900 series	.0004	.0004	.0004	.0006	.0006	.0007	.0009	.0010	.0012	.0014
			.009	.010	.011	.014	.016	.019	.023	.025	.031	.035
		100 series	.0003	.0003	.0004	.0004	.0006	.0007	.0009	.0010	.0012	.0014
			.007	.008	.009	.011	.016	.019	.023	.025	.031	.035
		200, 300, 400 series	.0002	.0002	.0003	.0003	.0004	.0004	.0006	.0006	.0007	.0008
			.005	.006	.007	.008	.010	.011	.014	.015	.019	.021
		100, 200, 300, 400 series shielded* and sealed	.0004	.0004	.0005	.0006	.0008	.0010	.0012	—	—	—
			.009	.010	.013	.016	.020	.025	.030	—	—	—
Radial runout (Max)			.0003	.0004	.0004	.0005	.0007	.0008	.0009	.0010	.0012	.0014
			.008	.009	.010	.013	.018	.020	.023	.025	.030	.035
Width variation (Max)			Identical to inner ring of same bearing									
Outside diameter runout with side (Max)			.0004	.0004	.0004	.0005	.0005	.0006	.0006	.0006	.0007	.0008
			.010	.010	.010	.013	.013	.015	.015	.015	.018	.020
Raceway runout with side (Max)			.0008	.0008	.0008	.0008	.0009	.0010	.0012	.0014	.0016	.0018
			.020	.020	.020	.020	.023	.025	.030	.035	.040	.045
Ring width single bearing			Identical to inner ring of same bearing									
Ring width duplex bearing												

*No values established for 1800 and 1900 series.

ABEC-5 ABMA/ISO tolerances for single-row, double-row, and duplex bearings

Tolerances in inches (shaded) and millimeters

Inner ring

Bore diameter (mm)		Over incl	2.5 10	10 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250
Bore diameter	+.0000		–.0002	–.0002	–.00025	–.0003	–.00035	–.0004	–.0005	–.0005	–.0006
			–.005	–.005	–.006	–.008	–.009	–.010	–.013	–.013	–.015
Bore out-of-round (Max)		1800, 1900 series	.0002	.0002	.00025	.0003	.00035	.0004	.0005	.0005	.0006
			.005	.005	.006	.008	.009	.010	.013	.013	.015
		100,200, 300, 400 series	.00015	.00015	.0002	.00025	.0003	.0003	.0004	.0004	.00045
			.004	.004	.005	.006	.007	.008	.010	.010	.012
Radial runout (Max)			.00015	.00015	.00015	.0002	.0002	.00025	.0003	.0003	.0004
			.004	.004	.004	.005	.005	.006	.008	.008	.010
Width variation (Max)			.0002	.0002	.0002	.0002	.00025	.0003	.0003	.0003	.0004
			.005	.005	.005	.005	.006	.007	.008	.008	.010
Side runout with bore (Max)			.0003	.0003	.0003	.0003	.0003	.00035	.0004	.0004	.00045
			.007	.007	.008	.008	.008	.009	.010	.010	.011
Raceway runout with side (Max)			.0003	.0003	.0003	.0003	.0003	.00035	.0004	.0004	.0005
			.007	.007	.008	.008	.008	.009	.010	.010	.013
Ring width single bearing	+.0000		–.0016	–.0031	–.0047	–.0047	–.0059	–.0079	–.0098	–.0098	–.0118
			–.040	–.080	–.120	–.120	–.150	–.200	–.250	–.250	–.300
Ring width duplex bearing	+.0000		–.0098	–.0098	–.0098	–.0098	–.0098	–.0150	–.0150	–.0150	–.0197
			–.250	–.250	–.250	–.250	–.250	–.380	–.380	–.380	–.500

Outer ring

Outside diameter (mm)		Over incl	6 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250	250 315	315 400
Outside diameter	+.0000		–.0002	–.00025	–.0003	–.00035	–.0004	–.00045	–.0005	–.0006	–.0007	–.0008
			–.005	–.006	–.007	–.009	–.010	–.011	–.013	–.015	–.018	–.020
Outside diameter out-of-round (Max)		1800, 1900 series	.0002	.00025	.0003	.00035	.0004	.00045	.0005	.0006	.0007	.0008
			.005	.006	.007	.009	.010	.011	.013	.015	.018	.020
		100, 200, 300,400 series	.00015	.0002	.0002	.0003	.0003	.0003	.0004	.00045	.00055	.0006
			.004	.005	.005	.007	.008	.008	.010	.011	.014	.015
Radial runout (Max)			.0002	.00025	.0003	.0003	.0004	.00045	.0005	.0006	.0007	.0008
			.005	.006	.007	.008	.010	.011	.013	.015	.018	.020
Width variation (Max)			Identical to inner ring of same bearing									
Outside diameter runout with side (Max)			.0003	.0003	.0003	.0003	.00035	.0004	.0004	.00045	.0005	.0005
			.008	.008	.008	.008	.009	.010	.010	.011	.013	.013
Raceway runout with side (Max)			.0003	.0003	.0003	.0004	.00045	.0005	.00055	.0006	.0007	.0008
			.008	.008	.008	.010	.011	.013	.014	.015	.018	.020
Ring width single bearing			Identical to inner ring of same bearing									
Ring width duplex bearing												

ABEC-7 ABMA/ISO tolerances for single row, double-row, and duplex bearings

Tolerances in inches (shaded) and millimeters

Inner ring

Bore diameter (mm)		Over incl	2.5 10	10 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250
Bore diameter	+.0000		**–.00015**	**–.00015**	**–.0002**	**–.00025**	**–.0003**	**–.0003**	**–.0004**	**–.0004**	**–.00045**
			–.004	–.004	–.005	–.006	–.007	–.008	–.010	–.010	–.012
Bore out-of-round (Max)		1800, 1900 series	**.00015**	**.00015**	**.0002**	**.00025**	**.0003**	**.0003**	**.0004**	**.0004**	**.00045**
			.004	.004	.005	.006	.007	.008	.010	.010	.012
		100, 200, 300, 400 series	**.0001**	**.0001**	**.00015**	**.0002**	**.0002**	**.00025**	**.0003**	**.0003**	**.00035**
			.003	.003	.004	.005	.005	.006	.008	.008	.009
Radial runout (Max)			**.0001**	**.0001**	**.0001**	**.00015**	**.00015**	**.0002**	**.00025**	**.00025**	**.0003**
			.0025	.0025	.003	.004	.004	.005	.006	.006	.008
Width variation (Max)			**.0001**	**.0001**	**.0001**	**.0001**	**.00015**	**.00015**	**.0002**	**.0002**	**.00025**
			.0025	.0025	.0025	.003	.004	.004	.005	.005	.006
Side runout with bore (Max)			**.0001**	**.0001**	**.00015**	**.00015**	**.0002**	**.0002**	**.00025**	**.00025**	**.0003**
			.003	.003	.004	.004	.005	.005	.006	.006	.007
Raceway runout with side (Max)			**.0001**	**.0001**	**.00015**	**.00015**	**.0002**	**.0002**	**.0003**	**.0003**	**.0003**
			.003	.003	.004	.004	.005	.005	.007	.007	.008
Ring width single bearing	+.0000		**–.0016**	**–.0031**	**–.0047**	**–.0047**	**–.0059**	**–.0079**	**–.0098**	**–.0098**	**–.0118**
			–.040	–.080	–.120	–.120	–.150	–.200	–.250	–.250	–.300
Ring width duplex bearing	+.0000		**–.0098**	**–.0098**	**–.008**	**–.0098**	**–.0098**	**–.0150**	**–.0150**	**–.0150**	**–.0197**
			–.250	–.250	–.250	–.250	–.250	–.380	–.380	–.380	–.500

Outer ring

Outside diameter (mm)		Over incl	6 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250	250 315	315 400
Outside diameter	+.0000		**–.00015**	**–.0002**	**–.00025**	**–.0003**	**–.0003**	**–.00035**	**–.0004**	**–.00045**	**–.0005**	**–.0006**
			–.004	–.005	–.006	–.007	–.008	–.009	–.010	–.011	–.013	–.015
Outside diameter out-of-round (Max)		1800, 1900 series	**.00015**	**.0002**	**.00025**	**.0003**	**.0003**	**.00035**	**.0004**	**.00045**	**.0005**	**.0006**
			.004	.005	.006	.007	.008	.009	.010	.011	.013	.015
		100, 200, 300,400 series	**.0001**	**.00015**	**.0002**	**.0002**	**.00025**	**.0003**	**.0003**	**.0003**	**.0004**	**.00045**
			.003	.004	.005	.005	.006	.007	.008	.008	.010	.011
Radial runout (Max)			**.0001**	**.00015**	**.0002**	**.0002**	**.00025**	**.0003**	**.0003**	**.0004**	**.00045**	**.0005**
			.003	.004	.005	.005	.006	.007	.008	.010	.011	.013
Width variation (Max)			Identical to inner ring of same bearing									
Outside diameter runout with side (Max)			**.00015**	**.00015**	**.00015**	**.00015**	**.0002**	**.0002**	**.0002**	**.0003**	**.0003**	**.0004**
			.004	.004	.004	.004	.005	.005	.005	.007	.008	.010
Raceway runout with side (Max)			**.0002**	**.0002**	**.0002**	**.0002**	**.00025**	**.0003**	**.0003**	**.0004**	**.0004**	**.0005**
			.005	.005	.005	.005	.006	.007	.008	.010	.010	.013
Ring width single bearing			Identical to inner ring of same bearing									
Ring width duplex bearing												

ABEC-9 ABMA/ISO tolerances for single row, double-row, and duplex bearings

Tolerances in inches (shaded) and millimeters

Inner ring

Bore diameter (mm)		Over incl	2.5 10	10 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250
Bore diameter	+.0000		**–.0001**	**–.0001**	**–.0001**	**–.0001**	**–.00015**	**–.0002**	**–.0003**	**–.0003**	**–.0003**
			–.0025	–.0025	–.0025	–.0025	–.004	–.005	–.007	–.007	–.008
Bore out-of-round (Max)			**.0001**	**.0001**	**.0001**	**.0001**	**.0015**	**.0002**	**.0003**	**.0003**	**.0003**
			.0025	.0025	.0025	.0025	.004	.005	.007	.007	.008
Radial runout (Max)			**.00005**	**.00005**	**.0001**	**.0001**	**.0001**	**.0001**	**.0001**	**.0002**	**.0002**
			.0015	.0015	.0025	.0025	.0025	.0025	.0025	.005	.005
Width variation (Max)			**.00005**	**.00005**	**.00005**	**.00005**	**.00005**	**.0001**	**.0001**	**.00015**	**.0002**
			.0015	.0015	.0015	.0015	.0015	.0025	.0025	.004	.005
Side runout with bore (Max)			**.00005**	**.00005**	**.00005**	**.00005**	**.00005**	**.0001**	**.0001**	**.00015**	**.0002**
			.0015	.0015	.0015	.0015	.0015	.0025	.0025	.004	.005
Raceway runout with side (Max)			**.00005**	**.00005**	**.0001**	**.0001**	**.0001**	**.0001**	**.0001**	**.0002**	**.0002**
			.0015	.0015	.0025	.0025	.0025	.0025	.0025	.005	.005
Ring width single bearing	+.0000		**–.0016**	**–.0031**	**–.0047**	**–.0047**	**–.0059**	**–.0079**	**–.0098**	**–.0118**	**–.0138**
			–.040	–.080	–.120	–.120	–.150	–.200	–.250	–.300	–.350
Ring width duplex bearing	+.0000		**–.0098**	**–.0098**	**–.0098**	**–.0098**	**–.0098**	**–.0150**	**–.0150**	**–.0197**	**–.0197**
			–.250	–.250	–.250	–.250	–.250	–.380	–.380	–.500	–.500

Outer ring

Outside diameter (mm)		Over incl	6 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250	250 315	315 400
Outside diameter	+.0000		**–.0001**	**–.00015**	**–.00015**	**–.00015**	**–.0002**	**–.0002**	**–.0003**	**–.0003**	**–.0003**	**–.0004**
			–.0025	–.004	–.004	–.004	–.005	–.005	–.007	–.008	–.008	–.010
Outside diameter out-of-round (Max)			**.0001**	**.00015**	**.00015**	**.00015**	**.0002**	**.0002**	**.0003**	**.0003**	**.0003**	**.0004**
			.0025	.004	.004	.004	.005	.005	.007	.008	.008	.010
Radial runout (Max)			**.00005**	**.0001**	**.0001**	**.00015**	**.0002**	**.0002**	**.0002**	**.0003**	**.0003**	**.0005**
			.0015	.0025	.0025	.004	.005	.005	.005	.007	.007	.008
Width variation (Max)			**Identical to inner ring of same bearing**									
Outside diameter runout with side (Max)			**.00005**	**.00005**	**.00005**	**.00005**	**.0001**	**.0001**	**.0001**	**.00015**	**.0002**	**.0003**
			.0015	.0015	.0015	.0015	.0025	.0025	.0025	.004	.005	.007
Raceway runout with side (Max)			**.00005**	**.0001**	**.0001**	**.00015**	**.0002**	**.0002**	**.0002**	**.0003**	**.0003**	**.0003**
			.0015	.0025	.0025	.004	.005	.005	.005	.007	.007	.008
Ring width single bearing			Identical to inner ring of same bearing									
Ring width duplex bearing												

Shaft and housing fits

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Shaft and housing fits

Radial location of bearings

If the load carrying ability of a bearing is to be fully utilized, its rings or washers must be supported around their complete circumference and across the whole width of the raceway. The support must be firm and even and, for inner rings, can be provided by a cylindrical or tapered seating or, for washers, by a flat (plane) support surface. This means that the seatings must be made with adequate accuracy and that they have a surface which is uninterrupted by grooves, holes or other features. In addition the rings must be reliably secured to prevent them from turning on or in their seatings under load. Inadequately or incorrectly secured bearing rings generally produce damage to the bearings and associated components.

A satisfactory radial location and an adequate support can generally only be obtained when the rings are mounted with an appropriate degree of interference. However, when simple mounting and dismounting are desirable, or when axial displacement is required with a non-locating bearing, interference fits cannot be used.

Selection of fit

When selecting a fit, the factors discussed in the following and the general guidelines in respect of them should be considered.

1 Conditions of rotation

Conditions of rotation refer to the movement of the bearing ring being considered in relation to the direction of the load. Essentially there are three different conditions: "rotating load", "stationary load", and "direction of load indeterminate".

If the bearing ring rotates and the load is stationary, or if the ring is stationary and the load rotates so that all points on the raceway are subjected to load in the course of one revolution, the load is defined as a "rotating load". Heavy loads which do not rotate but oscillate (for example, those acting on the outer rings of connecting rod bearings) are generally considered as rotating loads.

"Stationary load" applies if the bearing ring is stationary and the load is also stationary, or if the ring and load rotate at the same speed so that the load is always directed to the same point on the raceway.

Variable external loads, shock loads, vibrations and unbalanced loads in high-speed machines give rise to changes in the direction of load which cannot be accurately described. Such conditions are classified as "direction of load indeterminate".

A bearing ring subjected to a rotating load will turn (creep) on its own seating if mounted with a clearance fit, and wear (fretting corrosion) of the contacting surfaces will occur. To prevent this, interference fits must be used. The degree of interference needed is dictated by the operating conditions (see points 2 and 4).

When a stationary load exists, a bearing ring will not normally turn on its seating. Therefore, the ring need not necessarily have an interference fit unless this is required for other reasons.

When the direction of load is indeterminate and particularly where heavy loads are involved, it is desirable that both rings have an interference fit. For the inner ring, the fit recommended for rotating load is normally used. However, when the outer ring must be free to move axially in the housing and the load is not heavy, a somewhat looser fit than that recommended for rotating load may be used. When interference fits are used on both the inner ring and outer ring, the remaining internal clearance of the bearing should be considered to avoid excessive clearance reduction, i.e. internal preloading.

2 Magnitude of the load

The interference fit of a bearing inner ring on its seating will be loosened with increasing load as the ring will expand. Under the influence of rotating load, the ring may begin to creep. The degree of interference must therefore be related to the magnitude of the load: the heavier the load, particularly if it is of shock character, the greater the interference required.

3 Bearing internal clearance

An interference fit of a bearing on the shaft or in the housing means that the ring is elastically deformed (expanded or compressed) and the bearing internal clearance reduced. A certain minimum clearance should remain, however (see also "Bearing radial clearance", page 268). The initial clearance and permissible reduction depend on the type and size of the bearing. The reduction in clearance due to the interference fit can be so large that bearings with increased radial clearance have to be used in order to prevent the bearing from becoming preloaded.

4 Temperature conditions

In service, bearing rings normally reach a temperature which is higher than that of the components to which they are fitted. This can result in an easing of the fit of the inner ring on its seating, while outer ring expansion may prevent the desired axial displacement of the ring in its housing. Temperature differentials and the direction of heat flow must therefore be carefully considered.

(continued on next page)

Shaft and housing fits

Radial location of bearings

5 Running accuracy requirements

To reduce resilience and vibration, clearance fits should generally not be used for bearings where high demands are placed on running accuracy. Bearing seatings on the shaft and in the housing should be made to narrow dimensional tolerances.

6 Design and material of shaft and housing

Caution: The fit of a bearing ring on its seating must not lead to uneven distortion of the ring (out-of-round). This can be caused for example by discontinuities in the seating surface. Split housings are therefore not generally suitable where outer rings are to have an interference fit.

To ensure adequate support for bearing rings mounted in thin-walled housings, light alloy housings or on hollow shafts, heavier interference fits than those normally selected for thick-walled steel or cast iron housings or for solid shafts should be used (see also "Fits for hollow shafts", page 254).

For stainless steel shafts, reduced shaft interference or increased bearing internal clearance should be considered because of the high coefficient of expansion of stainless steel.

7 Ease of mounting and dismounting

Bearings with clearance fits are usually easier to mount or dismount than those with interference fits. Where operating conditions necessitate interference fits and it is essential that mounting and dismounting can be done easily, separable bearings, or bearings with tapered bore and adapter or withdrawal sleeve may be used.

8 Displacement of non-locating bearing

If non-separable bearings are used as non-locating bearings it is imperative that one of the bearing rings is free to move axially at all times during operation. This is ensured by adopting a clearance fit for that ring which carries a stationary load. When the outer ring is under stationary load so that axial displacement has to take place in the housing bore, a hardened intermediate bushing is often fitted to the outer ring, for example, where light alloy housings are employed. In this way a "hammering out" of the housing seating because of the lower material hardness is avoided; it would otherwise result in the axial displacement being restricted or even impossible after a time. If cylindrical or needle roller bearings having one ring without flanges are used, both bearing rings may be mounted with an interference fit because axial displacement will take place within the bearing.

Shaft and housing fits

Recommended fits

The general recommendation for shaft and housing diameters and resulting fits are shown in the tables on pages 256-259 for ABEC-1 tolerance grade and either rotating or stationary shaft or housing. They apply to single-row, double-row and duplex bearings mounted on steel shafts and in steel or cast iron housings. For special bearing applications and arrangements, other fits may be required as shown in the tables on pages 261-268.

Duplex bearings

MRC 7000PJ series, 40° contact angle, bearings are supplied in several different clearance/preload classes. These bearings are identified with additional suffix letters of either DE, DU, or DS for endplay, free-running no endplay, or preload respectively. The PJDE suffix would indicate a bearing specifically designed for paired mounting and axial endplay or looseness. The “DE” clearance class, without any additional suffix code letters is equivalent to a “CB” clearance range (see table below). However, the “DE” clearance class can also specify other clearance ranges if an additional 4-digit suffix code follows the “DE”. The other ranges include the “CA”, “CC”, and “CX” ranges which will be marked on the bearing box.

Duplex bearings may also be supplied without axial clearance and without preload. This range would be considered “free-running” or “no endplay” and is designated by the suffix letters “DU”. Ex. 7200PJDU.

Bearings with preload are identified with the suffix letters “DS” on the bearing itself and the bearing box would have an additional marking of either “DL”, “DM”, “DH”, or “DX” and a 4-digit MRC specification code, signifying light, medium, heavy, or special preload respectively.

The normal shaft and housing tolerances for duplexed bearings with endplay (DE) are “k5” and “H6” respectively. For the “DU” and “DS” variants, the recommended shaft and housing tolerances are “h5” and “H6” respectively. The reduced shaft interference resulting from the ISO “h5” fit minimizes the loss of internal clearance caused by expansion of the inner ring. Loss of internal clearance changes the bearing preload that can lead to excessive heating and premature failure. See pages 262 and 266 for specific tolerance dimensions. These recommendations are valid for solid steel shafts and cast iron or steel housings. If different shaft materials are being used, MRC Application Engineering should be contacted in order to select more appropriate fit tolerances.

Bore diameter (mm)		“CB” endplay per set			
		Minimum		Maximum	
Over	Incl	.001 mm	.0001 inch	.001 mm	.0001 inch
–	10	14	6	22	9
10	18	15	6	23	9
18	30	18	7	26	10
30	50	22	9	30	12
50	80	26	10	38	15
80	120	32	13	44	17
120	180	35	14	47	19
180	250	45	18	61	24
250	315	52	21	68	27

Tapered bore bearings

Bearings with tapered bores are mounted either on tapered shafts or on slotted sleeves having an external taper and mounted on cylindrical shafts. In these cases, the fit of the inner ring is not determined by the selected shaft tolerance but by the distance through which the ring is driven up on the tapered shaft or sleeve. Special precautions with respect to reduction in internal clearance must be observed. For the recommended mounting procedure refer to pages 86 and 87 in the self-aligning ball bearing section.

Fits for hollow shafts

If bearings are to be mounted with an interference fit on a hollow shaft, it is generally necessary to use a heavier interference fit than that used for a solid shaft in order to achieve the same surface pressure between the inner ring and shaft seating. The following diameter ratios are important when deciding on the fit to be used:

$$c_i = \frac{d_i}{d} \quad \text{and} \quad c_e = \frac{d}{d_e}$$

where

c_i = diameter ratio of hollow shaft
c_e = diameter ratio of inner ring
d = outside diameter of hollow shaft (= bore diameter of bearing)
d_i = internal diameter of hollow shaft
d_e = mean outside diameter of inner ring

The fit is not appreciably affected until the diameter ratio of the hollow shaft $c_i \geq 0.5$.
If the outside diameter of the inner ring is not known, the diameter ratio c_e can be calculated with sufficient accuracy from the equation.

$$c_e = \frac{d}{K\,(D-d) + d}$$

where

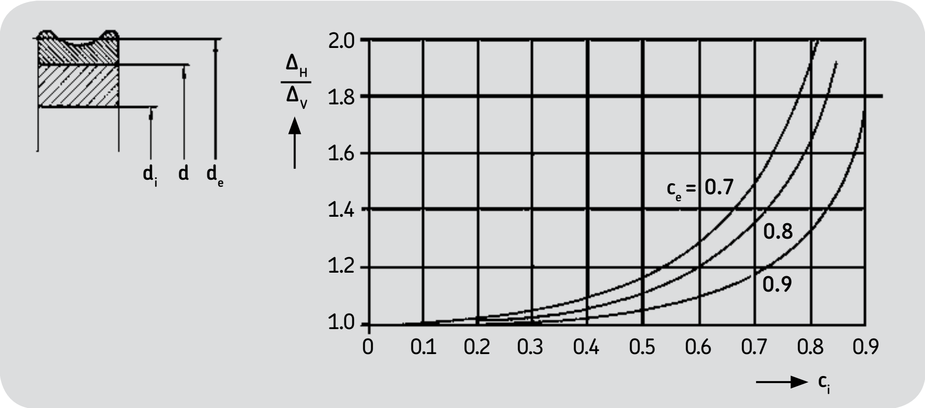
d = bore diameter of bearing
D = outside diameter of bearing
k = a factor for the bearing type
k = 0.25 for self-aligning ball bearings series 22 and 23 and for cylindrical roller bearings
k = 0.3 for all other bearings

To determine the requisite interference fit for a bearing to be mounted on a hollow shaft, use is made of the mean probable interference between shaft diameter and bearing bore obtained for the tolerance recommended for a solid shaft of the same diameter. If the plastic deformation (smoothing) of the mating surfaces produced during mounting is neglected, then the effective interference can be equated to the mean probable interference.

Shaft and housing fits

The interference Δ_H needed for a hollow shaft of steel can then be determined in relation to the known interference Δ_V for the solid shaft from the diagram below. Δ_V equals the mean value of the smallest and largest values of the probable interference given in the tables.

The tolerance for the hollow shaft is then selected so that the mean probable interference is as close as possible to the interference Δ_H obtained from the diagram below.



Example:
A 208S deep groove ball bearing is to be mounted on a hollow shaft having a diameter ratio of C_i = 0.8. The recommended mean probable interference for a solid steel shaft is 0.00055 determined from the tables for an ABEC-1 grade bearing with a 40 mm bore diameter.

For $C_i = 0.8$ and $C_e = \dfrac{40}{0.3\,(80 - 40) + 40} = 0.77$,

The ratio Δ_H/Δ_V =1.7 from the diagram.
Thus the required interference for the hollow shaft is Δ_H =1.7 × .00055 = .0009.

Shaft and housing surface finish

For ABEC-1 bearings, finishes should not exceed 32 AA for shafts up to 2 inches in diameter and 63 AA maximum over 2 inches. Housing bores should not exceed 125 AA.

Shaft limits - ABEC-1

General recommended shaft limits for metric bearings—ISO k5 and g6

mm	Bearing bore diameter				Shaft rotating						Shaft stationary					
	Max		Min		Shaft diameter (k5)				Fit		Shaft diameter (g6)				Fit	
					Max		Min		.001	.0001	Max		Min		.001	.0001
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
4	4	**0.1575**	3.992	**0.1572**	4.006	**0.1577**	4.001	**0.1575**			3.996	**0.1573**	3.988	**0.1570**		
5	5	**0.1969**	4.992	**0.1966**	5.006	**0.1971**	5.001	**0.1969**	1T	**0**	4.996	**0.1967**	4.988	**0.1964**	12L	**5L**
6	6	**0.2362**	5.992	**0.2359**	6.006	**0.2364**	6.001	**0.2362**	14T	**5T**	5.996	**0.2360**	5.988	**0.2357**	4T	**1T**
7	7	**0.2756**	6.992	**0.2753**	7.007	**0.2759**	7.001	**0.2756**			6.995	**0.2754**	6.986	**0.2750**		
8	8	**0.3150**	7.992	**0.3147**	8.007	**0.3153**	8.001	**0.3150**	1T	**0**	7.995	**0.3148**	7.986	**0.3144**	14L	**6L**
9	9	**0.3543**	8.992	**0.3540**	9.007	**0.3546**	9.001	**0.3543**	15T	**6T**	8.995	**0.3541**	8.986	**0.3537**	3T	**1T**
10	10	**0.3937**	9.992	**0.3934**	10.007	**0.3940**	10.001	**0.3937**			9.995	**0.3935**	9.986	**0.3931**		
12	12	**0.4724**	11.992	**0.4721**	12.009	**0.4728**	12.001	**0.4724**			11.994	**0.4722**	11.983	**0.4717**		
15	15	**0.5906**	14.992	**0.5903**	15.009	**0.5910**	15.001	**0.5906**	1T	**0**	14.994	**0.5904**	14.983	**0.5899**	17L	**7L**
17	17	**0.6693**	16.992	**0.6690**	17.009	**0.6697**	17.001	**0.6693**	17T	**7T**	16.994	**0.6691**	16.983	**0.6686**	2T	**1T**
20	20	**0.7874**	19.990	**0.7870**	20.011	**0.7878**	20.002	**0.7875**			19.993	**0.7871**	19.980	**0.7866**		
25	25	**0.9843**	24.990	**0.9839**	25.011	**0.9847**	25.002	**0.9844**	2T	**1T**	24.993	**0.9840**	24.980	**0.9835**	20L	**8L**
30	30	**1.1811**	29.990	**1.1807**	30.011	**1.1815**	30.002	**1.1812**	21T	**8T**	29.993	**1.1808**	29.980	**1.1803**	3T	**1T**
35	35	**1.3780**	34.987	**1.3775**	35.013	**1.3785**	35.002	**1.3781**			34.991	**1.3776**	34.975	**1.3770**		
40	40	**1.5748**	39.987	**1.5743**	40.013	**1.5753**	40.002	**1.5749**	2T	**1T**	39.991	**1.5744**	39.975	**1.5738**	25L	**10L**
45	45	**1.7717**	44.987	**1.7712**	45.013	**1.7722**	45.002	**1.7718**	26T	**10T**	44.991	**1.7713**	44.975	**1.7707**	4T	**1T**
50	50	**1.9685**	49.987	**1.9680**	50.013	**1.9690**	50.002	**1.9686**			49.991	**1.9681**	49.975	**1.9675**		
55	55	**2.1654**	54.985	**2.1648**	55.015	**2.1660**	55.002	**2.1655**			54.990	**2.1650**	54.971	**2.1643**		
60	60	**2.3622**	59.985	**2.3616**	60.015	**2.3628**	60.002	**2.3623**			59.990	**2.3618**	59.971	**2.3611**		
65	65	**2.5591**	64.985	**2.5585**	65.015	**2.5597**	65.002	**2.5592**	2T	**1T**	64.990	**2.5587**	64.971	**2.5580**	29L	**11L**
70	70	**2.7559**	69.985	**2.7553**	70.015	**2.7565**	70.002	**2.7560**	30T	**12T**	69.990	**2.7555**	69.971	**2.7548**	5T	**2T**
75	75	**2.9528**	74.985	**2.9522**	75.015	**2.9534**	75.002	**2.9529**			74.990	**2.9524**	74.971	**2.9517**		
80	80	**3.1496**	79.985	**3.1490**	80.015	**3.1502**	80.002	**3.1497**			79.990	**3.1492**	79.971	**3.1485**		
85	85	**3.3465**	84.980	**3.3457**	85.018	**3.3472**	85.003	**3.3466**			84.988	**3.3460**	84.966	**3.3452**		
90	90	**3.5433**	89.980	**3.5425**	90.018	**3.5440**	90.003	**3.5434**			89.988	**3.5428**	89.966	**3.5420**		
95	95	**3.7402**	94.980	**3.7394**	95.018	**3.7409**	95.003	**3.7403**	3T	**1T**	94.988	**3.7397**	94.966	**3.7389**	34L	**13L**
100	100	**3.9370**	99.980	**3.9362**	100.018	**3.9377**	100.003	**3.9371**	38T	**15T**	99.988	**3.9365**	99.966	**3.9357**	8T	**3T**
105	105	**4.1339**	104.980	**4.1331**	105.018	**4.1346**	105.003	**4.1340**			104.988	**4.1334**	104.966	**4.1326**		
110	110	**4.3307**	109.980	**4.3299**	110.018	**4.3314**	110.003	**4.3308**			109.988	**4.3302**	109.966	**4.3294**		
115	115	**4.5276**	114.980	**4.5268**	115.018	**4.5283**	115.003	**4.5277**			114.988	**4.5271**	114.966	**4.5263**		
120	120	**4.7244**	119.980	**4.7236**	120.018	**4.7251**	120.003	**4.7245**			119.988	**4.7239**	119.966	**4.7231**		
125	125	**4.9213**	124.975	**4.9203**	125.021	**4.9221**	125.003	**4.9214**			124.986	**4.9207**	124.961	**4.9198**		
130	130	**5.1181**	129.975	**5.1171**	130.021	**5.1189**	130.003	**5.1182**			129.986	**5.1175**	129.961	**5.1166**		
140	140	**5.5118**	139.975	**5.5108**	140.021	**5.5126**	140.003	**5.5119**	3T	**1T**	139.986	**5.5112**	139.961	**5.5103**	39L	**15L**
150	150	**5.9055**	149.975	**5.9045**	150.021	**5.9063**	150.003	**5.9056**	46T	**18T**	149.986	**5.9049**	149.961	**5.9040**	11T	**4T**
160	160	**6.2992**	159.975	**6.2982**	160.021	**6.3000**	160.003	**6.2993**			159.986	**6.2986**	159.961	**6.2977**		
170	170	**6.6929**	169.975	**6.6919**	170.021	**6.6937**	170.003	**6.6930**			169.986	**6.6923**	169.961	**6.6914**		
180	180	**7.0866**	179.975	**7.0856**	180.021	**7.0874**	180.003	**7.0867**			179.986	**7.0860**	179.961	**7.0851**		
190	190	**7.4803**	189.970	**7.4791**	190.024	**7.4812**	190.004	**7.4805**			189.985	**7.4797**	189.956	**7.4786**		
200	200	**7.8740**	199.970	**7.8728**	200.024	**7.8749**	200.004	**7.8742**			199.985	**7.8734**	199.956	**7.8723**		
210	210	**8.2677**	209.970	**8.2665**	210.024	**8.2626**	210.004	**8.2679**	4T	**2T**	209.985	**8.2671**	209.956	**8.2660**	44L	**17L**
220	220	**8.6614**	219.970	**8.6602**	220.024	**8.6623**	220.004	**8.6616**	54T	**21T**	219.985	**8.6608**	219.956	**8.6597**	15T	**6T**
230	230	**9.0551**	229.970	**9.0539**	230.024	**9.0560**	230.004	**9.0553**			229.985	**9.0545**	229.956	**9.0534**		
240	240	**9.4488**	239.970	**9.4476**	240.024	**9.4497**	240.004	**9.4490**			239.985	**9.4482**	239.956	**9.4471**		
250	250	**9.8425**	249.970	**9.8413**	250.024	**9.8434**	250.004	**9.8427**			249.985	**9.8419**	249.956	**9.8408**		
260	260	**10.2362**	259.965	**10.2348**	260.027	**10.2373**	260.004	**10.2364**	4T	**2T**	259.983	**10.2355**	259.951	**10.2343**	49L	**19L**
280	280	**11.0236**	279.965	**11.0222**	280.027	**11.0247**	280.004	**11.0238**	62T	**25T**	279.983	**11.0229**	279.951	**11.0217**	18T	**7T**
300	300	**11.8110**	299.965	**11.8096**	300.027	**11.8121**	300.004	**11.8112**			299.983	**11.8103**	299.951	**11.8091**		
320	320	**12.5984**	319.960	**12.5968**	320.029	**12.5995**	320.004	**12.5986**	4T	**2T**	319.982	**12.5977**	319.946	**12.5963**	54L	**21L**
									69T	**27T**					22T	**9T**

Shaft limits - ABEC-1

General recommended shaft limits for inch-size bearings—ISO k5 and g6

mm	Bearing bore diameter Max		Min		Shaft rotating Shaft diameter (k5) Max		Min		Fit .001	.0001	Shaft stationary Shaft diameter (g6) Max		Min		Fit .001	.0001
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
R2	3.175	**0.1250**	3.167	**0.1247**	3.181	**0.1252**	3.175	**0.1250**	0	**0**	3.171	**0.1248**	3.163	**0.1245**	12L	**5L**
R2A	3.175	**0.1250**	3.167	**0.1247**	3.181	**0.1252**	3.175	**0.1250**	14T	**5T**	3.171	**0.1248**	3.163	**0.1245**	4T	**1T**
R3	4.763	**0.1875**	4.755	**0.1872**	4.769	**0.1877**	4.763	**0.1875**			4.759	**0.1873**	4.751	**0.1870**		
R4	6.350	**0.2500**	6.342	**0.2497**	6.357	**0.2503**	6.350	**0.2500**	0	**0**	6.345	**0.2498**	6.336	**0.2494**	14L	**6L**
R4A	6.350	**0.2500**	6.342	**0.2497**	6.357	**0.2503**	6.350	**0.2500**	15T	**6T**	6.345	**0.2498**	6.336	**0.2494**	3T	**1T**
R6	9.525	**0.3750**	9.517	**0.3747**	9.532	**0.3753**	9.525	**0.3750**			9.520	**0.3748**	9.511	**0.3744**		
R8	12.700	**0.5000**	12.692	**0.4997**	12.709	**0.5004**	12.700	**0.5000**	0	**0**	12.694	**0.4998**	12.683	**0.4993**	17L	**7L**
R10	15.875	**0.6250**	15.867	**0.6247**	15.884	**0.6254**	15.875	**0.6250**	17T	**7T**	15.869	**0.6248**	15.858	**0.6243**	2T	**1T**
R12	19.050	**0.7500**	19.040	**0.7496**	19.061	**0.7504**	19.052	**0.7501**			19.043	**0.7497**	19.030	**0.7492**		
R14	22.225	**0.8750**	22.215	**0.8746**	22.236	**0.8754**	22.227	**0.8751**	2T	**1T**	22.218	**0.8747**	22.205	**0.8742**	20L	**8L**
R16	25.400	**1.0000**	25.390	**0.9996**	25.411	**1.0004**	25.402	**1.0001**	21T	**8T**	25.393	**0.9997**	25.380	**0.9992**	3T	**1T**
R18	28.575	**1.1250**	28.565	**1.1246**	28.586	**1.1254**	28.577	**1.1251**			28.568	**1.1247**	28.555	**1.1242**		
R20	31.750	**1.2500**	31.737	**1.2495**	31.763	**1.2505**	31.752	**1.2501**			31.741	**1.2496**	31.725	**1.2490**		
R24	38.100	**1.5000**	38.087	**1.4995**	38.113	**1.5005**	38.102	**1.5001**			38.091	**1.4996**	38.075	**1.4990**		
XLS1 3/8	34.925	**1.3750**	34.912	**1.3745**	34.938	**1.3755**	34.927	**1.3751**	2T	**1T**	34.916	**1.3746**	34.900	**1.3740**	25L	**10L**
XLS1 1/2	38.100	**1.5000**	38.087	**1.4995**	38.113	**1.5005**	38.102	**1.5001**	26T	**10T**	38.091	**1.4996**	38.075	**1.4990**	4T	**1T**
XLS1 5/8	41.275	**1.6250**	41.262	**1.6245**	41.288	**1.6255**	41.277	**1.6251**			41.266	**1.6246**	41.250	**1.6240**		
XLS1 3/4	44.450	**1.7500**	44.437	**1.7495**	44.463	**1.7505**	44.452	**1.7501**			44.441	**1.7496**	44.425	**1.7490**		
XLS1 7/8	47.625	**1.8750**	47.612	**1.8745**	47.638	**1.8755**	47.627	**1.8751**			47.616	**1.8746**	47.600	**1.8740**		
XLS2	50.800	**2.0000**	50.785	**1.9994**	50.815	**2.0006**	50.802	**2.0001**			50.790	**1.9996**	50.771	**1.9989**		
XLS2 1/8	53.975	**2.1250**	53.960	**2.1244**	53.990	**2.1256**	53.977	**2.1251**			53.965	**2.1246**	53.946	**2.1239**		
XLS2 1/4	57.150	**2.2500**	57.135	**2.2494**	57.165	**2.2506**	57.152	**2.2501**	2T	**1T**	57.140	**2.2496**	57.121	**2.2489**	29L	**11L**
XLS2 1/2	63.500	**2.5000**	63.485	**2.4994**	63.515	**2.5006**	63.502	**2.5001**	30T	**12T**	63.490	**2.4996**	63.471	**2.4989**	5T	**2T**
XLS2 5/8	66.675	**2.6250**	66.660	**2.6244**	66.690	**2.6256**	66.677	**2.6251**			66.665	**2.6246**	66.646	**2.6239**		
XLS2 3/4	69.850	**2.7500**	69.835	**2.7494**	69.865	**2.7506**	69.852	**2.7501**			69.840	**2.7496**	69.821	**2.7489**		
XLS3	76.200	**3.0000**	76.185	**2.9994**	76.215	**3.0006**	76.202	**3.0001**			76.190	**2.9996**	76.171	**2.9989**		
XLS3 1/4	82.550	**3.2500**	82.530	**3.2492**	82.568	**3.2507**	82.553	**3.2501**			82.538	**3.2495**	82.516	**3.2487**		
XLS3 1/2	88.900	**3.5000**	88.880	**3.4992**	88.918	**3.5007**	88.903	**3.5001**	3T	**1T**	88.888	**3.4995**	88.866	**3.4987**	34L	**13L**
XLS3 3/4	95.250	**3.7500**	95.230	**3.7492**	95.268	**3.7507**	95.253	**3.7501**	38T	**15T**	95.238	**3.7495**	95.216	**3.7487**	8T	**3T**
XLS4 1/4	107.950	**4.2500**	107.935	**4.2492**	107.973	**4.2507**	107.953	**4.2501**			107.943	**4.2495**	107.916	**4.2487**		
XLS4 1/2	114.300	**4.5000**	114.285	**4.4992**	114.323	**4.5007**	114.303	**4.5001**			114.293	**4.4995**	114.266	**4.4987**		
XLS4 3/4	120.650	**4.7500**	120.625	**4.7490**	120.671	**4.7508**	120.653	**4.7501**			120.636	**4.7494**	120.611	**4.7485**		
XLS5	127.000	**5.0000**	126.975	**4.9990**	127.021	**5.0008**	127.003	**5.0001**			126.986	**4.9994**	126.961	**4.9985**		
XLS5 1/2	139.700	**5.5000**	139.675	**5.4990**	139.721	**5.5008**	139.703	**5.5001**	3T	**1T**	139.686	**5.4994**	139.661	**5.4985**	39L	**15L**
XLS6	152.400	**6.0000**	152.375	**5.9990**	152.421	**6.0008**	152.403	**6.0001**	46T	**18T**	152.386	**5.9994**	152.361	**5.9985**	11T	**4T**
XLS6 1/4	158.750	**6.2500**	158.735	**6.2490**	158.781	**6.2508**	158.753	**6.2501**			158.746	**6.2494**	158.711	**6.2485**		
XLS6 1/2	165.100	**6.5000**	165.075	**6.4990**	165.121	**6.5008**	165.103	**6.5001**			165.086	**6.4994**	165.061	**6.4985**		
XLS7	177.800	**7.0000**	177.775	**6.9990**	177.821	**7.0008**	177.803	**7.0001**			177.786	**6.9994**	177.761	**6.9985**		
XLS7 1/4	184.150	**7.2500**	184.120	**7.2488**	184.174	**7.2509**	184.154	**7.2502**			184.135	**7.2494**	184.106	**7.2483**		
XLS7 3/4	196.850	**7.7500**	196.820	**7.7488**	196.874	**7.7509**	196.854	**7.7502**			196.835	**7.7494**	196.806	**7.7483**	44L	**17L**
XLS8	203.200	**8.0000**	203.170	**7.9988**	203.224	**8.0009**	203.204	**8.0002**	4T	**2T**	203.185	**7.9994**	203.156	**7.9983**	15T	**6T**
XLS8 1/4	209.950	**8.2500**	209.520	**8.2488**	209.574	**8.2509**	209.554	**8.2502**	54T	**21T**	209.535	**8.2494**	209.506	**8.2483**		
XLS8 1/2	215.900	**8.5000**	215.870	**8.4988**	215.924	**8.5009**	215.904	**8.5002**			215.885	**8.4994**	215.856	**8.4983**		
XLS9	228.600	**9.0000**	228.570	**8.9988**	228.624	**9.0009**	228.604	**9.0002**			228.585	**8.9994**	228.556	**8.9983**		
XLS10	254.000	**10.0000**	253.965	**9.9986**	254.027	**10.0011**	254.004	**10.0002**	4T	**2T**	253.983	**9.9993**	253.951	**9.9981**	49L	**19L**
									62T	**25T**					18T	**7T**

Housing bore limits - ABEC-1

General recommended housing bore limits for metric bearings—ISO H6 and N6

mm	Bearing outside diameter Max mm	Max in.	Min mm	Min in.	Housing stationary – Housing bore (H6) Max mm	Max in.	Min mm	Min in.	Fit .001 mm	Fit .0001 in.	Housing rotating – Housing bore (N6) Max mm	Max in.	Min mm	Min in.	Fit .001 mm	Fit .0001 in.
16	16	**0.6299**	15.992	**0.6296**	16.011	**0.6303**	16	**0.6299**	19L 0	**7L 0**	15.993	**0.6295**	15.980	**0.6291**	2T 20T	**1T 8T**
19	19	**0.7480**	18.991	**0.7476**	19.013	**0.7485**	19	**0.7480**			18.989	**0.7476**	18.976	**0.7471**		
21	21	**0.8268**	20.991	**0.8264**	21.013	**0.8273**	21	**0.8268**			20.989	**0.8264**	20.976	**0.8259**		
22	22	**0.8661**	21.991	**0.8657**	22.013	**0.8666**	22	**0.8661**			21.989	**0.8657**	21.976	**0.8652**		
24	24	**0.9449**	23.991	**0.9445**	24.013	**0.9454**	24	**0.9449**	22L 0	**9L 0**	23.989	**0.9445**	23.976	**0.9440**	2T 24T	**0 9T**
26	26	**1.0236**	25.991	**1.0232**	26.013	**1.0241**	26	**1.0236**			25.989	**1.0232**	25.976	**1.0227**		
28	28	**1.1024**	27.991	**1.1020**	28.013	**1.1029**	28	**1.1024**			27.989	**1.1020**	27.976	**1.1015**		
30	30	**1.1811**	29.991	**1.1807**	30.013	**1.1816**	30	**1.1811**			29.989	**1.1807**	29.976	**1.1802**		
32	32	**1.2598**	31.989	**1.2593**	32.016	**1.2604**	32	**1.2598**			31.988	**1.2593**	31.972	**1.2587**		
35	35	**1.3780**	34.989	**1.3775**	35.016	**1.3786**	35	**1.3780**			34.988	**1.3775**	34.972	**1.3769**		
37	37	**1.4567**	36.989	**1.4562**	37.016	**1.4573**	37	**1.4567**	27L 0	**11L 0**	36.988	**1.4562**	36.972	**1.4556**	1T 28T	**0 11T**
40	40	**1.5748**	39.989	**1.5743**	40.016	**1.5754**	40	**1.5748**			39.988	**1.5743**	39.972	**1.5737**		
42	42	**1.6535**	41.989	**1.6530**	42.016	**1.6541**	42	**1.6535**			41.988	**1.6530**	41.972	**1.6524**		
47	47	**1.8504**	46.989	**1.8499**	47.016	**1.8510**	47	**1.8504**			46.988	**1.8499**	46.972	**1.8493**		
52	52	**2.0472**	51.987	**2.0467**	52.019	**2.0479**	52	**2.0472**			51.986	**2.0466**	51.967	**2.0459**		
55	55	**2.1654**	54.987	**2.1649**	55.019	**2.1661**	55	**2.1654**			54.986	**2.1648**	54.967	**2.1641**		
58	58	**2.2835**	57.987	**2.2830**	58.019	**2.2842**	58	**2.2835**			57.986	**2.2829**	57.967	**2.2822**		
62	62	**2.4409**	61.987	**2.4404**	62.019	**2.4416**	62	**2.4409**			61.986	**2.4403**	61.967	**2.4396**		
65	65	**2.5591**	64.987	**2.5586**	65.019	**2.5598**	65	**2.5591**	32L 0	**12L 0**	64.986	**2.5585**	64.967	**2.5578**	1T 33T	**1T 13T**
68	68	**2.6772**	67.987	**2.6767**	68.019	**2.6779**	68	**2.6772**			67.986	**2.6766**	67.967	**2.6759**		
70	70	**2.7559**	69.987	**2.7554**	70.019	**2.7566**	70	**2.7559**			69.986	**2.7553**	69.967	**2.7546**		
72	72	**2.8346**	71.987	**2.8341**	72.019	**2.8353**	72	**2.8346**			71.986	**2.8340**	71.967	**2.8333**		
75	75	**2.9528**	74.987	**2.9523**	75.019	**2.9535**	75	**2.9528**			74.986	**2.9522**	74.967	**2.9515**		
78	78	**3.0709**	77.987	**3.0704**	78.019	**3.0716**	78	**3.0709**			77.986	**3.0703**	77.967	**3.0696**		
80	80	**3.1496**	79.987	**3.1491**	80.019	**3.1503**	80	**3.1496**			79.986	**3.1490**	79.967	**3.1483**		
85	85	**3.3465**	84.985	**3.3459**	85.022	**3.3474**	85	**3.3465**			84.984	**3.3459**	84.962	**3.3450**		
90	90	**3.5433**	89.985	**3.5427**	90.022	**3.5442**	90	**3.5433**			89.984	**3.5427**	89.962	**3.5418**		
95	95	**3.7402**	94.985	**3.7396**	95.022	**3.7411**	95	**3.7402**			94.984	**3.7396**	94.962	**3.7387**		
100	100	**3.9370**	99.985	**3.9364**	100.022	**3.9379**	100	**3.9370**	37L 0	**15L 0**	99.984	**3.9364**	99.962	**3.9355**	1T 38T	**0 15T**
105	105	**4.1339**	104.985	**4.1333**	105.022	**4.1348**	105	**4.1339**			104.984	**4.1333**	104.962	**4.1324**		
110	110	**4.3307**	109.985	**4.3301**	110.022	**4.3316**	110	**4.3307**			109.984	**4.3301**	109.962	**4.3292**		
115	115	**4.5276**	114.985	**4.5270**	115.022	**4.5285**	115	**4.5276**			114.984	**4.5270**	114.962	**4.5261**		
120	120	**4.7244**	119.985	**4.7238**	120.022	**4.7253**	120	**4.7244**			119.984	**4.7238**	119.962	**4.7229**		
125	125	**4.9213**	124.982	**4.9206**	125.025	**4.9223**	125	**4.9213**			124.980	**4.9205**	124.955	**4.9195**		
130	130	**5.1181**	129.982	**5.1174**	130.025	**5.1191**	130	**5.1181**			129.980	**5.1173**	129.955	**5.1163**		
135	135	**5.3150**	134.982	**5.3143**	135.025	**5.3160**	135	**5.3150**			134.980	**5.3142**	134.955	**5.3132**		
140	140	**5.5118**	139.982	**5.5111**	140.025	**5.5128**	140	**5.5118**	43L 0	**17L 0**	139.980	**5.5110**	139.955	**5.5100**	2T 45T	**1T 18T**
145	145	**5.7087**	144.982	**5.7080**	145.025	**5.7097**	145	**5.7087**			144.980	**5.7079**	144.955	**5.7069**		
150	150	**5.9055**	149.982	**5.9048**	150.025	**5.9065**	150	**5.9055**			149.980	**5.9047**	149.955	**5.9037**		
160	160	**6.2992**	159.975	**6.2982**	160.025	**6.3002**	160	**6.2992**			159.980	**6.2984**	159.955	**6.2973**		
165	165	**6.4961**	164.975	**6.4951**	165.025	**6.4971**	165	**6.4961**	50L 0	**20L 0**	164.980	**6.4953**	164.955	**6.4942**	5L 45T	**2L 19T**
170	170	**6.6929**	169.975	**6.6919**	170.025	**6.6939**	170	**6.6929**			169.980	**6.6921**	169.955	**6.6910**		
175	175	**6.8898**	174.975	**6.8888**	175.025	**6.8908**	175	**6.8898**			174.980	**6.8890**	174.955	**6.8879**		
180	180	**7.0866**	179.975	**7.0856**	180.025	**7.0876**	180	**7.0866**			179.980	**7.0858**	179.955	**7.0847**		
190	190	**7.4803**	189.970	**7.4791**	190.029	**7.4814**	190	**7.4803**			189.978	**7.4794**	189.949	**7.4783**		
200	200	**7.8740**	199.970	**7.8728**	200.029	**7.8751**	200	**7.8740**			199.978	**7.8731**	199.949	**7.8720**		
205	205	**8.0709**	204.970	**8.0697**	205.029	**8.0720**	205	**8.0709**			204.978	**8.0700**	204.949	**8.0689**		
210	210	**8.2677**	209.970	**8.2665**	210.029	**8.2688**	210	**8.2677**			209.978	**8.2668**	209.949	**8.2657**		
215	215	**8.4646**	214.970	**8.4634**	215.029	**8.4657**	215	**8.4646**	59L 0	**23L 0**	214.978	**8.4637**	214.949	**8.4626**	8L 51T	**3L 20T**
220	220	**8.6614**	219.970	**8.6602**	220.029	**8.6625**	220	**8.6614**			219.978	**8.6605**	219.949	**8.6594**		
225	225	**8.8583**	224.970	**8.8571**	225.029	**8.8594**	225	**8.8583**			224.978	**8.8574**	224.949	**8.8563**		
230	230	**9.0551**	229.970	**9.0539**	230.029	**9.0562**	230	**9.0551**			229.978	**9.0542**	229.949	**9.0531**		
235	235	**9.2520**	234.970	**9.2508**	235.029	**9.2531**	235	**9.2520**			234.978	**9.2511**	234.949	**9.2500**		
240	240	**9.4488**	239.970	**9.4476**	240.029	**9.4499**	240	**9.4488**			239.978	**9.4479**	239.949	**9.4468**		
250	250	**9.8425**	249.970	**9.8413**	250.029	**9.8436**	250	**9.8425**			249.978	**9.8416**	249.949	**9.8405**		
260	260	**10.2362**	259.965	**10.2348**	260.032	**10.2375**	260	**10.2362**			259.975	**10.2352**	259.943	**10.2340**		
265	265	**10.4331**	264.965	**10.4317**	265.032	**10.4344**	265	**10.4331**			264.975	**10.4321**	264.943	**10.4309**		
270	270	**10.6299**	269.965	**10.6285**	270.032	**10.6312**	270	**10.6299**			269.975	**10.6289**	269.943	**10.6277**		
280	280	**11.0236**	279.965	**11.0222**	280.032	**11.0249**	280	**11.0236**	67L 0	**27L 0**	279.975	**11.0226**	279.943	**11.0214**	10L 57T	**4L 22T**
290	290	**11.4173**	289.905	**11.4159**	290.032	**11.4186**	290	**11.4173**			289.975	**11.4163**	289.943	**11.4151**		
300	300	**11.8110**	299.965	**11.8096**	300.032	**11.8123**	300	**11.8110**			299.975	**11.8100**	299.943	**11.8088**		
310	310	**12.2047**	309.965	**12.2033**	310.032	**12.2060**	310	**12.2047**			309.975	**12.2037**	309.943	**12.2025**		
320	320	**12.5984**	319.960	**12.5968**	320.036	**12.5998**	320	**12.5984**			319.974	**12.5974**	319.939	**12.5960**		
340	340	**13.3858**	339.960	**13.3842**	340.036	**13.3872**	340	**13.3858**			339.974	**13.3848**	339.939	**13.3834**		
350	350	**13.7795**	349.960	**13.7779**	350.036	**13.7809**	350	**13.7795**			349.974	**13.7785**	349.939	**13.7771**		
360	360	**14.1732**	359.960	**14.1716**	360.036	**14.1746**	360	**14.1732**	76L 0	**30L 0**	359.974	**14.1722**	359.939	**14.1708**	14L 61T	**6L 24T**
370	370	**14.5669**	369.960	**14.5653**	370.036	**14.5683**	370	**14.5669**			369.974	**14.5659**	369.939	**14.5645**		
380	380	**14.9606**	379.960	**14.9590**	380.036	**14.9620**	380	**14.9606**			379.974	**14.9596**	379.939	**14.9582**		
390	390	**15.3543**	389.960	**15.3527**	390.036	**15.3557**	390	**15.3543**			389.974	**15.3533**	389.939	**15.3519**		
400	400	**15.7480**	399.960	**15.7464**	400.036	**15.7494**	400	**15.7480**			399.974	**15.7470**	399.939	**15.7456**		
410	410	**16.1417**	409.955	**16.1399**	410.040	**16.1433**	410	**16.1417**			409.973	**16.1406**	409.933	**16.1391**		
420	420	**16.5354**	419.955	**16.5336**	420.040	**16.5370**	420	**16.5354**			419.973	**16.5343**	419.933	**16.5328**		
430	430	**16.9291**	429.955	**16.9273**	430.040	**16.9307**	430	**16.9291**			429.973	**16.9280**	429.933	**16.9265**		
440	440	**17.3228**	439.955	**17.3210**	440.040	**17.3244**	440	**17.3228**	85L 0	**34L 0**	439.973	**17.3217**	439.933	**17.3202**	18L 67T	**7L 26T**
460	460	**18.1102**	459.955	**18.1084**	460.040	**18.1118**	460	**18.1102**			459.973	**18.1091**	459.933	**18.1076**		
480	480	**18.8976**	479.955	**18.8958**	480.040	**18.8992**	480	**18.8976**			479.973	**18.8965**	479.933	**18.8950**		
500	500	**19.6850**	499.955	**19.6832**	500.040	**19.6866**	500	**19.6850**			499.973	**19.6839**	499.933	**19.6824**		
520	520	**20.4724**	519.950	**20.4704**	520.044	**20.4741**	520	**20.4724**			519.956	**20.4707**	519.911	**20.4689**		
540	540	**21.2598**	539.950	**21.2578**	540.044	**21.2615**	540	**21.2598**			539.956	**21.2581**	539.911	**21.2563**		
560	560	**22.0472**	559.950	**22.0452**	560.044	**22.0489**	560	**22.0472**	94L 0	**37L 0**	559.956	**22.0455**	559.911	**22.0437**	6L 89T	**3L 35T**
580	580	**22.8346**	579.950	**22.8326**	580.044	**22.8363**	580	**22.8346**			579.956	**22.8329**	579.911	**22.8311**		
600	600	**23.6220**	599.950	**23.6200**	600.044	**23.6237**	600	**23.6220**			599.956	**23.6203**	599.911	**23.6185**		
620	620	**24.4094**	619.950	**24.4074**	620.044	**24.4111**	620	**24.4094**			619.956	**24.4077**	619.911	**24.4059**		

For aluminum or other soft metal housings, make bore limits same as bearing O.D. limits.

Housing bore limits - ABEC-1

General recommended housing bore limits for inch-size bearings— ISO H6 and N6

	Bearing outside diameter				Housing stationary						Housing rotating					
	Max		Min		Housing bore (H6)				Fit		Housing bore (N6)				Fit	
mm					Max		Min		.001	.0001	Max		Min		.001	.0001
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
R2	9.525	0.3750	9.517	0.3747	9.536	0.3754	9.525	0.3750			9.515	0.3746	9.505	0.3742		
R2A	12.700	0.5000	12.692	0.4997	12.711	0.5004	12.700	0.5000	19L	7L	12.690	0.4996	12.680	0.4992	2T	1T
R3	12.700	0.5000	12.692	0.4997	12.711	0.5004	12.700	0.5000	0	0	12.690	0.4996	12.680	0.4992	20T	8T
R4	15.875	0.6250	15.867	0.6247	15.886	0.6254	15.875	0.6250			15.865	0.6246	15.855	0.6242		
R4A	19.050	0.7500	19.041	0.7496	19.063	0.7505	19.050	0.7500	22L	9L	19.039	0.7496	19.026	0.7491	2T	0
R6	22.225	0.8750	22.216	0.8746	22.238	0.8755	22.225	0.8750	0	0	22.214	0.8746	22.201	0.8741	24T	9T
R8	28.575	1.1250	28.566	1.1246	28.588	1.1255	28.575	1.1250			28.564	1.1246	28.551	1.1241		
R10	34.925	1.3750	34.914	1.3745	34.941	1.3756	34.925	1.3750	27L	11L	34.913	1.3744	34.897	1.3739	1T	1T
R12	41.275	1.6250	41.264	1.6245	41.291	1.6256	41.275	1.6250	0	0	41.263	1.6244	41.247	1.6239	28T	11T
R14	47.625	1.8750	47.614	1.8745	47.641	1.8756	47.625	1.8750			47.613	1.8744	47.597	1.8739		
R16	50.800	2.0000	50.787	1.9995	50.819	2.0007	50.800	2.0000			50.786	1.9994	50.767	1.9987		
R18	53.975	2.1250	53.962	2.1245	53.994	2.1257	53.975	2.1250			53.961	2.1244	53.942	2.1237		
R20	57.150	2.2500	57.137	2.2495	57.169	2.2507	57.150	2.2500	32L	12L	57.136	2.2494	57.117	2.2487	1T	1T
R24	66.675	2.6250	66.662	2.6245	66.694	2.6257	66.675	2.6250	0	0	66.661	2.6244	66.642	2.6237	33T	13T
XLS1 3/8	65.088	2.5625	65.151	2.5620	65.183	2.5632	65.088	2.5625			65.150	2.5619	65.055	2.5612		
XLS1 1/2	68.263	2.6875	68.250	2.6870	68.282	2.6882	68.263	2.6875			68.249	2.6869	68.230	2.6862		
XLS1 3/8	73.025	2.8750	73.012	2.8745	73.044	2.8757	73.025	2.8750			73.011	2.8744	72.992	2.8737		
XLS1 3/4	76.200	3.0000	76.187	2.9995	76.219	3.0007	76.200	3.0000			76.186	2.9994	76.167	2.9987		
XLS1 7/8	80.963	3.1875	80.948	3.1869	80.985	3.1884	80.963	3.1875			80.947	3.1869	80.925	3.1860		
XLS2	84.138	3.3125	84.123	3.3119	84.160	3.3134	84.138	3.3125			84.122	3.3119	84.100	3.3110		
XLS2 1/8	87.313	3.4375	87.298	3.4369	87.335	3.4384	87.313	3.4375	37L	15L	87.297	3.4369	87.275	3.4360	1T	0
XLS2 1/4	90.488	3.5625	90.473	3.5619	90.510	3.5634	90.488	3.5625	0	0	90.472	3.5619	90.450	3.5610	38T	15T
XLS2 1/2	98.425	3.8750	98.410	3.8744	98.447	3.8759	98.425	3.8750			98.409	3.8744	98.387	3.8735		
XLS2 5/8	104.775	4.1250	104.760	4.1244	104.797	4.1259	104.775	4.1250			104.759	4.1244	104.737	4.1235		
XLS2 3/4	104.775	4.1250	104.760	4.1244	104.797	4.1259	104.775	4.1250			104.759	4.1244	104.737	4.1235		
XLS3	114.300	4.5000	114.285	4.4994	114.322	4.5009	114.300	4.5000			114.284	4.4994	114.262	4.4985		
XLS3 1/4	120.650	4.7500	120.632	4.7493	120.675	4.7510	120.650	4.7500	43L	17L	120.630	4.7492	120.605	4.7482	2T	1T
XLS3 1/2	127.000	5.0000	126.982	4.9993	126.995	5.0010	127.000	5.0000	0	0	126.980	4.9992	126.955	4.9982	45T	18T
XLS3 3/4	133.350	5.2500	133.332	5.2493	133.375	5.2510	133.350	5.2500			133.330	5.2492	133.305	5.2482		
XLS4 1/4	152.400	6.0000	152.375	5.9990	152.425	6.0010	152.400	6.0000			152.380	5.9992	152.355	5.9981		
XLS4 1/2	158.750	6.2500	158.725	6.2490	158.775	6.2510	158.750	6.2500	50L	20L	158.730	6.2492	158.705	6.2481	5L	2L
XLS4 3/4	165.100	6.5000	165.075	6.4990	165.125	6.5010	165.100	6.5000	0	0	165.080	6.4992	165.055	6.4981	45T	18T
XLS5	177.800	7.0000	177.775	6.9990	177.825	7.0010	177.800	7.0000			177.780	6.9992	177.755	6.9981		
XLS5 1/2	190.500	7.5000	190.470	7.4988	190.529	7.5011	190.500	7.5000			190.478	7.4991	190.449	7.4980		
XLS6	203.200	8.0000	203.170	7.9988	203.229	8.0011	203.200	8.0000			203.178	7.9991	203.149	7.9980		
XLS6 1/4	215.900	8.5000	215.870	8.4988	215.929	8.5011	215.900	8.5000	59L	23L	215.878	8.4991	215.849	8.4980	8L	3L
XLS6 1/2	222.250	8.7500	222.220	8.7488	222.279	8.7511	222.250	8.7500	0	0	222.228	8.7491	222.199	8.7480	51T	20T
XLS7	241.300	9.5000	241.270	9.4988	241.329	9.5011	241.300	9.5000			241.278	9.4991	241.249	9.4980		
XLS7 1/4	247.650	9.7500	247.620	9.7488	247.679	9.7511	247.650	9.7500			247.628	9.7491	247.599	9.7480		
XLS7 3/4	266.700	10.5000	266.665	10.4986	266.732	10.5013	266.700	10.5000			266.675	10.4990	266.643	10.4978		
XLS8	273.051	10.7500	273.016	10.7486	273.083	10.7513	273.051	10.7500	67L	27L	273.026	10.7490	272.994	10.7478	10L	4L
XLS8 1/4	279.401	11.0000	279.366	10.9986	279.433	11.0013	279.401	11.0000	0	0	279.376	10.9990	279.344	10.9978	57T	22T
XLS8 1/2	292.101	11.5000	292.066	11.4986	292.133	11.5013	292.101	11.5000			292.076	11.4990	292.044	11.4978		
XLS9	304.801	12.0000	304.766	11.9986	304.833	12.0013	304.801	12.0000			304.776	11.9990	304.744	11.9978		
XLS10	336.551	13.2500	336.514	13.2484	336.587	13.2514	336.551	13.2500	76L	30L	336.525	13.2490	336.489	13.2476	14L	6L
									0	0					62T	24T

For aluminum or other soft metal housings, make bore limits same as bearing O.D. limits.

Shaft fit tolerances for solid steel shafts

Classification for metric radial ball and roller bearings with cylindrical bore, Classes ABEC-1, RBEC-1 (except inch dimensioned taper roller bearings)

Conditions	Examples	Shaft diameter, mm Ball bearings[1]	Tolerance[6]
Rotating inner ring load or direction of load indeterminate			
Light and variable loads (P ≤ 0.05 C)	Conveyors, lightly loaded gearbox bearings	≤ 17 18 to 100 101 to 140	js5 (h5)[2] j6 (js5)[2] k6
Normal to heavy loads (P > 0.05 C)	Bearing applications generally, electric motors, turbines, pumps, gearing, wood working machines, windmills	≤ 10 11 to 17 18 to 100 101 to 140 141 to 200 201 to 500	js5 j5 (js5)[2] k5[3] m5 m6 n6[4]
High demands on running accuracy with light loads (P ≤ 0.05 C)	Machine tools	8 to 240	js4
Stationary inner ring load			
Easy axial displacement of inner ring on shaft desirable	Wheels on non-rotating axles		g6[5]
Easy axial displacement of inner ring on shaft unnecessary	Tension pulleys, rope sheaves		h6
Axial loads only	Bearing applications of all kinds	≤ 250	j6

1) For normally to heavily loaded ball bearings (P > 0.05 C), radial clearance greater than normal is often needed when the shaft tolerances in the table above are used. Sometimes the working conditions require tighter fits to prevent ball bearing inner rings from turning (creeping) on the shaft. If proper clearance, mostly larger than normal clearance is selected, the following tolerances can then be used: k4 for shaft diameters 10 to 17 mm, k5 for shaft diameters 18 to 25 mm, m5 for shaft diameters 26 to 140 mm, n6 for shaft diameters 141 to 300 mm, p6 for shaft diameters 301 to 500 mm
For additional information please contact SKF Application Engineering.
2) The tolerance in brackets applies to stainless steel bearings.
3) For stainless steel bearings within the diameter range 17 to 30 mm, tolerance j5 applies.
4) Bearings with radial internal clearance greater than normal are recommended for d ≤ 150 mm. For d > 150 mm bearings with radial internal clearance greater than normal may be necessary.
5) Tolerance f6 can be selected for large bearings to provide easy displacement.
6) See page 262 for specific shaft diameters.

ISO fits for solid steel shafts

Shaft bearing-seat diameters (values in inches)

Bearing bore diameter mm	inches Max	inches Min	g6 Shaft diameter Max	g6 Shaft diameter Min	g6 Resultant fit[1] in 0.0001″	h5 Shaft diameter Max	h5 Shaft diameter Min	h5 Resultant fit[1] in 0.0001″	h6 Shaft diameter Max	h6 Shaft diameter Min	h6 Resultant fit[1] in 0.0001″	j5 Shaft diameter Max	j5 Shaft diameter Min	j5 Resultant fit[1] in 0.0001″	j6 Shaft diameter Max	j6 Shaft diameter Min	j6 Resultant fit[1] in 0.0001″
4	**0.1575**	**0.1572**	0.1573	0.1570		0.1575	0.1573		0.1575	0.1572		0.1576	0.1574		0.1577	0.1574	
5	**0.1969**	**0.1966**	0.1967	0.1964	5 L	0.1969	0.1967	2 L	0.1969	0.1966	3 L	0.1970	0.1968	1 L	0.1971	0.1968	1 L
6	**0.2362**	**0.2359**	0.2360	0.2357	1 T	0.2362	0.2360	3 T	0.2362	0.2359	3 T	0.2363	0.2361	4 T	0.2364	0.2361	5 T
7	**0.2756**	**0.2753**	0.2754	0.2750		0.2756	0.2754		0.2756	0.2752		0.2758	0.2755		0.2759	0.2755	
8	**0.3150**	**0.3147**	0.3148	0.3144	6 L	0.3150	0.3148	2 L	0.3150	0.3146	4 L	0.3152	0.3149	1 L	0.3153	0.3149	1 L
9	**0.3543**	**0.3540**	0.3541	0.3537	1 T	0.3543	0.3541	3 T	0.3543	0.3539	3 T	0.3545	0.3542	5 T	0.3546	0.3542	6 T
10	**0.3937**	**0.3934**	0.3935	0.3931		0.3937	0.3935		0.3937	0.3933		0.3939	0.3936		0.3940	0.3936	
12	**0.4724**	**0.4721**	0.4722	0.4717		0.4724	0.4721		0.4724	0.4720		0.4726	0.4723		0.4727	0.4723	
15	**0.5906**	**0.5903**	0.5904	0.5899	7 L	0.5906	0.5903	3 L	0.5906	0.5902	4 L	0.5908	0.5905	1 L	0.5909	0.5905	1 L
17	**0.6693**	**0.6690**	0.6691	0.6686	1 T	0.6693	0.6690	3 T	0.6693	0.6689	3 T	0.6695	0.6692	5 T	0.6696	0.6692	6 T
20	**0.7874**	**0.7870**	0.7871	0.7866		0.7874	0.7870		0.7874	0.7869		0.7876	0.7872		0.7878	0.7872	
25	**0.9843**	**0.9839**	0.9840	0.9835	8 L	0.9843	0.9839	4 L	0.9843	0.9838	5 L	0.9845	0.9841	2 L	0.9847	0.9841	2 L
30	**1.1811**	**1.1807**	1.1808	1.1803	1 T	1.1811	1.1807	4 T	1.1811	1.1806	4 T	1.1813	1.1809	6 T	1.1815	1.1809	8 T
35	**1.3780**	**1.3775**	1.3776	1.3770		1.3780	1.3776		1.3780	1.3774		1.3782	1.3778		1.3784	1.3778	
40	**1.5748**	**1.5743**	1.5744	1.5738	10 L	1.5748	1.5744	4 L	1.5748	1.5742	6 L	1.5750	1.5746	2 L	1.5752	1.5746	2 L
45	**1.7717**	**1.7712**	1.7713	1.7707	1 T	1.7717	1.7713	5 T	1.7717	1.7711	5 T	1.7719	1.7715	7 T	1.7721	1.7715	9 T
50	**1.9685**	**1.9680**	1.9681	1.9675		1.9685	1.9681		1.9685	1.9679		1.9687	1.9683		1.9689	1.9683	
55	**2.1654**	**2.1648**	2.1650	2.1643		2.1654	2.1649		2.1654	2.1647		2.1656	2.1651		2.1659	2.1651	
60	**2.3622**	**2.3616**	2.3618	2.3611		2.3622	2.3617		2.3622	2.3615		2.3624	2.3619		2.3627	2.3619	
65	**2.5591**	**2.5585**	2.5587	2.5580	11 L	2.5591	2.5586	5 L	2.5591	2.5584	7 L	2.5593	2.5588	3 L	2.5596	2.5588	3 L
70	**2.7559**	**2.7553**	2.7555	2.7548	2 T	2.7559	2.7554	6 T	2.7559	2.7552	6 T	2.7561	2.7556	8 T	2.7564	2.7556	11 T
75	**2.9528**	**2.9522**	2.9524	2.9517		2.9528	2.9523		2.9528	2.9521		2.9530	2.9525		2.9533	2.9525	
80	**3.1496**	**3.1490**	3.1492	3.1485		3.1496	3.1491		3.1496	3.1489		3.1498	3.1493		3.1501	3.1493	
85	**3.3465**	**3.3457**	3.3460	3.3452		3.3465	3.3459		3.3465	3.3456		3.3467	3.3461		3.3470	3.3461	
90	**3.5433**	**3.5425**	3.5428	3.5420		3.5433	3.5427		3.5433	3.5424		3.5435	3.5429		3.5438	3.5429	
95	**3.7402**	**3.7394**	3.7397	3.7389		3.7402	3.7396		3.7402	3.7393		3.7404	3.7398		3.7407	3.7398	
100	**3.9370**	**3.9362**	3.9365	3.9357	13 L	3.9370	3.9364	6 L	3.9370	3.9361	9 L	3.9372	3.9366	4 L	3.9375	3.9366	4 L
105	**4.1339**	**4.1331**	4.1334	4.1326	3 T	4.1339	4.1333	8 T	4.1339	4.1330	8 T	4.1341	4.1335	10 T	4.1344	4.1335	13 T
110	**4.3307**	**4.3299**	4.3302	4.3294		4.3307	4.3301		4.3307	4.3298		4.3309	4.3303		4.3312	4.3303	
115	**4.5276**	**4.5268**	4.5271	4.5263		4.5276	4.5270		4.5276	4.5267		4.5278	4.5272		4.5281	4.5272	
120	**4.7244**	**4.7236**	4.7239	4.7231		4.7244	4.7238		4.7244	4.7235		4.7246	4.7240		4.7249	4.7240	
125	**4.9213**	**4.9203**	4.9207	4.9198		4.9213	4.9206		4.9213	4.9203		4.9216	4.9209		4.9219	4.9209	
130	**5.1181**	**5.1171**	5.1175	5.1166		5.1181	5.1174		5.1181	5.1171		5.1184	5.1177		5.1187	5.1177	
140	**5.5118**	**5.5108**	5.5112	5.5103		5.5118	5.5111		5.5118	5.5108		5.5121	5.5114		5.5124	5.5114	
150	**5.9055**	**5.9045**	5.9049	5.9040	15 L	5.9055	5.9048	7 L	5.9055	5.9045	10 L	5.9058	5.9051	4 L	5.9061	5.9051	4 L
160	**6.2992**	**6.2982**	6.2986	6.2977	4 T	6.2992	6.2985	10 T	6.2992	6.2982	10 T	6.2995	6.2988	13 T	6.2998	6.2988	16 T
170	**6.6929**	**6.6919**	6.6923	6.6914		6.6929	6.6922		6.6929	6.6919		6.6932	6.6925		6.6935	6.6925	
180	**7.0866**	**7.0856**	7.0860	7.0851		7.0866	7.0859		7.0866	7.0856		7.0869	7.0862		7.0872	7.0862	
190	**7.4803**	**7.4791**	7.4797	7.4786		7.4803	7.4795		7.4803	7.4792		7.4806	7.4798		7.4809	7.4798	
200	**7.8740**	**7.8728**	7.8734	7.8723	17 L	7.8740	7.8732	8 L	7.8740	7.8729	11 L	7.8743	7.8735	5 L	7.8746	7.8735	5 L
220	**8.6614**	**8.6602**	8.6608	8.6597	6 T	8.6614	8.6606	12 T	8.6614	8.6603	12 T	8.6617	8.6609	15 T	8.6620	8.6609	18 T
240	**9.4488**	**9.4476**	9.4482	9.4471		9.4488	9.4480		9.4488	9.4477		9.4491	9.4483		9.4494	9.4483	
250	**9.8425**	**9.8413**	9.8419	9.8408		9.8425	9.84170		9.8425	9.8414		9.8428	9.8420		9.8431	9.8420	
260	**10.2362**	**10.2348**	10.2355	10.2343		10.2362	10.2353		10.2362	10.2349		10.2365	10.2356		10.2368	10.2356	
280	**11.0236**	**11.0222**	11.0229	11.0217	19 L	11.0236	11.0227	9 L	11.0236	11.0223	13 L	11.0239	11.0230	6 L	11.0242	11.0230	6 L
300	**11.8110**	**11.8096**	11.8103	11.8091	7 T	11.8110	11.8101	14 T	11.8110	11.8097	14 T	11.8113	11.8104	17 T	11.8116	11.8104	20 T
310	**12.2047**	**12.2033**	12.2040	12.2028		12.2047	12.2038		12.2047	12.2034		12.2050	12.2041		12.2053	12.2041	
320	**12.5984**	**12.5968**	12.5977	12.5963		12.5984	12.5974		12.5984	12.5970		12.5987	12.5977		12.5991	12.5977	
340	**13.3858**	**13.3842**	13.3851	13.3837		13.3858	13.3848		13.3858	13.3844		13.3861	13.3851		13.3865	13.3851	
350	**13.7795**	**13.7779**	13.7788	13.7774	21 L	13.7795	13.7785	10 L	13.7795	13.7781	14 L	13.7798	13.7788	7 L	13.7802	13.7788	7 L
360	**14.1732**	**14.1716**	14.1725	14.1711	9 T	14.1732	14.1722	16 T	14.1732	14.1718	16 T	14.1735	14.1725	19 T	14.1739	14.1725	23 T
380	**14.9606**	**14.959**	14.9599	14.9585		14.9606	14.9596		14.9606	14.9592		14.9609	14.9599		14.9613	14.9599	
400	**15.7480**	**15.7464**	15.7473	15.7459		15.7480	15.7470		15.7480	15.7466		15.7483	15.7473		15.7487	15.7473	
420	**16.5354**	**16.5336**	16.5346	16.5330		16.5354	16.5343		16.5354	16.5338		16.5357	16.5346		16.5362	16.5346	
440	**17.3228**	**17.3210**	17.3220	17.3204	24 L	17.3228	17.3217	11 L	17.3228	17.3212	16 L	17.3231	17.3220	8 L	17.3236	17.3220	8 L
460	**18.1102**	**18.1084**	18.1094	18.1078	10 T	18.1102	18.1091	18 T	18.1102	18.1086	18 T	18.1105	18.1094	21 T	18.1110	18.1094	26 T
480	**18.8976**	**18.8958**	18.8968	18.8952		18.8976	18.8965		18.8976	18.8960		18.8979	18.8968		18.8984	18.8968	
500	**19.6850**	**19.6832**	19.6842	19.6826		19.6850	19.6839		19.6850	19.6834		19.6853	19.6842		19.6858	19.6842	
530	**20.8661**	**20.8641**	20.8652	20.8635		—	—		20.8661	20.8644		—	—		20.8670	20.8652	
560	**22.0472**	**22.0452**	22.0463	22.0446	26 L	—	—		22.0472	22.0455	17 L	—	—		22.0481	22.0463	9 L
600	**23.6220**	**23.6200**	23.6211	23.6194	11 T	—	—		23.6220	23.6203	20 T	—	—		23.6229	23.6211	29 T
630	**24.8031**	**24.8011**	24.8022	24.8005		—	—		24.8031	24.8014		—	—		24.8040	24.8022	
660	**25.9843**	**25.9813**	25.9834	25.9814		—	—		25.9843	25.9823		—	—		25.9853	25.9833	
670	**26.3780**	**26.3750**	26.3771	26.3751		—	—		26.3780	26.3760		—	—		26.3790	26.3770	
710	**27.9528**	**27.9498**	27.9519	27.9499	29 L	—	—		27.9528	27.9508	20 L	—	—		27.9538	27.9518	10 L
750	**29.5276**	**29.5246**	29.5267	29.5247	21 T	—	—		29.5276	29.5256	30 T	—	—		29.5286	29.5266	40 T
780	**30.7087**	**30.7057**	30.7078	30.7058		—	—		30.7087	30.7067		—	—		30.7097	30.7077	
800	**31.4961**	**31.4931**	31.4952	31.4932		—	—		31.4961	31.4941		—	—		31.4971	31.4951	
850	**33.4646**	**33.4607**	33.4636	33.4614		—	—		33.4646	33.4624		—	—		33.4657	33.4635	
900	**35.4331**	**35.4292**	35.4321	35.4299	32 L	—	—		35.4331	35.4309	22 L	—	—		35.4342	35.4320	11 L
950	**37.4016**	**37.3977**	37.4006	37.3984	29 T	—	—		37.4016	37.3994	39 T	—	—		37.4027	37.4005	50 T
1000	**39.3701**	**39.3662**	39.3691	39.3669		—	—		39.3701	39.3679		—	—		39.3712	39.3690	

Note: To convert inches to mm, multiply inches by 25.4.
[1] L indicates "LOOSE" fit, T indicates "TIGHT" fit.

ISO fits for solid steel shafts

Shaft bearing-seat diameters (values in inches)

Bearing bore diameter			js4			js5			js6			k5			k6		
	inches		Shaft diameter		Resultant fit[1] in	Shaft diameter		Resultant fit[1] in	Shaft diameter		Resultant fit[1] in	Shaft diameter		Resultant fit[1] in	Shaft diameter		Resultant fit[1] in
mm	Max	Min	Max	Min	0.0001″	Max	Min	0.0001″	Max	Min	0.0001″	Max	Min	0.0001″	Max	Min	0.0001″
4	**0.1575**	**0.1572**	—	—		0.1576	0.1574		0.1577	0.1573		0.1577	0.1575		0.1579	0.1575	
5	**0.1969**	**0.1966**	—	—		0.1970	0.1968	1 L	0.1971	0.1967	2 L	0.1971	0.1969	0 T	0.1973	0.1969	0 T
6	**0.2362**	**0.2359**	—	—		0.2363	0.2361	4 T	0.2364	0.2360	5 T	0.2364	0.2362	5 T	0.2366	0.2362	7 T
7	**0.2756**	**0.2753**	0.2757	0.2755		0.2757	0.2755		0.2758	0.2754		0.2759	0.2756		0.2760	0.2756	
8	**0.3150**	**0.3147**	0.3151	0.3149	1 L	0.3151	0.3149	1 L	0.3152	0.3148	2 L	0.3153	0.3150	0 T	0.3154	0.3150	0 T
9	**0.3543**	**0.3540**	0.3544	0.3542	4 T	0.3544	0.3542	4 T	0.3545	0.3541	5 T	0.3546	0.3543	6 T	0.3547	0.3543	7 T
10	**0.3937**	**0.3934**	0.3938	0.3936		0.3938	0.3936		0.3939	0.3935		0.3940	0.3937		0.3941	0.3937	
12	**0.4724**	**0.4721**	0.4725	0.4723		0.4726	0.4722		0.4726	0.4722		0.4728	0.4724		0.4729	0.4724	
15	**0.5906**	**0.5903**	0.5907	0.5905	1 L	0.5908	0.5904	2 L	0.5908	0.5904	2 L	0.5910	0.5906	0 T	0.5911	0.5906	0 T
17	**0.6693**	**0.6690**	0.6694	0.6692	4 T	0.6695	0.6691	5 T	0.6695	0.6691	5 T	0.6697	0.6693	7 T	0.6698	0.6693	8 T
20	**0.7874**	**0.7870**	0.7875	0.7872		0.7876	0.7872		0.7876	0.7871		0.7878	0.7875		0.7880	0.7875	
25	**0.9843**	**0.9839**	0.9844	0.9841	2 L	0.9845	0.9841	2 L	0.9845	0.9840	3 L	0.9847	0.9844	1 T	0.9849	0.9844	1 T
30	**1.1811**	**1.1807**	1.1812	1.1809	5 T	1.1813	1.1809	6 T	1.1813	1.1808	6 T	1.1815	1.1812	8 T	1.1817	1.1812	10 T
35	**1.3780**	**1.3775**	1.3781	1.3778		1.3782	1.3778		1.3783	1.3777		1.3785	1.3781		1.3787	1.3781	
40	**1.5748**	**1.5743**	1.5749	1.5746	2 L	1.5750	1.5746	2 L	1.5751	1.5745	3 L	1.5753	1.5749	1 T	1.5755	1.5749	1 T
45	**1.7717**	**1.7712**	1.7718	1.7715	6 T	1.7719	1.7715	7 T	1.7720	1.7714	8 T	1.7722	1.7718	10 T	1.7724	1.7718	12 T
50	**1.9685**	**1.9680**	1.9686	1.9683		1.9687	1.9683		1.9688	1.9682		1.9690	1.9686		1.9692	1.9686	
55	**2.1654**	**2.1648**	2.1655	2.1652		2.1656	2.1651		2.1658	2.1650		2.1660	2.1655		2.1662	2.1655	
60	**2.3622**	**2.3616**	2.3623	2.3620		2.3624	2.3619		2.3626	2.3618		2.3628	2.3623		2.3630	2.3623	
65	**2.5591**	**2.5585**	2.5592	2.5589	2 L	2.5593	2.5588	3 L	2.5595	2.5587	4 L	2.5597	2.5592	1 T	2.5599	2.5592	1 T
70	**2.7559**	**2.7553**	2.7560	2.7557	7 T	2.7561	2.7556	8 T	2.7563	2.7555	10 T	2.7565	2.7560	12 T	2.7567	2.7560	14 T
75	**2.9528**	**2.9522**	2.9529	2.9526		2.9530	2.9525		2.9532	2.9524		2.9534	2.9529		2.9536	2.9529	
80	**3.1496**	**3.1490**	3.1497	3.1494		3.1498	3.1493		3.1500	3.1492		3.1502	3.1497		3.1504	3.1497	
85	**3.3465**	**3.3457**	3.3467	3.3463		3.3468	3.3462		3.3469	3.3461		3.3472	3.3466		3.3475	3.3466	
90	**3.5433**	**3.5425**	3.5435	3.5431		3.5436	3.5430		3.5437	3.5429		3.5440	3.5434		3.5443	3.5434	
95	**3.7402**	**3.7394**	3.7404	3.7400		3.7405	3.7399		3.7406	3.7398		3.7409	3.7403		3.7412	3.7403	
100	**3.9370**	**3.9362**	3.9372	3.9368	2 L	3.9373	3.9367	3 L	3.9374	3.9366	4 L	3.9377	3.9371	1 T	3.9380	3.9371	1 T
105	**4.1339**	**4.1331**	4.1341	4.1337	10 T	4.1342	4.1336	11 T	4.1343	4.1335	12 T	4.1346	4.1340	15 T	4.1349	4.1340	18 T
110	**4.3307**	**4.3299**	4.3309	4.3305		4.3310	4.3304		4.3311	4.3303		4.3314	4.3308		4.3317	4.3308	
115	**4.5276**	**4.5268**	4.5278	4.5274		4.5279	4.5273		4.5280	4.5272		4.5283	4.5277		4.5286	4.5277	
120	**4.7244**	**4.7236**	4.7246	4.7242		4.7247	4.7241		4.7248	4.7240		4.7251	4.7245		4.7254	4.7245	
125	**4.9213**	**4.9203**	4.9215	4.9210		4.9216	4.9209		4.9218	4.9208		4.9221	4.9214		4.9224	4.9214	
130	**5.1181**	**5.1171**	5.1183	5.1178		5.1184	5.1177		5.1186	5.1176		5.1189	5.1182		5.1192	5.1182	
140	**5.5118**	**5.5108**	5.5120	5.5115		5.5121	5.5114		5.5123	5.5113		5.5126	5.5119		5.5129	5.5119	
150	**5.9055**	**5.9045**	5.9057	5.9052	3 L	5.9058	5.9051	4 L	5.9060	5.9050	5 L	5.9063	5.9056	1 T	5.9066	5.9056	1 T
160	**6.2992**	**6.2982**	6.2994	6.2989	12 T	6.2995	6.2988	13 T	6.2997	6.2987	15 T	6.3000	6.2993	18 T	6.3003	6.2993	21 T
170	**6.6929**	**6.6919**	6.6931	6.6926		6.6932	6.6925		6.6934	6.6924		6.6937	6.6930		6.6940	6.6930	
180	**7.0866**	**7.0856**	7.0868	7.0863		7.0869	7.0862		7.0871	7.0861		7.0874	7.0867		7.0877	7.0867	
190	**7.4803**	**7.4791**	7.4806	7.4800		7.4807	7.4799		7.4809	7.4797		7.4812	7.4805		7.4815	7.4805	
200	**7.8740**	**7.8728**	7.8743	7.8737	3 L	7.8744	7.8736	4 L	7.8746	7.8734	6 L	7.8749	7.8742	2 T	7.8753	7.8742	2 T
220	**8.6614**	**8.6602**	8.6617	8.6611	15 T	8.6618	8.6610	16 T	8.6620	8.6608	18 T	8.6623	8.6616	21 T	8.6627	8.6616	25 T
240	**9.4488**	**9.4476**	9.4491	9.4485		9.4492	9.4484		9.4494	9.4482		9.4497	9.4490		9.4501	9.4490	
250	**9.8425**	**9.8413**	9.8428	9.8422		9.8429	9.8421		9.8431	9.8419		9.8434	9.8427		9.8438	9.8427	
260	**10.2362**	**10.2348**	10.2365	10.2359		10.2366	10.2357		10.2368	10.2356		10.2373	10.2364		10.2376	10.2364	
280	**11.0236**	**11.0222**	11.0239	11.0233	3 L	11.0240	11.0231	5 L	11.0242	11.0230	6 L	11.0247	11.0238	2 T	11.0250	11.0238	2 T
300	**11.8110**	**11.8096**	11.8113	11.8107	17 T	11.8114	11.8105	18 T	11.8116	11.8104	20 T	11.8121	11.8112	25 T	11.8124	11.8112	28 T
310	**12.2047**	**12.2033**	12.2050	12.2044		12.2051	12.2042		12.2053	12.2041		12.2058	12.2049		12.2061	12.2049	
320	**12.5984**	**12.5968**	—	—		12.5989	12.5979		12.5991	12.5977		12.5995	12.5986		12.6000	12.5986	
340	**13.3858**	**13.3842**	—	—		13.3863	13.3853		13.3865	13.3851		13.3869	13.3860		13.3874	13.3860	
350	**13.7795**	**13.7779**	—	—		13.7800	13.7790	5 L	13.7802	13.7788	7 L	13.7806	13.7797	2 T	13.7811	13.7797	2 T
360	**14.1732**	**14.1716**	—	—		14.1737	14.1727	21 T	14.1739	14.1725	23 T	14.1743	14.1734	27 T	14.1748	14.1734	32 T
380	**14.9606**	**14.9590**	—	—		14.9611	14.9601		14.9613	14.9599		14.9617	14.9608		14.9622	14.9608	
400	**15.7480**	**15.7464**	—	—		15.7485	15.7475		15.7487	15.7473		15.7491	15.7482		15.7496	15.7482	
420	**16.5354**	**16.5336**	—	—		16.5359	16.5349		16.5362	16.5346		16.5367	16.5356		16.5372	16.5356	
440	**17.3228**	**17.3210**	—	—		17.3233	17.3223	5 L	17.3236	17.3220	8 L	17.3241	17.3230	2 T	17.3246	17.3230	2 T
460	**18.1102**	**18.1084**	—	—		18.1107	18.1097	23 T	18.1110	18.1094	26 T	18.1115	18.1104	31 T	18.1120	18.1104	36 T
480	**18.8976**	**18.8958**	—	—		18.8981	18.8971		18.8984	18.8968		18.8989	18.8978		18.8994	18.8978	
500	**19.6850**	**19.6832**	—	—		19.6855	19.6845		19.6858	19.6842		19.6863	19.6852		19.6868	19.6852	
530	**20.8661**	**20.8641**	—	—		20.8666	20.8655		20.8669	20.8652		20.8673	20.8661		20.8678	20.8661	
560	**22.0472**	**22.0452**	—	—		22.0477	22.0466	6 L	22.0480	22.0463	9 L	22.0484	22.0472	0 T	22.0489	22.0472	0 T
600	**23.6220**	**23.6200**	—	—		23.6225	23.6214	25 T	23.6228	23.6211	28 T	23.6232	23.6220	32 T	23.6237	23.6220	37 T
630	**24.8031**	**24.8011**	—	—		24.8036	24.8025		24.8039	24.8022		24.8043	24.8031		24.8048	24.8031	
660	**25.9843**	**25.9813**	—	—		25.9849	25.9837		25.9852	25.9833		25.9857	25.9843		25.9862	25.9843	
670	**26.3780**	**26.3750**	—	—		26.3786	26.3774		26.3789	26.3770		26.3794	26.3780		26.3799	26.3780	
710	**27.9528**	**27.9498**	—	—		27.9534	27.9522	6 L	27.9537	27.9518	10 L	27.9542	27.9528	0 T	27.9547	27.9528	0 T
750	**29.5276**	**29.5246**	—	—		29.5282	29.5270	36 T	29.5285	29.5266	39 T	29.5290	29.5276	44 T	29.5295	29.5276	49 T
780	**30.7087**	**30.7057**	—	—		30.7093	30.7081		30.7096	30.7077		30.7101	30.7087		30.7106	30.7087	
800	**31.4961**	**31.4931**	—	—		31.4967	31.4955		31.4970	31.4951		31.4975	31.4961		31.4980	31.4961	
850	**33.4646**	**33.4607**	—	—		33.4653	33.4639		33.4657	33.4635		33.4662	33.4646		33.4668	33.4646	
900	**35.4331**	**35.4292**	—	—		35.4338	35.4324	7 L	35.4342	35.4320	11 L	35.4347	35.4331	0 T	35.4353	35.4331	0 T
950	**37.4016**	**37.3977**	—	—		37.4023	37.4009	46 T	37.4027	37.4005	50 T	37.4032	37.4016	55 T	37.4038	37.4016	61 T
1000	**39.3701**	**39.3662**	—	—		39.3708	39.3694		39.3712	39.3690		39.3717	39.3701		39.3723	39.3701	

Note: To convert inches to mm, multiply inches by 25.4.
[1] L indicates "LOOSE" fit, T indicates "TIGHT" fit.

ISO fits for solid steel shafts

Shaft bearing-seat diameters (values in inches)

Bearing bore diameter			m5			m6			n6		
	inches		Shaft diameter		Resultant fit[1] in 0.0001″	Shaft diameter		Resultant fit[1] in 0.0001″	Shaft diameter		Resultant fit[1] in 0.0001″
mm	Max	Min	Max	Min		Max	Min		Max	Min	
4	**0.1575**	**0.1572**	0.1579	0.1577		0.1580	0.1577		0.1581	0.1578	
5	**0.1969**	**0.1966**	0.1973	0.1971	2 T	0.1974	0.1971	2 T	0.1975	0.1972	3 T
6	**0.2362**	**0.2359**	0.2366	0.2364	7 T	0.2367	0.2364	8 T	0.2368	0.2365	9 T
7	**0.2756**	**0.2753**	0.2761	0.2758		0.2762	0.2758		0.2763	0.2760	
8	**0.3150**	**0.3147**	0.3155	0.3152	2 T	0.3156	0.3152	2 T	0.3157	0.3154	4 T
9	**0.3543**	**0.3540**	0.3548	0.3545	8 T	0.3549	0.3545	9 T	0.3550	0.3547	10 T
10	**0.3937**	**0.3934**	0.3942	0.3939		0.3943	0.3939		0.3944	0.3941	
12	**0.4724**	**0.4721**	0.4730	0.4727		0.4731	0.4727		0.4733	0.4729	
15	**0.5906**	**0.5903**	0.5912	0.5909	3 T	0.5913	0.5909	3 T	0.5915	0.5911	5 T
17	**0.6693**	**0.6690**	0.6699	0.6696	9 T	0.6700	0.6696	10 T	0.6702	0.6698	12 T
20	**0.7874**	**0.7870**	0.7881	0.7877		0.7882	0.7877		0.7885	0.7880	
25	**0.9843**	**0.9839**	0.9850	0.9846	3 T	0.9851	0.9846	3 T	0.9854	0.9849	6 T
30	**1.1811**	**1.1807**	1.1818	1.1814	11 T	1.1819	1.1814	12 T	1.1822	1.1817	15 T
35	**1.3780**	**1.3775**	1.3788	1.3784		1.3790	1.3784		1.3793	1.3787	
40	**1.5748**	**1.5743**	1.5756	1.5752	4 T	1.5758	1.5752	4 T	1.5761	1.5755	7 T
45	**1.7717**	**1.7712**	1.7725	1.7721	13 T	1.7727	1.7721	15 T	1.7730	1.7724	18 T
50	**1.9685**	**1.9680**	1.9693	1.9689		1.9695	1.9689		1.9698	1.9692	
55	**2.1654**	**2.1648**	2.1663	2.1658		2.1666	2.1658		2.1669	2.1662	
60	**2.3622**	**2.3616**	2.3631	2.3626		2.3634	2.3626		2.3637	2.3630	
65	**2.5591**	**2.5585**	2.5600	2.5595	4 T	2.5603	2.5595	4 T	2.5606	2.5599	8 T
70	**2.7559**	**2.7553**	2.7568	2.7563	15 T	2.7571	2.7563	18 T	2.7574	2.7567	21 T
75	**2.9528**	**2.9522**	2.9537	2.9532		2.9540	2.9532		2.9543	2.9536	
80	**3.1496**	**3.1490**	3.1505	3.1500		3.1508	3.1500		3.1511	3.1504	
85	**3.3465**	**3.3457**	3.3476	3.3470		3.3479	3.3470		3.3483	3.3474	
90	**3.5433**	**3.5425**	3.5444	3.5438		3.5447	3.5438		3.5451	3.5442	
95	**3.7402**	**3.7394**	3.7413	3.7407		3.7416	3.7407		3.7420	3.7411	
100	**3.9370**	**3.9362**	3.9381	3.9375	5 T	3.9384	3.9375	5 T	3.9388	3.9379	9 T
105	**4.1339**	**4.1331**	4.1350	4.1344	19 T	4.1353	4.1344	22 T	4.1357	4.1348	26 T
110	**4.3307**	**4.3299**	4.3318	4.3312		4.3321	4.3312		4.3325	4.3316	
115	**4.5276**	**4.5268**	4.5287	4.5281		4.5290	4.5281		4.5294	4.5285	
120	**4.7244**	**4.7236**	4.7255	4.7249		4.7258	4.7249		4.7262	4.7253	
125	**4.9213**	**4.9203**	4.9226	4.9219		4.9229	4.9219		4.9233	4.9224	
130	**5.1181**	**5.1171**	5.1194	5.1187		5.1197	5.1187		5.1201	5.1192	
140	**5.5118**	**5.5108**	5.5131	5.5124		5.5134	5.5124		5.5138	5.5129	
150	**5.9055**	**5.9045**	5.9068	5.9061	6 T	5.9071	5.9061	6 T	5.9075	5.9066	11 T
160	**6.2992**	**6.2982**	6.3005	6.2998	23 T	6.3008	6.2998	26 T	6.3012	6.3003	30 T
170	**6.6929**	**6.6919**	6.6942	6.6935		6.6945	6.6935		6.6949	6.6940	
180	**7.0866**	**7.0856**	7.0879	7.0872		7.0882	7.0872		7.0886	7.0877	
190	**7.4803**	**7.4791**	7.4818	7.4810		7.4821	7.4810		7.4827	7.4815	
200	**7.8740**	**7.8728**	7.8755	7.8747	7 T	7.8758	7.8747	7 T	7.8764	7.8752	12 T
220	**8.6614**	**8.6602**	8.6629	8.6621	27 T	8.6632	8.6621	30 T	8.6638	8.6626	36 T
240	**9.4488**	**9.4476**	9.4503	9.4495		9.4506	9.4495		9.4512	9.4500	
250	**9.8425**	**9.8413**	9.8440	9.8432		9.8443	9.8432		9.8449	9.8437	
260	**10.2362**	**10.2348**	10.2379	10.2370		10.2382	10.2370		10.2388	10.2375	
280	**11.0236**	**11.0222**	11.0253	11.0244	8 T	11.0256	11.0244	8 T	11.0262	11.0249	13 T
300	**11.8110**	**11.8096**	11.8127	11.8118	31 T	11.8130	11.8118	34 T	11.8136	11.8123	40 T
310	**12.2047**	**12.2033**	12.2064	12.2055		12.2067	12.2055		12.2073	12.2060	
320	**12.5984**	**12.5968**	12.6002	12.5992		12.6006	12.5992		12.6013	12.5999	
340	**13.3858**	**13.3842**	13.3876	13.3866		13.3880	13.3866		13.3887	13.3873	
350	**13.7795**	**13.7779**	13.7813	13.7803	8 T	13.7817	13.7803	8 T	13.7824	13.7810	15 T
360	**14.1732**	**14.1716**	14.1750	14.1740	34 T	14.1754	14.1740	38 T	14.1761	14.1747	45 T
380	**14.9606**	**14.9590**	14.9624	14.9614		14.9628	14.9614		14.9635	14.9621	
400	**15.7480**	**15.7464**	15.7498	15.7488		15.7502	15.7488		15.7509	15.7495	
420	**16.5354**	**16.5336**	16.5374	16.5363		16.5379	16.5363		16.5385	16.5370	
440	**17.3228**	**17.3210**	17.3248	17.3237	9 T	17.3253	17.3237	9 T	17.3259	17.3244	16 T
460	**18.1102**	**18.1084**	18.1122	18.1111	38 T	18.1127	18.1111	43 T	18.1133	18.1118	49 T
480	**18.8976**	**18.8958**	18.8996	18.8985		18.9001	18.8985		18.9007	18.8992	
500	**19.6850**	**19.6832**	19.6870	19.6859		19.6875	19.6859		19.6881	19.6866	
530	**20.8661**	**20.8641**	20.8683	20.8671		—	—		20.8696	20.8678	
560	**22.0472**	**22.0452**	22.0494	22.0482	10 T	—	—		22.0507	22.0489	17 T
600	**23.6220**	**23.6200**	23.6242	23.6230	42 T	—	—		23.6255	23.6237	55 T
630	**24.8031**	**24.8011**	24.8053	24.8041		—	—		24.8066	24.8048	
660	**25.9843**	**25.9813**	25.9869	25.9855		—	—		25.9882	25.9863	
670	**26.3780**	**26.3750**	26.3806	26.3792		—	—		26.3819	26.3800	
710	**27.9528**	**27.9498**	27.9554	27.9540	12 T	—	—		27.9567	27.9548	20 T
750	**29.5276**	**29.5246**	29.5302	29.5288	56 T	—	—		29.5315	29.5296	69 T
780	**30.7087**	**30.7057**	30.7113	30.7099		—	—		30.7126	30.7107	
800	**31.4961**	**31.4931**	31.4987	31.4973		—	—		31.5000	31.4981	
850	**33.4646**	**33.4607**	33.4675	33.4659		—	—		33.4690	33.4668	
900	**35.4331**	**35.4292**	35.4360	35.4344	13 T	—	—		35.4375	35.4353	22 T
950	**37.4016**	**37.3977**	37.4045	37.4029	68 T	—	—		37.4060	37.4038	83 T
1000	**39.3701**	**39.3662**	39.3730	39.3714		—	—		39.3745	39.3723	

Note: To convert inches to mm, multiply inches by 25.4.
[1] L indicates "LOOSE" fit, T indicates "TIGHT" fit.

ISO fits for cast iron and steel housings

Radial bearings

The ISO housing tolerances listed are shown in the tables on pages 266 and 267.

Conditions	Examples	Tolerance	Displacement of outer ring
Inner ring rotation			
Loads of all kinds	General bearing applications, railway axleboxes	H6[1]	Can be displaced
Light and normal loads ($P \leq 0.10C$) with simple working conditions	General bearing applications	H8	Can be displaced
Heat conduction through shaft	Drying cylinders, large electrical machines with spherical roller bearings	G7[2]	Can be displaced
Direction of load indeterminate*			
Light and normal loads ($P \leq 0.10C$); axial displacement of outer ring desirable	Medium-size electrical machines, pumps, crankshaft bearings	J7	Can usually be displaced
Heavy shock loads	Electric traction motors	M7	Cannot be displaced
Normal and heavy loads ($P > 0.06C$); axial displacement of outer ring unnecessary	Electrical motors, pumps, crankshaft bearings	K7	Cannot usually be displaced
Outer ring rotation**			
Heavy loads on bearings in thin-walled housings, heavy shock loads	Roller bearing wheel hubs, big end bearings	P7	Cannot be displaced
Normal and heavy loads ($P > 0.06C$)	Ball bearing wheel hubs, big end bearings, crane traveling wheels	N7	Cannot be displaced
Light and variable loads ($P \leq 0.06C$)	Conveyor rollers, rope sheaves, belt tension pulleys	M7	Cannot be displaced
Accurate or silent running[3]			
Light loads	Small electric motors	J6[2]	Can be displaced

*Variable external loads, shock loads, and vibratory and unbalanced loads in high-speed machinery cannot be accurately described and are classified as "direction of load indeterminate."
**Warning: If a press fit is also being used on the shaft, special consideration should be given to assembly and bearing internal clearance.
1) For large bearings (D > 250 mm) and temperature difference between outer ring and housing >10° C, use G7.
2) For large bearings (D > 250 mm) and temperature difference between outer ring and housing >10° C, use F7.
3) Not applicable to high precision bearings.

ISO fits for cast iron and steel housings

Housing bearing-seat diameters (values in inches)

Bearing outside diameter			F7			G7			H6			H8			J6		
	inches		Housing bore		Resultant fit[1] in 0.0001″	Housing bore		Resultant fit[1] in 0.0001″	Housing bore		Resultant fit[1] in 0.0001″	Housing bore		Resultant fit[1] in 0.0001″	Housing bore		Resultant fit[1] in 0.0001″
mm	Max	Min	Min	Max		Min	Max		Min	Max		Min	Max		Min	Max	
16	0.6299	0.6296	0.6305	0.6312	16 L 6 L	0.6301	0.6308	12 L 2 L	0.6299	0.6303	7 L 0 L	0.6299	0.6310	14 L 0 L	0.6297	0.6301	5 L 2 T
19	0.7480	0.7476	0.7488	0.7496		0.7483	0.7491		0.7480	0.7485		0.7480	0.7493		0.7478	0.7483	
22	0.8661	0.8657	0.8669	0.8677		0.8664	0.8672		0.8661	0.8666		0.8661	0.8674		0.8659	0.8664	
24	0.9449	0.9445	0.9457	0.9465	20 L	0.9452	0.9460	15 L	0.9449	0.9454	9 L	0.9449	0.9462	17 L	0.9447	0.9452	7 L
26	1.0236	1.0232	1.0244	1.0252	8 L	1.0239	1.0247	3 L	1.0236	1.0241	0 L	1.0236	1.0249	0 L	1.0234	1.0239	2 T
28	1.1024	1.1020	1.1032	1.1040		1.1027	1.1035		1.1024	1.1029		1.1024	1.1037		1.1022	1.1027	
30	1.1811	1.1807	1.1819	1.1827		1.1814	1.1822		1.1811	1.1816		1.1811	1.1824		1.1809	1.1814	
32	1.2598	1.2594	1.2608	1.2618		1.2602	1.2611		1.2598	1.2604		1.2598	1.2613		1.2596	1.2602	
35	1.3780	1.3776	1.3790	1.4000		1.3784	1.3793		1.3780	1.3786		1.3780	1.3795		1.3778	1.3784	
37	1.4567	1.4563	1.4577	1.4587	24 L	1.4571	1.4580	17 L	1.4567	1.4573	10 L	1.4567	1.4582	19 L	1.4565	1.4571	8 L
40	1.5748	1.5744	1.5758	1.5768	10 L	1.5752	1.5761	4 L	1.5748	1.5754	0 L	1.5748	1.5763	0 L	1.5746	1.5752	2 T
42	1.6535	1.6531	1.6545	1.6555		1.6539	1.6548		1.6535	1.6541		1.6535	1.6550		1.6533	1.6539	
47	1.8504	1.8500	1.8514	1.8524		1.8508	1.8517		1.8504	1.8510		1.8504	1.8519		1.8502	1.8508	
52	2.0472	2.0467	2.0484	2.0496		2.0476	2.0488		2.0472	2.0479		2.0472	2.0490		2.0470	2.0477	
55	2.1654	2.1649	2.1666	2.1678		2.1658	2.1670		2.1654	2.1661		2.1654	2.1672		2.1652	2.1659	
62	2.4409	2.4404	2.4421	2.4433	29 L	2.4413	2.4425	21 L	2.4409	2.4416	12 L	2.4409	2.4427	23 L	2.4407	2.4414	10 L
68	2.6772	2.6767	2.6784	2.6796	12 L	2.6776	2.6788	4 L	2.6772	2.6779	0 L	2.6772	2.6790	0 L	2.6770	2.6777	2 T
72	2.8346	2.8341	2.8358	2.8370		2.8350	2.8362		2.8346	2.8353		2.8346	2.8364		2.8344	2.8351	
75	2.9527	2.9522	2.9539	2.9551		2.9532	2.9543		2.9527	2.9534		2.9527	2.9545		2.9525	2.9532	
80	3.1496	3.1491	3.1508	3.1520		3.1500	3.1512		3.1496	3.1503		3.1496	3.1514		3.1494	3.1501	
85	3.3465	3.3459	3.3479	3.3493		3.3470	3.3484		3.3465	3.3474		3.3465	3.3486		3.3463	3.3471	
90	3.5433	3.5427	3.5447	3.5461		3.5438	3.5452		3.5433	3.5442		3.5433	3.5454		3.5431	3.5439	
95	3.7402	3.7396	3.7416	3.7430		3.7407	3.7421		3.7402	3.7411		3.7402	3.7423		3.7400	3.7408	
100	3.9370	3.9364	3.9384	3.9398	34 L	3.9375	3.9389	25 L	3.9370	3.9379	15 L	3.9370	3.9391	27 L	3.9368	3.9376	12 L
110	4.3307	4.3301	4.3321	4.3335	14 L	4.3312	4.3326	5 L	4.3307	4.3316	0 L	4.3307	4.3328	0 L	4.3305	4.3313	2 T
115	4.5276	4.5270	4.5290	4.5304		4.5281	4.5295		4.5276	4.5285		4.5276	4.5297		4.5274	4.5282	
120	4.7244	4.7238	4.7258	4.7272		4.7249	4.7263		4.7244	4.7253		4.7244	4.7265		4.7242	4.7250	
125	4.9213	4.9206	4.9230	4.9246		4.9219	4.9234		4.9213	4.9223		4.9213	4.9238		4.9210	4.9220	
130	5.1181	5.1174	5.1198	5.1214		5.1187	5.1202		5.1181	5.1191		5.1181	5.1206		5.1178	5.1188	
140	5.5118	5.5111	5.5135	5.5151	40 L	5.5124	5.5139	28 L	5.5118	5.5128	17 L	5.5118	5.5143	32 L	5.5115	5.5125	14 L
145	5.7087	5.7080	5.7104	5.7120	17 L	5.7093	5.7108	6 L	5.7087	5.7097	0 L	5.7087	5.7112	0 L	5.7084	5.7094	3 T
150	5.9055	5.9048	5.9072	5.9088		5.9061	5.9076		5.9055	5.9065		5.9055	5.9080		5.9052	5.9062	
160	6.2992	6.2982	6.3009	6.3025		6.2998	6.3013		6.2992	6.3002		6.2992	6.3017		6.2989	6.2999	
165	6.4961	6.4951	6.4978	6.4994	43 L	6.4967	6.4982	31 L	6.4961	6.4971	20 L	6.4961	6.4986	35 L	6.4958	6.4968	17 L
170	6.6929	6.6919	6.6946	6.6962	17 L	6.6935	6.6950	6 L	6.6929	6.6939	0 L	6.6929	6.6954	0 L	6.6926	6.6936	3 T
180	7.0866	7.0856	7.0883	7.0899		7.0872	7.0887		7.0866	7.0876		7.0866	7.0891		7.0863	7.0873	
190	7.4803	7.4791	7.4823	7.4841		7.4809	7.4827		7.4803	7.4814		7.4803	7.4831		7.4800	7.4812	
200	7.8740	7.8728	7.8760	7.8778		7.8746	7.8764		7.8740	7.8751		7.8740	7.8768		7.8737	7.8749	
210	8.2677	8.2665	8.2697	8.2715		8.2683	8.2701		8.2677	8.2688		8.2677	8.2705		8.2674	8.2686	
215	8.4646	8.4634	8.4666	8.4684	50 L	8.4652	8.4670	36 L	8.4646	8.4657	23 L	8.4646	8.4674	40 L	8.4643	8.4655	21 L
220	8.6614	8.6602	8.6634	8.6652	20 L	8.6602	8.6638	6 L	8.6614	8.6625	0 L	8.6614	8.6642	0 L	8.6611	8.6623	3 T
225	8.8583	8.8571	8.8603	8.8621		8.8589	8.8607		8.8583	8.8594		8.8583	8.8611		8.8580	8.8592	
230	9.0551	9.0539	9.0571	9.0589		9.0557	9.0575		9.0551	9.0562		9.0551	9.0579		9.0548	9.0560	
240	9.4488	9.4476	9.4508	9.4526		9.4494	9.4512		9.4488	9.4499		9.4488	9.4516		9.4485	9.4497	
250	9.8425	9.8413	9.8445	9.8463		9.8431	9.8449		9.8425	9.8436		9.8425	9.8453		9.8422	9.8434	
260	10.2362	10.2348	10.2384	10.2405		10.2369	10.2389		10.2362	10.2375		10.2362	10.2394		10.2359	10.2372	
270	10.6299	10.6285	10.6321	10.6342		10.6306	10.6326		10.6299	10.6312		10.6299	10.6331		10.6296	10.6309	
280	11.0236	11.0222	11.0258	11.0279	57 L	11.0243	11.0263	41 L	11.0236	11.0249	27 L	11.0236	11.0268	46 L	11.0233	11.0246	24 L
290	11.4173	11.4159	11.4195	11.4216	22 L	11.4180	11.4200	7 L	11.4173	11.4186	0 L	11.4173	11.4205	0 L	11.4170	11.4183	3 T
300	11.8110	11.8096	11.8132	11.8153		11.8117	11.8137		11.8110	11.8123		11.8110	11.8142		11.8107	11.8120	
310	12.2047	12.2033	12.2069	12.2090		12.2054	12.2074		12.2047	12.2060		12.2047	12.2079		12.2044	12.2057	
320	12.5984	12.5968	12.6008	12.6031		12.5991	12.6014		12.5984	12.5998		12.5984	12.6019		12.5981	12.5995	
340	13.3858	13.3842	13.3882	13.3905		13.3865	13.3888		13.3858	13.3872		13.3858	13.3893		13.3855	13.3869	
360	14.1732	14.1716	14.1756	14.1779	63 L	14.1739	14.1762	46 L	14.1732	14.1746	30 L	14.1732	14.1767	51 L	14.1729	14.1743	27 L
370	14.5669	14.5654	14.5694	14.5717	24 L	14.5677	14.5700	7 L	14.5669	14.5684	0 L	14.5670	14.5705	0 L	14.5666	14.5681	3 T
380	14.9606	14.9590	14.9630	14.9653		14.9613	14.9636		14.9606	14.9620		14.9606	14.9641		14.9603	14.9617	
400	15.7480	15.7464	15.7504	15.7527		15.7487	15.7510		15.7480	15.7494		15.7480	15.7515		15.7477	15.7491	
420	16.5354	16.5336	16.5381	16.5406		16.5362	16.5387		16.5354	16.5370		16.5354	16.5392		16.5351	16.5367	
440	17.3228	17.3210	17.3255	17.3280	70 L	17.3236	17.3261	51 L	17.3228	17.3244	34 L	17.3228	17.3266	56 L	17.3225	17.3241	31 L
460	18.1102	18.1084	18.1129	18.1154	27 L	18.1110	18.1135	8 L	18.1102	18.1118	0 L	18.1102	18.1140	0 L	18.1099	18.1115	3 T
480	18.8976	18.8958	18.9003	18.9028		18.8984	18.9009		18.8976	18.8992		18.8976	18.9014		18.8973	18.8989	
500	19.6850	19.6832	19.6877	19.6902		19.6858	19.6883		19.6850	19.6866		19.6850	19.6888		19.6847	19.6863	
520	20.4724	20.4704	20.4754	20.4781		20.4733	20.4760		20.4724	20.4741		20.4724	20.4767		20.4721	20.4739	
540	21.2598	21.2578	21.2628	21.2655		21.2607	21.2634		21.2598	21.2615		21.2598	21.2641		21.2595	21.2613	
560	22.0472	22.0452	22.0502	22.0529	77 L	22.0481	22.0508	56 L	22.0472	22.0489	37 L	22.0472	22.0515	63 L	22.0469	22.0487	35 L
580	22.8346	22.8326	22.8376	22.8403	30 L	22.8355	22.8382	9 L	22.8346	22.8363	0 L	22.8346	22.8389	0 L	22.8343	22.8361	3 T
600	23.6220	23.6200	23.6250	23.6277		23.6229	23.6256		23.6220	23.6237		23.6202	23.6263		23.6217	23.6235	
620	24.4094	24.4074	24.4124	24.4151		24.4103	24.4130		24.4094	24.4111		24.4094	24.4137		24.4091	24.4109	
650	25.5906	25.5876	25.5937	25.5969		25.5915	25.5947		25.5906	25.5926		25.5906	25.5955		25.5902	25.5922	
670	26.3780	26.3750	26.3811	26.3843		26.3789	26.3821		26.3780	26.3800		26.3780	26.3829		26.3776	26.3796	
680	26.7717	26.7687	26.7748	26.7780		26.7726	26.7758		26.7717	26.7737		26.7717	26.7766		26.7713	26.7733	
700	27.5591	27.5561	27.5622	27.5654		27.5600	27.5632		27.5591	27.5611		27.5591	27.5640		27.5587	27.5607	
720	28.3465	28.3435	28.3496	28.3528	93 L	28.3474	28.3506	71 L	28.3465	28.3485	50 L	28.3465	28.3514	79 L	28.3461	28.3481	46 L
750	29.5276	29.5246	29.5307	29.5339	31 L	29.5285	29.5317	9 L	29.5276	29.5296	0 L	29.5276	29.5325	0 L	29.5272	29.5292	4 T
760	29.9213	29.9183	29.9244	29.9276		29.9222	29.9254		29.9213	29.9233		29.9213	29.9262		29.9209	29.9229	
780	30.7087	30.7057	30.7118	30.7150		30.7096	30.7128		30.7087	30.7107		30.7087	30.7136		30.7083	30.7103	
790	31.1024	31.0994	31.1055	31.1087		31.1033	31.1065		31.1024	31.1044		31.1024	31.1073		31.1020	31.1040	
800	31.4961	31.4931	31.4992	31.5024		31.4970	31.5002		31.4961	31.4981		31.4961	31.5010		31.4957	31.4968	

Note: To convert inches to mm, multiply inches by 25.4.
[1] L indicates "LOOSE" fit, T indicates "TIGHT" fit.

ISO fits for cast iron and steel housings

Housing bearing-seat diameters (values in inches)

Bearing outside diameter			J7			K7			M7			N7			P7		
	inches		Housing bore		Resultant fit[1] in	Housing bore		Resultant fit[1] in	Housing bore		Resultant fit[1] in	Housing bore		Resultant fit[1] in	Housing bore		Resultant fit[1] in
mm	Max	Min	Min	Max	0.0001″	Min	Max	0.0001″	Min	Max	0.0001″	Min	Max	0.0001″	Min	Max	0.1000″
16	0.6299	0.6296	0.6296	0.6303	7 L 3 T	0.6294	0.6301	5 L 5 T	0.6292	0.6299	3 L 7 T	0.6290	0.6297	1 L 9 T	0.6288	0.6295	1 T 11 T
19	0.7480	0.7476	0.7476	0.7485		0.7474	0.7482		0.7472	0.7480		0.7469	0.7477		0.7466	0.7474	
22	0.8661	0.8657	0.8657	0.8666		0.8655	0.8663		0.8653	0.8661		0.8650	0.8658		0.8647	0.8655	
24	0.9449	0.9445	0.9445	0.9454	9 L	0.9443	0.9451	6 L	0.9441	0.9449	4 L	0.9438	0.9446	1 L	0.9435	0.9443	2 T
26	1.0236	1.0232	1.0232	1.0241	4 T	1.0230	1.0238	6 T	1.0228	1.0236	8 T	1.0225	1.0233	11 T	1.0222	1.0230	14 T
28	1.1024	1.1020	1.1020	1.1029		1.1018	1.1026		1.1016	1.1024		1.1013	1.1021		1.1010	1.1018	
30	1.1811	1.1807	1.1807	1.1816		1.1805	1.1813		1.1803	1.1811		1.1800	1.1808		1.1797	1.1805	
32	1.2598	1.2594	1.2594	1.2604		1.2591	1.2601		1.2588	1.2598		1.2585	1.2595		1.2581	1.2591	
35	1.3780	1.3776	1.3776	1.3786		1.3773	1.3783		1.3770	1.3780		1.3767	1.3777		1.3763	1.3773	
37	1.4567	1.4563	1.4563	1.4573	10 L	1.4560	1.4570	7 L	1.4557	1.4567	4 L	1.4554	1.4564	1 L	1.4550	1.4560	3 T
40	1.5748	1.5744	1.5744	1.5754	4 T	1.5741	1.5751	7 T	1.5738	1.5748	10 T	1.5735	1.5745	13 T	1.5731	1.5741	17 T
42	1.6535	1.6531	1.6531	1.6541		1.6528	1.6538		1.6525	1.6535		1.6522	1.6532		1.6518	1.6528	
47	1.8504	1.8500	1.8500	1.8510		1.8497	1.8507		1.8494	1.8504		1.8491	1.8501		1.8487	1.8497	
52	2.0472	2.0467	2.0467	2.0479		2.0464	2.0476		2.0460	2.0472		2.0457	2.0468		2.0452	2.0464	
55	2.1654	2.1649	2.1649	2.1661		2.1646	2.1658		2.1642	2.1654		2.1639	2.1650		2.1634	2.1646	
62	2.4409	2.4404	2.4404	2.4416	12 L	2.4401	2.4413	9 L	2.4397	2.4409	5 L	2.4394	2.4405	1 L	2.4389	2.4401	3 T
68	2.6772	2.6767	2.6767	2.6779	5 T	2.6764	2.6776	8 T	2.6760	2.6772	12 T	2.6760	2.6770	15 T	2.6752	2.6763	20 T
72	2.8346	2.8341	2.8341	2.8353		2.8338	2.8350		2.8334	2.8346		2.8331	2.8342		2.8326	2.8338	
75	2.9527	2.9522	2.9522	2.9534		2.9519	2.9531		2.9516	2.9528		2.9510	2.9520		2.9507	2.9519	
80	3.1496	3.1491	3.1491	3.1503		3.1488	3.1500		3.1484	3.1496		3.1481	3.1492		3.1476	3.1488	
85	3.3465	3.3459	3.3460	3.3474		3.3455	3.3469		3.3451	3.3465		3.3447	3.3461		3.3442	3.3456	
90	3.5433	3.5427	3.5428	3.5442		3.5423	3.5437		3.5419	3.5433		3.5415	3.5429		3.5410	3.5424	
95	3.7402	3.7396	3.7397	3.7411		3.7392	3.7406		3.7388	3.7402		3.7380	3.7400		3.7378	3.7392	
100	3.9370	3.9364	3.9365	3.9379	15 L	3.9360	3.9374	10 L	3.9356	3.9370	6 L	3.9352	3.9366	2 L	3.9347	3.9361	3 T
110	4.3307	4.3301	4.3302	4.3316	5 T	4.3297	4.3311	10 T	4.3293	4.3307	14 T	4.3289	4.3303	18 T	4.3284	4.3298	23 T
115	4.5276	4.5270	4.5271	4.5285		4.5266	4.5280		4.5262	4.5276		4.5258	4.5272		4.5253	4.5267	
120	4.7244	4.7238	4.7239	4.7253		4.7234	4.7248		4.7230	4.7244		4.7226	4.7240		4.7221	4.7235	
125	4.9213	4.9206	4.9207	4.9223		4.9202	4.9218		4.9197	4.9213		4.9193	4.9208		4.9186	4.9202	
130	5.1181	5.1174	5.1175	5.1191		5.1170	5.1186		5.1165	5.1181		5.1161	5.1176		5.1154	5.1170	
140	5.5118	5.5111	5.5112	5.5128	17 L	5.5107	5.5123	12 L	5.5102	5.5118	7 L	5.5098	5.5113	2 L	5.5091	5.5107	4 T
145	5.7087	5.7080	5.7081	5.7097	6 T	5.7076	5.7092	11 T	5.7071	5.7087	16 T	5.7067	5.7082	20 T	5.7060	5.7076	27 T
150	5.9055	5.9048	5.9049	5.9065		5.9044	5.9060		5.9039	5.9055		5.9035	5.9050		5.9028	5.9044	
160	6.2992	6.2982	6.2986	6.3002		6.2981	6.2997		6.2976	6.2992		6.2972	6.2987		6.2965	6.2981	
165	6.4961	6.4951	6.4955	6.4971	20 L	6.4950	6.4966	15 L	6.4945	6.4961	10 L	6.4940	6.4960	5 L	6.4934	6.4950	1 T
170	6.6929	6.6919	6.6923	6.6939	6 T	6.6918	6.6934	11 T	6.6913	6.6929	16 T	6.6909	6.6924	20 T	6.6902	6.6918	27 T
180	7.0866	7.0856	7.0860	7.0876		7.0855	7.0871		7.0850	7.0866		7.0846	7.0861		7.0839	7.0855	
190	7.4803	7.4791	7.4797	7.4815		7.4790	7.4808		7.4785	7.4803		7.4779	7.4797		7.4772	7.4790	
200	7.8740	7.8728	7.8734	7.8752		7.8727	7.8745		7.8722	7.8740		7.8716	7.8734		7.8709	7.8727	
210	8.2677	8.2665	8.2671	8.2689		8.2664	8.2682		8.2659	8.2677		8.2653	8.2671		8.2646	8.2664	
215	8.4646	8.4634	8.4640	8.4658	24 L	8.4633	8.4651	17 L	8.4628	8.4646	12 L	8.4622	8.4640	6 L	8.4615	8.4633	1 T
220	8.6614	8.6602	8.6608	8.6626	6 T	8.6601	8.6619	13 T	8.6596	8.6614	18 T	8.6590	8.6610	24 T	8.6583	8.6601	31 T
225	8.8583	8.8571	8.8577	8.8595		8.8570	8.8588		9.0571	8.8583		8.8559	8.8577		8.8552	8.8570	
230	9.0551	9.0539	9.0545	9.0563		9.0538	9.0556		9.0533	9.0551		9.0530	9.0550		9.0520	9.0538	
240	9.4488	9.4476	9.4482	9.4500		9.4475	9.4493		9.4470	9.4488		9.4464	9.4482		9.4457	9.4475	
250	9.8425	9.8413	9.8419	9.8437		9.8412	9.8430		9.8407	9.8425		9.8401	9.8419		9.8394	9.8412	
260	10.2362	10.2348	10.2356	10.2376		10.2348	10.2368		10.2342	10.2362		10.2336	10.2356		10.2327	10.2348	
270	10.6299	10.6285	10.6293	10.6313		10.6285	10.6305		10.6279	10.6299		10.6270	10.6290		10.6265	10.6285	
280	11.0236	11.0222	11.0230	11.0250	28 L	11.0222	11.0242	20 L	11.0216	11.0236	14 L	11.0210	11.0230	8 L	11.0201	11.0222	0 T
290	11.4173	11.4159	11.4167	11.4187	6 T	11.4159	11.4179	14 T	11.4153	11.4173	20 T	11.4150	11.4170	26 T	11.4139	11.4159	35 T
300	11.8110	11.8096	11.8104	11.8124		11.8096	11.8116		11.8090	11.8110		11.8084	11.8104		11.8075	11.8096	
310	12.2047	12.2033	12.2041	12.2061		12.2033	12.2053		12.2027	12.2047		12.2021	12.2041		12.2012	12.2033	
320	12.5984	12.5968	12.5977	12.5999		12.5968	12.5991		12.5962	12.5984		12.5955	12.5978		12.5945	12.5968	
340	13.3858	13.3842	13.3851	13.3873		13.3842	13.3865		12.3836	12.3858		13.3829	13.3852		13.3819	13.3842	
360	14.1732	14.1716	14.1725	14.1747	31 L	14.1716	14.1739	23 L	14.1710	14.1732	16 L	14.1703	14.1726	10 L	14.1693	14.1716	0 T
370	14.5669	14.5654	14.5662	14.5685	7 T	14.5653	14.5677	16 T	14.5647	14.5669	22 T	14.5640	14.5660	29 T	14.5631	14.5653	39 T
380	14.9606	14.9590	14.9599	14.9621		14.9590	14.9613		14.9584	14.9606		14.9577	14.9600		14.9567	14.9590	
400	15.7480	15.7464	15.7473	15.7495		15.7464	15.7487		15.7458	15.7480		15.7451	15.7474		15.7441	15.7464	
420	16.5354	16.5336	16.5346	16.5371		16.5336	16.5361		16.5329	16.5354		16.5323	16.5347		16.5311	16.5336	
440	17.3228	17.321	17.3220	17.3245	35 L	17.3210	17.3235	25 L	17.3203	17.3228	18 L	17.3197	17.3221	11 L	17.3185	17.3210	0 T
460	18.1102	18.1084	18.1094	18.1119	8 T	18.1084	18.1109	18 T	18.1077	18.1102	25 T	18.1071	18.1095	31 T	18.1059	18.1084	43 T
480	18.8976	18.8958	18.8968	18.8993		18.8958	18.8983		18.8951	18.8976		18.8945	18.8969		18.8933	18.8958	
500	19.6850	19.6832	19.6842	19.6867		19.6832	19.6857		19.6825	19.6850		19.6819	19.6843		19.6807	19.6832	
520	20.4724	20.4704	20.4715	20.4743		20.4696	20.4724		20.4686	20.4714		20.4679	20.4707		20.4666	20.4693	
540	21.2598	21.2578	21.2589	21.2617		21.2570	21.2598		21.2560	21.2588		21.2553	21.2581		21.2540	21.2567	
560	22.0472	22.0452	22.0463	22.0491	39 L	22.0444	22.0472	20 L	22.0435	22.0462	10 L	22.0430	22.0460	3 L	22.0414	22.0442	11 T
580	22.8346	22.8326	22.8337	22.8365	9 T	22.8318	22.8346	28 T	22.8308	22.8336	38 T	22.8301	22.8329	45 T	22.8288	22.8315	58 T
600	23.6220	23.6200	23.6211	23.6239		23.6192	23.6220		23.6182	23.6210		23.6175	23.6203		23.6162	23.6189	
620	24.4094	24.4074	24.4085	24.4113		24.4066	24.4094		24.4056	24.4084		24.4049	24.4077		24.4036	24.4063	
650	25.5906	25.5876	25.5897	25.5928		25.5875	25.5906		25.5863	25.5894		25.5855	25.5886		25.5840	25.5871	
670	26.3780	26.3750	26.3771	26.3802		26.3749	26.3780		26.3737	26.3768		26.3729	26.3760		26.3714	26.3745	
680	26.7717	26.7687	26.7708	26.7739		26.7686	26.7717		26.7674	26.7705		26.7666	26.7697		26.7651	26.7682	
700	27.5591	27.5561	27.5582	27.5613		27.5560	27.5591		27.5548	27.5579		27.5540	27.5571		27.5525	27.5556	
720	28.3465	28.3435	28.3456	28.3487	52 L	28.3434	28.3465	30 L	28.3422	28.3453	18 L	28.3414	28.3445	10 L	28.3399	28.3430	5 T
750	29.5276	29.5246	29.5267	29.5298	9 T	29.5245	29.5276	31 T	29.5233	29.5264	43 T	29.5225	29.5256	51 T	29.5210	29.5241	66 T
760	29.9213	29.9183	29.9204	29.9235		29.9182	29.9213		29.9169	29.9201		29.9160	29.9190		29.9146	29.9178	
780	30.7087	30.7057	30.7078	30.7109		30.7056	30.7087		30.7044	30.7075		30.7036	30.7077		30.7021	30.7052	
790	31.1024	31.0994	31.1015	31.1046		31.0993	31.1024		31.0981	31.1012		31.0973	31.1004		31.0958	31.0989	
800	31.4961	31.4931	31.4952	31.4974		31.4930	31.4952		31.4917	31.4949		31.4910	31.4940		31.4894	31.4926	

Note: To convert inches to mm, multiply inches by 25.4.
[1] L indicates "LOOSE" fit, T indicates "TIGHT" fit.

Internal radial clearance tolerances for single-row ball bearings

ABMA tolerances are listed up to and including 200 mm.

MRC tolerances are listed from 200 mm up to and including 500 mm.

Tolerance limits are listed in ten thousandths inches (.0001″) and micrometers (µm).

Axial and radial clearance for double row bearings are shown on page 95.

Bore over		Including		Bearing Series		ABMA C2 / MRC TI		C0 / ST		C3 / LO		C4 / XL	
				Inch sizes R, XLS	Metric sizes 30, 100K, 200, 300, 400, 1900								
mm	in.	mm	in.			in.	(µm)	in.	(µm)	in.	(µm)	in.	(µm)
2.50	—	10	—	—	34-39	**0-3**	0-8	**1-5**	3-13	**3-9**	8-23	**6-12***	15-30*
2.50	**.0984**	10	**.3937**	R2–R6	00	**0-3**	0-8	**1-5**	3-13	**3-9**	8-23	**6-12***	15-30*
10	**.3937**	18	**.7087**	R8–R10	01-03	**0-3.5**	0-9	**1-7**	3-18	**4-10**	10-25	**7-13**	18-33
18	**.7087**	24	**.9449**	R12–R14	04	**0-4**	0-10	**2-8**	5-20	**5-11**	13-28	**8-14**	20-36
24	**.9449**	30	**1.1811**	R16–R18	05-06	**0-4.5**	0-11	**2-8**	5-20	**5-11**	13-28	**9-16**	23-41
30	**1.1811**	40	**1.5748**	R20	07-08	**0-4.5**	0-11	**2-8**	5-20	**6-13**	15-33	**11-18**	28-46
—	**1.1811**	—	**1.5748**	1 3/8–1 1/2	—	**0-4.5**	0-11	**2-8**	5-20	**6-13**	15-33	**11-18**	28-46
40	**1.5748**	50	**1.9665**	1 5/8–1 7/8	09-10	**0-4.5**	0-11	**2-9**	5-23	**7-14**	18-36	**12-20**	30-51
50	**1.9685**	65	**2.5591**	2–2 1/2	11-13	**0-6**	0-15	**3-11**	8-28	**9-17**	23-43	**15-24**	38-61
65	**2.5591**	80	**3.1496**	2 5/8–3 1/8	14-16	**0-6**	0-15	**4-12**	10-30	**10-20**	25-51	**18-28**	45-71
80	**3.1496**	100	**3.9370**	3 1/4–3 7/8	17-20	**0-7**	0-18	**5-14**	13-36	**12-23**	30-58	**21-33**	53-64
100	**3.9370**	120	**4.7244**	4–4 5/8	21-24	**0-8**	0-20	**6-16**	15-41	**14-26**	36-66	**24-38**	61-97
120	**4.7244**	140	**5.5118**	4 3/4–5 1/2	26-28	**0-9**	0-23	**7-19**	18-48	**16-32**	41-81	**28-45**	71-114
140	**5.5118**	160	**6.2992**	5 3/8–6 1/4	30-32	**0-9**	0-23	**7-21**	18-53	**18-36**	46-91	**32-51**	81-130
160	**6.2992**	180	**7.0866**	6 1/2–7	34-36	**0-10**	0-25	**8-24**	20-61	**21-40**	53-102	**36-58**	91-147
180	**7.0866**	200	**7.8740**	7 1/4–7 3/4	38-40	**0-12**	0-30	**10-28**	25-71	**25-46**	64-117	**42-64**	107-163
200	**7.8740**	220	**8.6614**	8–8 1/2	42-44	**0-12**	0-30	**12-30**	30-76	**29-50**	74-127	**47-69**	119-175
220	**8.6614**	240	**9.4488**	8 3/4–9	46-48	**1-13**	3-33	**15-33**	38-84	**35-56**	89-142	**55-77**	140-196
240	**9.4485**	260	**10.2362**	9 1/2–10	50-52	**2-14**	5-36	**18-36**	45-91	**42-63**	107-160	**64-86**	163-218
260	**10.2352**	280	**11.0236**	10 1/2–11	56	**2-14**	5-36	**21-39**	53-99	**49-70**	124-178	**74-96**	188-244
280	**11.0236**	300	**11.8110**	11 1/2	60	**3-15**	8-38	**25-43**	64-109	**57-78**	145-198	**85-107**	216-272
300	**11.8110**	320	**12.5984**	12	64	**4-16**	10-41	**29-47**	74-119	**67-88**	107-223	**98-120**	249-304
320	**12.5984**	340	**13.3858**	—	—	**4-16**	10-41	**33-51**	84-130	**78-99**	198-251	**113-135**	287-343
340	**13.3858**	360	**14.1732**	—	—	**5-17**	13-43	**38-56**	96-142	**91-112**	231-284	**129-151**	327-384
360	**14.1732**	380	**14.9606**	—	—	**6-18**	15-46	**43-61**	109-155	**106-127**	269-323	**149-171**	378-434
380	**14.9606**	400	**15.7480**	—	—	**7-19**	18-48	**48-66**	122-168	**126-147**	320-373	**169-191**	429-485
400	**15.7480**	420	**16.5354**	—	—	**7-19**	18-48	**54-72**	137-183	**148-169**	376-429	**193-215**	490-546
420	**16.5354**	440	**17.3223**	—	—	**8-20**	20-51	**60-78**	152-198	**173-194**	439-493	**220-242**	559-615
440	**17.3223**	460	**18.1102**	—	—	**9-21**	23-53	**67-85**	170-216	**202-223**	513-566	**251-273**	638-693
460	**18.1106**	480	**18.8976**	—	—	**10-22**	25-56	**74-92**	188-234	**234-255**	594-648	**285-307**	724-780
480	**18.8976**	500	**19.6850**	—	—	**12-24**	30-61	**82-100**	208-254	**269-290**	683-737	**326-348**	828-884

*Not ABMA Value

Definition of dynamic and static radial load ratings

The size of a bearing to be used for an application is initially selected on the basis of its load carrying capacity in relation to the loads to be carried and the requirements regarding life and reliability. Numerical values of basic load ratings are used in calculations to express load carrying capacity. The basic dynamic load rating C and the basic static load rating C_0 are quoted in the bearing tables. All values expressed are radial ratings.

Dynamic radial load rating

The basic dynamic load rating C is used for calculations involving the selection of bearings which rotate under load. It expresses the bearing radial load which will give a basic rating life of one million revolutions. The actual calculated life depends on the magnitude of the imposed load. The imposed load produces rolling element and raceway deformation as illustrated in Figure 1, resulting in tensile (t) and compressive (c) stresses as each rolling element passes through the loaded zone. As these stress cycles are repeated, as determined by the number of revolutions of calculated life, sub-surface metal fatigue cracks occur which eventually propagate to the raceway surface causing metal flaking, or spalling, at which time the bearing has achieved its useful life.

The basic dynamic radial load ratings of MRC bearings have been determined in accordance with the latest ISO and ABMA standards and are based on the material and manufacturing techniques used for MRC standard production. They apply to radial loads acting on radial and angular contact bearings which are constant in magnitude and direction. For single row angular contact bearings, the radial load rating refers to the radial component of that load which causes a purely radial displacement of the bearing rings in relation to each other.

Static radial load rating

The basic static radial load rating C_0 is used when bearings rotate at very slow speeds, are subjected to very slow oscillations, or stationary under load. It also must be considered when heavy shock loads of short duration act on a rotating bearing.

The basic static radial load rating is defined in accordance with ISO and ABMA standards as the static radial load which corresponds to a calculated contact stress at the center of the most heavily loaded rolling element/raceway contact of 609000 PSI for all radial and angular contact ball bearings. For this contact stress, a total permanent deformation of rolling element and raceway occurs which is approximately 0.0001 of the rolling element diameter as shown in Figure 2.

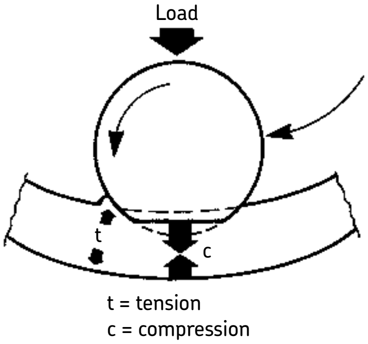


Figure 1

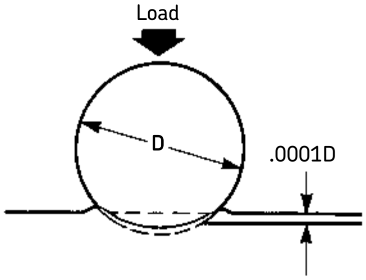


Figure 2

Bearing life

Definition of bearing life

The life of a rolling bearing is defined as the number of revolutions or the number of hours at a given speed which the bearing is capable of enduring before the first sign of fatigue failure occurs on one of its rings or rolling elements.

The fatigue failure usually takes the form of surface spalling or flaking which progresses to the point where the bearing becomes inoperative. The load ratings shown in this catalog are based on the useful life of a bearing as limited by this type of failure.

When a group of identical bearings are run under a set condition of speed and load, there will be considerable variation in the fatigue lives in the group. As a result, life must be treated statistically.

The life which 90% of a group of bearings will exceed is known as the "minimum life" or "rating life". A commonly used term as used in this catalog is "L_{10}". The life which 50% of a group of bearings will exceed is the "median life" (L_{50}) and is approximately five times the "minimum life".

The actual life of a specific bearing is referred to as "service life" and unlike "minimum" or "rating" life, is not generated by fatigue. It is the result of contamination, corrosion, misalignment, etc., significantly reducing life.

Life adjustment factor for reliability, a_1

To determine bearing life in accordance with reliability greater than 90%, the L_{10} life must be multiplied by the factor a_1 as shown in the table below.

Life adjustment factor for reliability, a_1

Reliability %	L_{ma}	a_1
90	L_{10}	1
95	L_5	0.62
96	L_4	0.53
97	L_3	0.44
98	L_2	0.33
99	L_1	0.21

When bearings are stationary, rotate or oscillate very slowly or subjected to heavy shock loads, the basic static load rating (C_0) must not be exceeded. As specified in ABMA and ISO standards, the static load rating is that load which produces a total permanent deformation of the rolling element or raceway which is approximately 0.0001 of the rolling element diameter. Deformation greater than this amount may result in noisy operation and premature failure.

Determination of bearing life

Bearing "rating life" can be calculated by referring to the procedure and example located at the back of each bearing section. Both dynamic (C) and static (C_0) load ratings are listed on the preceding pages. The load ratings and life calculation method agree with ABMA and ISO standards, with the exception of mast guide and PumPac bearings. The rating of these bearings has been modified to reflect raceway curvatures less than a total of 54%.

Speed factors for dynamic load ratings

The speed factors shown in the table below are used to convert the basic dynamic radial load rating (C) to speeds other than 33$^1/_3$ rpm, by multiplying C by the speed factor. The values of C are listed in the bearing dimension tables.

Example:
Find dynamic radial load rating of 309S bearing at 2000 rpm
Basic dynamic radial loading rating (C) = 11900 lbs
Speed factor at 2000 rpm = .255
Rating at 2000 rpm = 11900 × .255 = 3035

For speed factors at speeds not shown, use the following formula:

$$\text{Speed factor} = 3.218\left(\frac{1}{n}\right)^{1/3} \text{ where n = operating rpm}$$

rpm	Factor	rpm	Factor	rpm	Factor	rpm	Factor	rpm	Factor	rpm	Factor	rpm	Factor
35	.9838	420	.4297	870	.3371	1 640	.2729	2 600	.2340	6 100	.1761	16 000	.1277
40	.9409	430	.4263	880	.3358	1 660	.2718	2 650	.2325	6 200	.1752	17 000	.1252
45	.9047	440	.4231	890	.3345	1 680	.2707	2 700	.2311	6 300	.1742	18 000	.1228
50	.8735	450	.4199	900	.3333	1 700	.2696	2 750	.2297	6 400	.1733	19 000	.1206
55	.8462	460	.4169	910	.3321	1 720	.2686	2 800	.2283	6 500	.1724	20 000	.1186
60	.8220	470	.4139	920	.3309	1 740	.2675	2 850	.2270	6 600	.1716	21 000	.1166
65	.8004	480	.4110	930	.3297	1 760	.2665	2 900	.2257	6 700	.1707	22 000	.1148
70	.7808	490	.4082	940	.3285	1 780	.2655	2 950	.2244	6 800	.1699	23 000	.1132
75	.7631	500	.4054	950	.3273	1 800	.2645	3 000	.2231	6 900	.1690	24 000	.1116
80	.7468	510	.4028	960	.3262	1 820	.2636	3 050	.2219	7 000	.1682	25 000	.1101
85	.7319	520	.4002	970	.3251	1 840	.2626	3 100	.2207	7 100	.1674	26 000	.1086
90	.7181	530	.3976	980	.3240	1 860	.2617	3 150	.2195	7 200	.1667	27 000	.1073
95	.7053	540	.3952	990	.3229	1 880	.2607	3 200	.2184	7 300	.1659	28 000	.1060
100	.6933	550	.3928	1 000	.3218	1 900	.2598	3 250	.2172	7 400	.1651	29 000	.1047
110	.6716	560	.3904	1 020	.3197	1 920	.2589	3 300	.2161	7 500	.1644	30 000	.1036
120	.6524	570	.3881	1 040	.3176	1 940	.2580	3 350	.2151	7 600	.1637	31 000	.1024
130	.6352	580	.3859	1 060	.3156	1 960	.2571	3 400	.2140	7 700	.1630	32 000	.1014
140	.6197	590	.3837	1 080	.3136	1 980	.2563	3 450	.2130	7 800	.1623	33 000	.1003
150	.6057	600	.3815	1 100	.3117	2 000	.2554	3 500	.2119	7 900	.1616	34 000	.0993
160	.5928	610	.3794	1 120	.3098	2 020	.2546	3 550	.2109	8 000	.1609	35 000	.0984
170	.5809	620	.3774	1 140	.3080	2 040	.2537	3 600	.2100	8 100	.1602	40 000	.0941
180	.5699	630	.3754	1 160	.3063	2 060	.2529	3 700	.2081	8 200	.1596	45 000	.0905
190	.5598	640	.3734	1 180	.3045	2 080	.2521	3 800	.2062	8 300	.1589	50 000	.0873
200	.5503	650	.3715	1 200	.3028	2 100	.2513	3 900	.2044	8 400	.1583	55 000	.0846
210	.5414	660	.3696	1 220	.3012	2 120	.2505	4 000	.2027	8 500	.1577	60 000	.0822
220	.5331	670	.3678	1 240	.2995	2 140	.2497	4 100	.2011	8 600	.1571	70 000	.0781
230	.5252	680	.3659	1 260	.2979	2 160	.2489	4 200	.1995	8 700	.1565	80 000	.0747
240	.5178	690	.3642	1 280	.2964	2 180	.2482	4 300	.1979	8 800	.1559	90 000	.0718
250	.5108	700	.3624	1 300	.2949	2 200	.2474	4 400	.1964	8 900	.1552	100 000	.0693
260	.5042	710	.3607	1 320	.2934	2 220	.2467	4 500	.1949	9 000	.1547		
270	.4979	720	.3590	1 340	.2919	2 240	.2459	4 600	.1935	9 100	.1541		
280	.4919	730	.3574	1 360	.2905	2 260	.2452	4 700	.1921	9 200	.1536		
290	.4862	740	.3558	1 380	.2890	2 280	.2445	4 800	.1908	9 300	.1530		
300	.4807	750	.3542	1 400	.2877	2 300	.2438	4 900	.1895	9 400	.1525		
310	.4755	760	.3526	1 420	.2863	2 320	.2431	5 000	.1882	9 500	.1519		
320	.4705	770	.3511	1 440	.2850	2 340	.2424	5 100	.1870	9 600	.1514		
330	.4657	780	.3496	1 460	.2837	2 360	.2417	5 200	.1857	9 700	.1509		
340	.4611	790	.3481	1 480	.2824	2 380	.2410	5 300	.1846	9 800	.1504		
350	.4566	800	.3466	1 500	.2811	2 400	.2404	5 400	.1834	9 900	.1499		
360	.4524	810	.3452	1 520	.2799	2 420	.2397	5 500	.1823	10 000	.1494		
370	.4482	820	.3438	1 540	.2787	2 440	.2390	5 600	.1812	11 000	.1447		
380	.4443	830	.3424	1 560	.2775	2 460	.2384	5 700	.1801	12 000	.1406		
390	.4405	840	.3411	1 580	.2763	2 480	.2377	5 800	.1791	13 000	.1369		
400	.4367	850	.3397	1 600	.2751	2 500	.2371	5 900	.1781	14 000	.1335		
410	.4332	860	.3384	1 620	.2740	2 550	.2355	6 000	.1771	15 000	.1305		

Speed ratings

There is a limit to the speed at which rolling bearings can be operated. Generally it is the operating temperature which can be permitted, with respect to the lubricant being used or to the material of the bearing components, that sets the limit. The speed at which this bearing temperature is reached depends on the frictional heat generated in the bearing (including any externally applied heat) and the amount of heat which can be transported away from the bearing. Bearing type and size, internal design, load, lubrication and cooling conditions as well as cage design, accuracy and internal clearance all play a part in determining the permissible speed.

Speed ratings

Speed ratings for grease and oil lubrication are quoted in the bearing tables. The speed rating for a given bearing represents the speed at which, under normal loading conditions there is a balance between the heat which can be removed from the bearing via the shaft and housing and sometimes via the lubricant and the heat generated in the bearing by friction at an acceptable temperature interval above ambient.

The speed ratings apply to bearings where the inner ring rotates. Some reduction may be necessary where bearings are to operate with rotating outer ring. More detailed information will be supplied on request.

When heavier loads are applied to the bearing, the friction in the bearing will be increased so that the bearing cannot be operated at such high speeds as the speed rating would indicate unless higher temperatures can be permitted. However, the influence of heavier loads on the permissible speed is generally only of importance for large bearings (≥ 100 mm).

Speeds above the speed ratings

It is possible to operate bearings at speeds above the speed ratings given in the bearing tables if the bearing friction can be reduced by lubrication considerations or when heat can be removed from the bearing by circulating oil lubrication with cooling of the oil, by cooling ribs on the housing or by directed cold air streams. Any increase in speed above the speed rating without taking any of these precautions would only cause the temperature to rise excessively. An increase of bearing temperature means that lubricant viscosity is reduced and lubricant film formation is made more difficult, thus leading to higher friction and further temperature increases. If, at the same time, the operational clearance in the bearing is reduced because of increased inner ring temperature, the final consequence would be bearing seizure. Any increase in speed above the speed rating generally means that the temperature difference between the inner and outer rings is greater than normal. Usually, therefore, an internal clearance greater than normal (C_3) is required, and it may be necessary to look more closely at the temperature distribution in the bearing.

The speed limit as defined by the speed rating is the first limit to be reached with almost all bearing types. Above this limit, other criteria have a stronger influence, depending on bearing type. These criteria include the form stability or strength of the cage, lubrication of cage guiding surfaces, centrifugal and gyratory forces acting on the rolling elements and other speed-limiting factors.

Another limit is set with grease lubrication by the grease used. The base oil viscosity and thickener determine the shear strength of the lubricant, which in turn determines the permissible operating speed for the particular bearing.

For high speed bearing arrangements, all components, particularly those which rotate, must have a higher accuracy than normal to take account of the vibrating behavior. Special cage designs may also be required and it is therefore advisable to contact MRC.

For satisfactory bearing operation, especially at high speeds, a minimum load must be applied.

The speed ratings listed in the tables may be modified due to grade and cage variants. The multiplying factors shown in the footnotes are based on historical application and experience.

Materials and limitations

Materials for rolling bearings

The performance and reliability of rolling bearings are determined to a large degree by the materials from which the bearing components are made.

Steels for bearing rings and rolling elements

Steels used for bearing rings and rolling elements must be capable of high fatigue strength and wear resistance. The structural and dimensional stability of the bearing components must be satisfactory at the operating temperatures which can be expected. In most cases the choice of a particular steel is dictated by the application requirements.

Through-hardening steels

The most common through-hardening steel used for rolling bearings is a carbon chromium steel containing approximately 1% carbon and 1.5% chromium. For bearing components having large cross sections of steels alloyed with manganese and molybdenum are used because of their superior through-hardening properties.

Much development has been accomplished in the area of through-hardened steels. Particular attention has been paid to cleanliness and modern bearing steels have such small contents of inclusions that it is now recognized that under ideal conditions bearings should no longer fail from fatigue.

Case-hardening steels

Chromium-nickel and manganese-chromium alloyed steels with a carbon content of approximately 0.15% are those case-hardening steels most commonly used for rolling bearings.

Steels for MRC rolling bearings

In the majority of applications there is virtually no difference in behavior between bearings made of through-hardened or case-hardened steels. This fact has been acknowledged by ISO in that no distinction is made between steel types in the life calculation. In fact, steel cleanliness and proper manufacturing methods as well as bearing design are the decisive factors. However, there are applications where a particular type of steel has certain advantages.

Because MRC has both the competence and the facilities for through hardening, case hardening and induction hardening, attention is paid to the main application fields for each particular bearing and the steel and method of heat treatment are chosen to give the best performance in these applications.

Steels for temperature-resistant bearings

MRC rolling bearings can generally be used at operating temperatures up to 250° F (121° C). If the operating temperatures are higher than this, the bearings must be subjected to a special heat treatment (stabilization) so that inadmissible changes in dimensions do not occur as a result of microstructural changes. However, the bearings should not be stabilized for a higher temperature than the expected operating temperature.

For bearings which are required to operate at temperatures in excess of 450° F (232° C) special steels with high hot-hardness are required. In such cases it is advisable to contact MRC Engineering.

Steels for corrosion-resistant bearings

For bearings that come into contact with corrosive media during operation, there are a couple options. Historically, chromium or chromium/molybdenum stainless steel has been used. Because of the reduced hardness of these steels, the bearings do not have the same high load carrying capacity as bearings made of conventional steels. The corrosion resistance is only available when the whole surface is perfectly polished and if it is not roughened or damaged during mounting. Some specialty high nitrogen steels have been developed which provide better corrosion resistance than the chromium stainless steels as well as the same high load carrying capacity as conventional bearing steels. For more information on the different types of corrosion resistant steels and their application, it is recommended to contact MRC Application Engineering.

Hybrid bearings with ceramic balls

MRC hybrid bearings use steel inner and outer rings with ceramic balls. This combination provides a bearing that has greater stiffness, is able to handle higher speeds and higher temperatures.

The lower density of the silicon nitride ceramic balls creates less centrifugal force than steel balls. Lower density combined with the reduced friction due to the ball's smooth surface, allows the bearing to run at much higher speeds. The low thermal expansion of the ceramic balls makes them less sensitive to differences in temperature between the inner and outer rings. The higher modulus of elasticity makes the bearings much stiffer.

Materials for cages

The main purpose of the cage is to keep the rolling elements at an appropriate distance from each other and to prevent immediate contact between two neighboring rolling elements in order to keep friction and thus heat generation in the bearing at a minimum.

In grease lubricated bearings some of the grease inside the bearing will adhere to the cage forming a lubricant reservoir and ensuring good lubrication of the operating surfaces of the bearing.

The cage is guided either on the rolling elements or on one of the bearing rings and is thus radially centered. Pressed steel or brass cages are generally guided on the rolling elements. Inner or outer ring land-guided machined cages generally permit operation at higher speeds and are necessary when

(continued on next page)

movements additional to the pure rotational are superimposed, particularly when conditions of high acceleration prevail. Suitable steps must be taken (e.g. oil lubrication) to ensure that there is a sufficient supply of lubricant to the guiding surfaces of the cage and to the inside of the bearing.

Rolling bearing cages are mechanically stressed by frictional, strain and inertia forces. They may also be subjected to the chemical action of certain lubricants, lubricant additives or products of their aging, organic solvents, coolants (halogenated hydrocarbons, ammonia), etc. Thus the design and choice of material are of paramount importance for the performance of the cage as well as for the operational reliability of the bearing as a whole.

Standard cages

As rolling bearings have been developed, various cage types and designs for the different bearing types and sizes have emerged; the cages differ as to form, material, manufacturing methods, cost of production and operational limits.

In the text preceding each section, information is provided regarding the standard cages with which the bearings are fitted and also the possible alternatives. The standard cage is always well proven in service and is the design considered most suitable for the majority of applications. With reference to the viability of production, the costs and the different application areas of the bearings, the standard cage for the larger bearings may be different from that for the smaller bearings in one and the same series. If a bearing with a non-standard cage is required it is always advisable to check availability before ordering.

Molded polyamide cages

For some bearing types, e.g. double row deep groove ball bearings, and angular contact ball bearings, the small and medium-sized bearings are available with molded cages of heat stabilized, glass fiber reinforced polyamide 6.6. Heat stabilized, unfilled polyamide cages are available for a limited number of sizes. This material is characterized by a favorable combination of strength and elasticity. The good sliding properties of polyamide on lubricated steel surfaces and the smoothness of the cage surfaces in contact with the rolling elements mean that little friction is generated by the cage so that heat generation and wear in the bearing are at a minimum. The low density of the material means that the inertia of the cage is small. All these factors plus inherently superior dynamic balance result in smoother and quieter running bearings.

The injection molding process used to produce the cages allows functionally suitable designs to be made. The excellent running properties of polyamide cages under lubricant starvation conditions permit continued operation of the bearing for a time, reducing the risk of seizure and secondary damage.

When using bearings with polyamide cages, the permissible operating temperatures for the material and its resistance to the lubricant used must be observed. At operating temperatures up to the values given in the table below for the various oils and greases which are used as bearing lubricants, cage properties are unaffected. If the permissible temperature is exceeded, the cage material will age, this process being accelerated the longer the cage is exposed to the excessive temperature. Brief periods at up to 70° F (21° C) above the recommended maximum temperatures can be tolerated provided they are interspersed with longer periods at operating temperatures below the recommended values, and provided the maximum operating temperature for the lubricant is not exceeded. When operating temperatures are constantly above 250° F (121° C) bearings fitted with metallic cages are recommended. Molded polyamide cages are also unsuitable for operating temperatures below -40° F (-40° C) as they lose their elasticity.

The organic solvents normally used to clean rolling bearings such as white mineral spirits or trichloroethane do not affect cage properties, nor do they dilute alkaline cleaners (e.g. soda) if they are at room temperature and the period during which they are in contact is short. The chlorofluorocarbons or ammonia used in refrigeration do not attack polyamide. In vacuum, polyamide cages become brittle because they become dehydrated.

Permissible operating temperatures for cages of glass fiber reinforced polyamide 6.6 with various bearing lubricants

Lubricant	Permissible operating temperature[1]	
	° C	° F
Mineral oils		
Oils without EP additives e.g. machine oils, hydraulic oils	120	248
EP oils e.g. industrial and automotive gearbox oils	110	230
EP oils e.g. rear axle and differential gear oils (automotive), hypoid gear oils	100	212
Synthetic oils		
Polyglycols, poly-a-olefins	120	248
Diesters, silicones	110	230
Phosphate esters	80	176
Greases		
Lithium base[2], polyurea bentonite, calcium complex	120	248

1) Measured on the outside surface of the outer ring.
2) For sodium and calcium based greases and other bearing greases with a maximum operating temperature below 120° C, the maximum temperature for the polyamide cage is the same as the maximum temperature for the grease, otherwise the permissible operating temperature is 120° C.

Materials and limitations

Steel cages

Pressed cages of steel sheet are standard for many deep groove ball bearings. These cages have relatively high strength and weigh little. To reduce friction and wear they may be hardened and surface treated. High strength, machined steel cages, often silver plated are also available for critical and extra heavy duty applications.

Machined bronze

Machined bronze cages are used for heavy duty applications and larger size bearings. Machined bronze cages can be used at operating temperatures up to 450° F (232° C). They are not affected by the mineral or synthetic oil based lubricants normally used for rolling bearings nor by the organic solvents used to clean bearings. They are very resistant to corrosive attack.

Brass cages

Pressed brass cages are used for some small and medium-sized bearings, but most brass cages are machined from cast or wrought material. Brass cages should not be used at temperatures in excess of 450° F (232° C). They are unaffected by most of the commonly used bearing lubricants, including synthetic oils and greases, and can be cleaned using normal organic solvents. The use of alkaline cleaning agents is not recommended. Ammonia (e.g. in refrigeration) causes embrittlement in brass so that brass cages are unsuitable and other alternatives should be considered.

Phenolic (Bakelite) cages

Phenolic cages are used primarily for angular contact ball bearings. These cages are composed of machined, cotton fabric impregnated with phenolic resin. The light weight construction of the phenolic cage makes it ideal for high speed applications. Phenolic cages should not be used in temperatures in excess of 225° F (107° C).

Materials and limitations

Bearing component	Material	Description	Dynamic operating temperature limits
Race way rings and balls	SAE 52100 (AISI E-52100)	Vacuum processed high carbon chromium steel. Special heat treatment increases maximum temperatures and improves dimensional stability.[1]	250° F (121° C) Max Special heat treatment up to 400° F (204° C) max[1]
	440C martensitic stainless steel[1]	Moderate corrosive environments	300° F (148° C) Max Special heat treatment up to 800° F (426° C) max[1]
	XD15NW	High corrosive environments	300° F (150° C) Max
	M50 tool steel[1]	High temperature service, improved life at elevated temperatures	600° F (315° C) Max
Seals	Nitrile rubber	Standard MRC seal material, identified by black color	-70° F to 250° F -56° C to 121° C
	Fluorocarbon seals (Viton®)[1]	Better temperature and chemical resistance, identified by grey or brown color	-40° F to 400° F -40° C to 204° C
	PTFE seals (Teflon)[1]	Superior chemical and heat resistance, identified by tan color and "woven" appearance	-450° F to 550° F -267° C to 288° C
Shields	1010 low carbon steel	Standard MRC shield material	450° F (232° C) Max
	302 stainless pressed steel[1]	Corrosive environments	450° F (232° C) Max
Ball cages[2] (separator)	1010 pressed steel	Standard MRC pressed cage material	450° F (232° C) Max
	Machined phenolic (Bakelite)	Composition made from a cotton fabric impregnated with phenolic resin; two piece riveted or one piece machined design	225° F (110° C) Max
	Molded polyamide	Heat stabilized 6.6 polyamide, identified by natural (cream) color; ball guided design	250° F (121° C) Max
	Molded reinforced polyamide	Heat stabilized 6.6 polyamide reinforced with glass fiber; ball guided design, identified by dark grey color	250° F (121° C) Max
	302 pressed stainless steel	Corrosive environments; ball guided two piece riveted design	450° F (232° C) Max
	Pressed brass	Stamped one piece ball guided or two piece ball guided riveted design	450° F (232° C) Max
	4340 machined steel	One piece land or ball guided design	575° F (302° C) Max
	Machined bronze	One piece land or ball guided design	450° F (232° C) Max

1) Contact MRC for availability.
2) Contact MRC for ball cages available for specific sizes.

Lubrication

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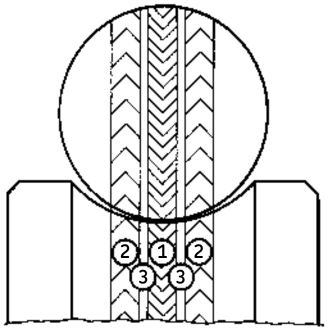
Lubrication of anti-friction bearings

Introduction

Although the basic principle of ball and roller bearings is the rolling of one element over another, some sliding friction is generated during operation of anti-friction bearings. Successful operation of an anti-friction bearing requires a lubricating film in the areas of sliding contact. In cageless bearings, the rolling elements slide against each other. When a cage is present the rolling elements slide against this and under some operating conditions, the cage slides against ring guiding surfaces. When a ball under load rolls in a curved bearing raceway, pure rolling occurs only along two lines in the contact area; other contact points on the ball slide or spin along areas of the raceway. This is because the effective diameter of the ball is smaller at points distant from the bottom of the race-groove. See Figure 1.

- The forces of slippage between zone 1 and the two zones 2 are equal in magnitude.
- The slippage in zone 1 is in opposite direction from that in zone 2.
- Technically the zones of pure rolling in 3 are very narrow but there are larger areas that approach pure rolling.
- These conditions exist, although less obvious, even when loads are lighter and the ball paths narrower.

Without lubrication in the highly loaded contact areas, very high friction will be encountered in ball bearings. High friction generally creates high heat and thermal expansion, usually concentrated in the rolling elements and inner ring races which may cause a loss of internal clearance and radial preloading. This frequently causes surface degeneration and early fatigue. Cage breakage may also result from extreme stresses.



1 Central slippage zone
2 Outboard slippage zone
3 Zones of rolling

Figure 1

Bearing construction

An anti-friction bearing is a precision device and a marvel of engineering. It is unlikely that any other mass produced item is machined to such close tolerances. While boundary dimensions are usually held to tenths of a thousandth of an inch, rolling contact surfaces and geometries are maintained to millionths of an inch. It is for this obvious reason that very little surface degradation can be tolerated.

Bearing steels are hard, durable alloys, highly free of impurities in order to withstand the high unit stresses which occur at the point of contact between a rolling element and the race. Also, they must be sufficiently elastic to quickly regain their original shape after deformation through loading.

Race and rolling element finish are also critical since even minute surface imperfections can cause high stress concentrations resulting in premature failure.

Principle of operation

When a ball in a bearing is subjected to load, an elliptical area of contact results between the ball and the race. In operation, as each ball enters the loaded area, slight deformation of both the ball and the race occurs. The ball flattens out in the lower front quadrant and bulges in the lower rear quadrant. See Figure 2. The amount of deformation is a function of the magnitude and direction of load, ball size, race geometry, and elasticity of the bearing materials. Any particular point on the race goes through a cycle of these stress reversals as each ball passes it. One source of heat developed in a bearing results from these stresses and the deformation of the bearing material associated with them.

The life of an anti-friction bearing running under good operating conditions is usually limited by fatigue failure rather than by wear. Under optimum operating conditions, the fatigue life of a bearing is determined by the number of stress reversals and by the cube of the load causing these stresses. As examples, if the load on the bearing is doubled, the theoretical fatigue life is reduced to one-eighth. Also, if speed is doubled, the theoretical fatigue is reduced to one-half.

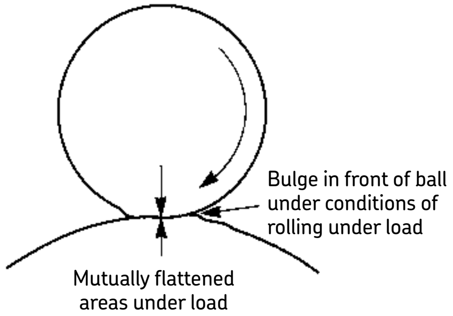


Figure 2

Lubrication of anti-friction bearings

Friction torque

The friction torque in an anti-friction bearing consists essentially of two components. One of these is a function of the bearing design and the load imposed on the bearing. The other is a function of the lubricant type, the quantity, and the speed of the bearing.

It has been found that the friction torque in a bearing is lowest with a quantity of the correct viscosity oil just sufficient to form a film over the contacting surfaces. The friction will increase with greater quantity and/or high viscosity of the oil. With more oil than just enough to make a film, the friction torque will also increase with the speed.

Function of the lubricant

1 To lubricate sliding contact between the cage and other parts of the bearing.
2 To provide a film of oil between rolling contact surfaces (elastohydrodynamic lubrication).
3 To lubricate the sliding contact between the rolls and guiding elements in roller bearings.
4 In some cases, to carry away the heat developed in the bearing.
5 To protect the highly finished surfaces from corrosion.
6 To provide a sealing barrier against foreign matter.

Oil versus grease

The ideal lubricant for rolling element bearings is oil. Grease, formed by combining oil with soap or non-soap thickeners, is simply a means of effecting greater utilization of the oil. In a grease, the thickener acts fundamentally as a carrier and not as a lubricant.

Greases are now used for lubricating by far the larger number of rolling bearings. The extensive use of grease has been dictated by the possibilities of simpler housing designs, less maintenance, less difficulty with leakage, and better sealing against dirt. On the other hand, there are limitations which do not permit the use of grease. Where a lubricant must dissipate heat rapidly, grease should not be used. In many cases, associated machine elements that are oil lubricated dictate the use of oil for anti-friction bearings. Listed below are some of the advantages and disadvantages of grease lubrication.

Advantages

1 Simpler housing designs are possible; piping is greatly reduced or eliminated.
2 Maintenance is greatly reduced since oil levels do not have to be maintained.
3 Being a solid when not under shear, grease forms an effective collar at bearing edges to help seal against dirt and water.
4 With grease lubrication, leakage is minimized where contamination of products must be avoided.
5 During start-up periods, the bearing is instantly lubricated whereas with pressure or splash oil systems, there can be a time interval during which the bearing may operate before oil flow reaches the bearing.

Disadvantages

1 Extreme loads at low speed or moderate loads at high speed may create sufficient heat in the bearing to make grease lubrication unsatisfactory.
2 Oil may flush debris out of the bearing, grease will not.
3 The correct amount of lubricant is not easily controlled as with oil.

Oil characteristics

The ability of any oil to meet the requirements of specific operating conditions depends upon certain physical and chemical properties.

Viscosity

The single most important property of oil is viscosity. It is the relative resistance to flow. A high viscosity oil will flow less readily than a thinner, low viscosity oil.

Lubrication viscosity

There are a number of instruments used for determining the viscosity of oil. In the United States, the instruments that are usually used are the Viscosimeter or the Viscometer. The Saybolt Universal Viscosimeter measures the time in seconds required for 60 cc of oil to drain through a standard hole at some fixed temperature. When this unit is used, the viscosities are quoted in terms of Saybolt Universal Seconds (SUS).

When the Kinematic Viscometer is used to measure oil viscosity, the time required for a fixed amount of oil to flow through a calibrated capillary is used as an intermediate value for calculating viscosity. The unit of kinematic viscosity is the stoke or the centistoke (cSt). The common temperatures for reporting viscosity are 104° F and 212° F (40° C and 100° C).

Generally, for ball bearings and cylindrical roller bearings, it is a good rule to select an oil which will have a viscosity of at least 70 SUS (15 cSt) at operating temperature.

Lubrication of anti-friction bearings

Viscosity index

All oils are more viscous when cold and become thinner when heated. However, some oils resist this change of viscosity more than others. Such oils are said to have a high viscosity index (V.I.). Viscosity index is most important in an oil where it must be used over a wide range of temperatures. Such an oil should resist excessive changes in viscosity. A high V.I. is usually associated with good oxidation stability and can be used as a rough indication of such quality.

Pour point

Any oil, when cooled, eventually reaches a temperature below which it will no longer flow. This temperature is said to be the pour point of the oil. At temperatures below its pour point an oil will not feed into the bearing and lubricant starvation may result.

In selecting an oil for anti-friction bearings, the pour point must be considered in relation to the operating temperature.

Flash and fire point

As an oil is heated, the lighter fractions tend to volatilize. With any oil, there is some temperature at which enough vapor is liberated to flash into momentary flame when ignition is applied. This temperature is called the flash point of the oil. At a somewhat higher temperature enough vapors are liberated to support continuous combustion. This is called the fire point of the oil. The flash and fire points are significant indications of the tendency of an oil to volatilize at high operating temperatures. High V.I. base oils generally have higher flash and fire points than lower V.I. base oils of the same viscosity.

Oxidation resistance

All petroleum oils are subject to oxidation by chemical reaction with oxygen of air. This reaction results in the formation of acids, gum, sludge, and varnish residues which can reduce bearing clearances, plug oil lines and cause corrosion.

Some lubricating fluids are more resistant to this action than others. Oxidation resistance depends upon the fluid type, the methods and degree of refining used, and whether oxidation inhibitors are used.

There are many factors which contribute to the oxidation of oils and practically all of these are present in lubricating systems. These include temperature, agitation, and the effects of metals and various contaminants which increase the rate of oxidation.

Temperature is a primary accelerator of oxidation. It is well known that rates of chemical reaction double for every 18° F (10° C) increase in temperature. Below 140° F (60° C), the rate of oxidation of oil is rather slow. Above this temperature, however, the rate of oxidation increases to such an extent that it becomes an important factor in the life of the oil. It is for this reason that it is desirable that oil systems operate at as low an overall temperature as is practical.

The oxidation rate of oil is accelerated by metals such as copper and copper-containing alloys and to a much lesser extent by steel. Contaminants such as water and dust also act as catalysts to promote oxidation of the oil.

Emulsification

Generally, water and straight oils do not mix. However, when an oil becomes dirty, the contaminating particles act as agents to promote emulsification. In anti-friction bearing lubricating systems, emulsification is undesirable and the oil should separate readily from any water present. The oil should have good demulsibility characteristics.

Rust prevention

Although straight petroleum oils have some rust protective properties, they cannot be depended upon to do an unfailing job of protecting rust-susceptible metallic surfaces. In many instances, water can displace the oil from the surfaces and cause rusting. Rust is particularly undesirable in an anti-friction bearing because it can seriously abrade the bearing elements and areas that are pitted by rust will cause rough operation or failure of the bearing.

Additives

High grade lubricating fluids are formulated to contain small amounts of special chemical materials called additives. Additives are used to increase the viscosity index, fortify oxidation resistance, improve rust protection, provide detergent properties, increase film strength, provide extreme pressure properties, or lower the pour point.

Application of lubrication fluids

The amount of oil needed to maintain a satisfactory lubricant film in an anti-friction bearing is extremely small. The minimum quantity required is a film averaging only a few micro-inches in thickness. Once this small amount has been supplied, make-up is required only to replace that lost by vaporization, atomization, and creepage from the bearing surfaces. Some idea of the small quantity of oil required can be realized when it is known that 1/1000 of a drop of oil, having a viscosity of 300 SUS at 100° F (38° C) per hour can lubricate a 50 mm bore bearing running at 3,600 rpm. Although this small amount of oil can adequately lubricate a bearing, much more oil is needed to dissipate heat generated in high speed, heavily loaded bearings.

Lubrication of anti-friction bearings

Oil may be supplied to anti-friction bearings in a number of ways. These include bath oiling, oil mist from an external supply, wick feed, drip feed, circulating system, oil jet, and splash or spray from a slinger or nearby machine parts.

One of the simplest methods of oil lubrication is to provide a bath of oil through which the rolling element will pass during a portion of each revolution. Where cooling is required in high speed and heavily loaded bearings, oil jets and circulating systems should be considered. If necessary, the oil can be passed through a heat exchanger before returning to the bearing.

Selection of oil

The most important property of lubricating oil is the viscosity. Figures 3 and 4 should be used to assure that the viscosity is adequate in an application. Figure 3 yields the minimum required viscosity as a function of bearing size and rotational speed.

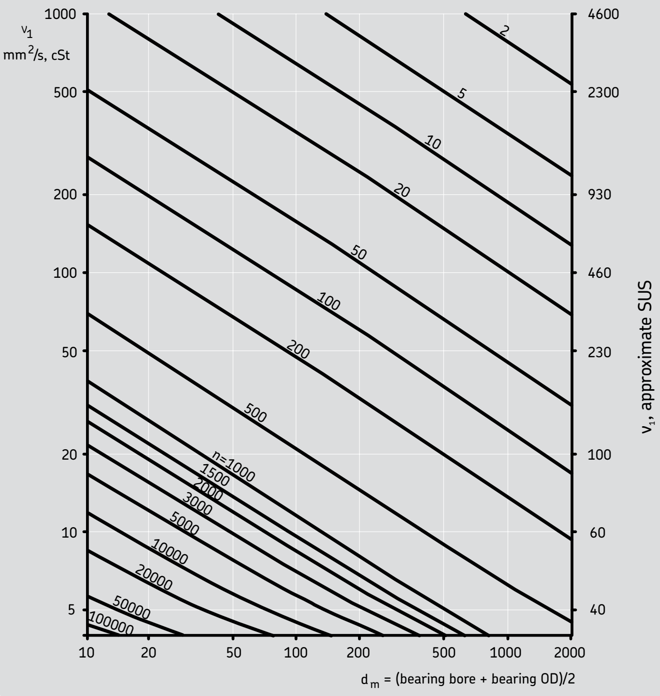
The viscosity of a lubricating oil, however, varies with temperature. It decreases with increasing temperature. Therefore, the viscosity at the operating temperature must be used, rather than the viscosity grade (VG) which is based on the viscosity at the internationally standardized reference temperature of 40° C (104° F). Figure 4 can be used to determine the actual viscosity at the operating temperature, which, however, varies with bearing design. For instance tapered and spherical roller bearings usually have a higher operating temperature than ball bearings or cylindrical roller bearings under comparable operating conditions.

Example:
A bearing having a bore diameter of 45 mm and an outside diameter of 85 mm is required to operate at a speed of 2000 rpm. The pitch diameter $d_m = 0.5\,(d + D) = 0.5\,(45 + 85) = 65$ mm. As shown in Figure 3, the intersection of d_m = 65 mm with the oblique line representing 2000 rpm yields a minimum viscosity required of 13 mm²/s. Now let us assume that the operating temperature is 80° C (176° F). In Figure 4, the intersection between temperature 80° C and required viscosity 13 mm²/s is between the oblique lines for VG46 and VG68. Therefore, a lubricant with the viscosity grade of at least VG46 should be used, i.e. a lubricant of at least 46 mm²/s viscosity at the standard reference temperature of 40° C.

When determining the operating temperature, it should be kept in mind that the temperature of the oil is usually 3° C to 11° C (5° F to 20° F) higher than that of the bearing housing. For example, assuming that the temperature of the bearing housing is 77° C (170° F), the temperature of the oil will usually be 80° C to 88° C (176° F to 190° F).

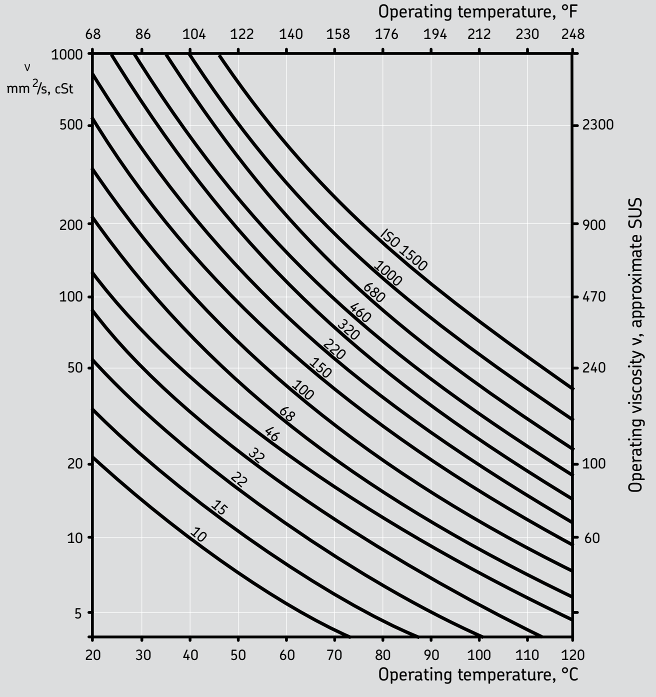
If a lubricant with higher than required viscosity is selected, an improvement in bearing performance (life) can be expected.

Figure 3
Estimation of the required viscosity ν_1 at operating temperature



ν_1 = required lubricant viscosity for adequate lubrication at the operating temperature

Figure 4
Estimation of viscosity, ν at operating temperature assumes VI=95 and a mineral oil



Note: Viscosity classification numbers are according to International Standard ISO 3448–1975 for oils having a viscosity index of 95.

Lubrication of anti-friction bearings

However, since increased viscosity raises the bearing operating temperature, there is frequently a practical limit to the lubrication improvement which can be obtained by this means. Additionally, only solvent refined mineral oil should be used.

For exceptionally low or high speeds, for critical loading conditions or for unusual lubrication conditions, please consult MRC Applications Engineering.

For all calculations, the viscosity should be expressed in mm²/s (cSt) rather than in Saybolt Universal Seconds (SUS), as the conversion between these two viscosity units is nonlinear. However, the SUS scale shown on the right of Figures 3 and 4 can be used for approximate conversion of SUS to mm²/s (cSt).

For viscosity equivalents see next page.

Oil flow requirement

For high speed and/or high temperature applications, a major function of the lubricant is to remove heat, and circulating oil lubrication is necessary.

Unfortunately, excessive quantity of lubricant within the bearing boundary dimensions, i.e., within the free volume, causes increased friction and hence increased heat generation owing to fluid churning. Therefore the lubricant flow rate through the bearing should be as little as possible, consistent with good lubricant film formation and heat removal. This minimum acceptable flow rate can be achieved using air-oil mist lubrication. Care must be exercised to assure that the lubricant flow rate is sufficient to avoid lubricant starvation in high speed applications. In this condition, insufficient lubricant enters the rolling element-raceway contacts to permit formation of lubricant films thick enough to separate the components.

From a heat removal standpoint and as a starting point to determine the required lubricant flow rate in gallons per minute (W), the following approximate formula may be used:

In English system units, the flow rate in gallons per minute (W) is:

$$W = \frac{1.9 \times 10^{-4}\, \mu P d_m n}{(T_0 - T_i)}$$

in which μ is the bearing coefficient of friction, P is imposed load in pounds, d_m is bearing pitch diameter in inches, n is bearing net speed (shaft speed minus outer ring speed) in rpm, T_0 is lubricant outlet temperature in degrees F and T_i is lubricant inlet temperature in degrees F. The table below gives appropriate values of μ.

Coefficient of friction (μ)

Radial ball bearings	0.0015
Angular-contact ball bearings	0.0020
Split inner ring ball bearings	0.0024
Cylindrical roller bearings	0.0011

Grease lubrication

Most greases are composed of a soap thickening agent in petroleum oil. Soap is formed by combining a metallic alkali such as the hydroxide of sodium or lithium with a fatty material. The type and quality of soap determines the grease consistency, texture, melting point, and solubility in water. Sometimes a mixture of soaps is used to alter the properties. Additives are used to impart such properties as increase in load carrying capacity, rust prevention, and oxidation stability.

Lithium soap petroleum greases are widely used because of their good water resistance, relatively good high and low temperature characteristics, and good mechanical stability. Sodium soap greases are not water resistant and are readily washed away by large amounts of water. However, they have excellent rust preventive properties due to their ability to absorb minor amounts of water contamination.

Greases containing thickeners other than metallic soaps are being used increasingly because they offer greater resistance to heat. They are a multi-purpose type and have good water resistance. Surface treated clay is an inorganic thickener used in many greases.

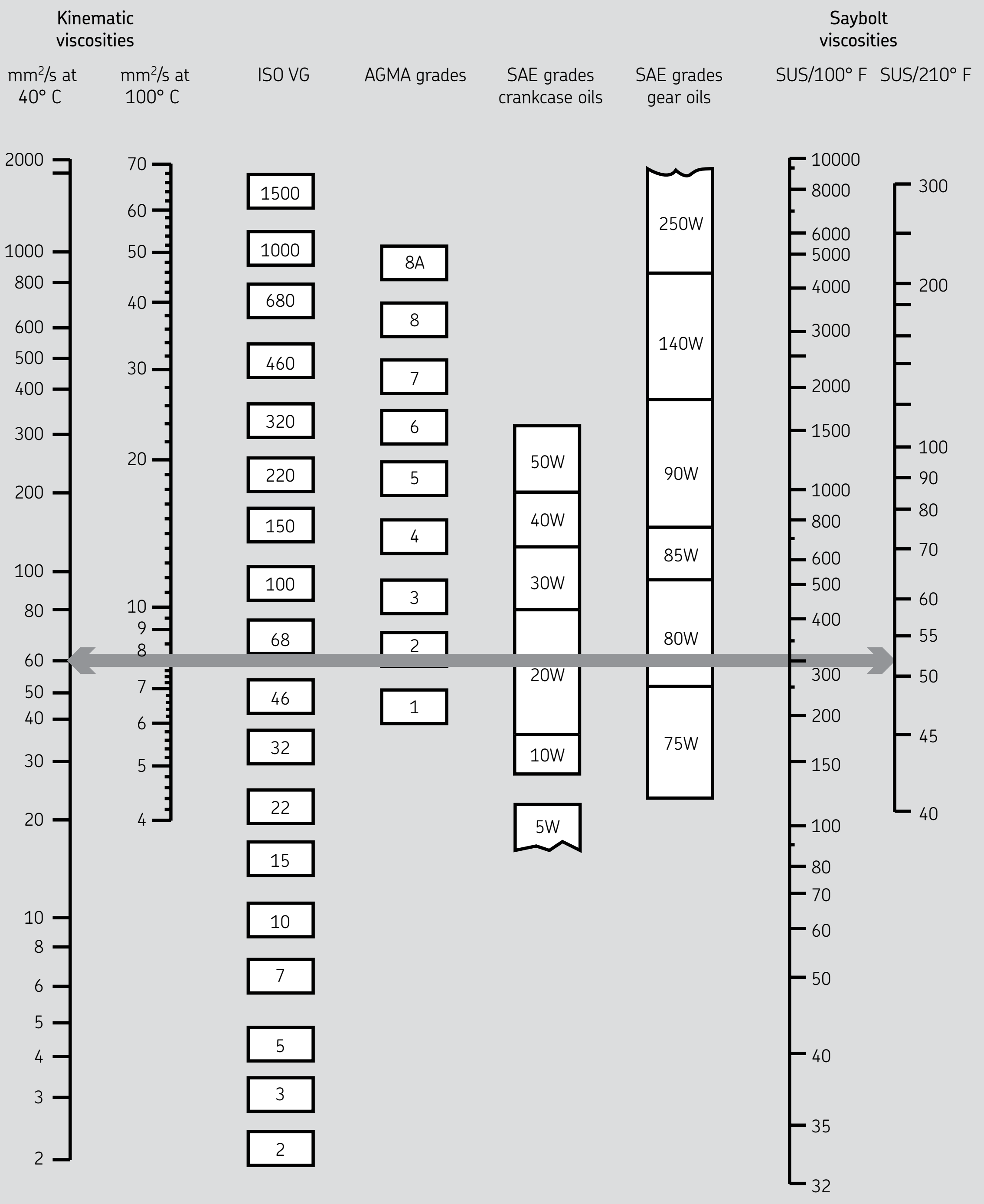
Intensive research in the development of oxidation resistant formulations has resulted in great increases in the life which lubricating greases can provide. Through the use of synthetic oily compounds and non-soap thickeners, grease lubrication can now be achieved over a temperature range of -100° F to +500° F (-73° C to 260° C) and higher in some cases.

Synthetic greases are formulated with synthetic fluids such as silicones, esters, perfluoroalkyl ethers, or polyphenyl ethers instead of petroleum oil. The thickener may be soap or non-soap. Synthetic greases are used in extremely high or low temperature applications that are outside the range for petroleum greases. They are relatively expensive and therefore are not usually recommended if petroleum greases will serve the purpose.

In the great majority of applications where the operating conditions are normal, many different greases can be used satisfactorily. However, each grease has certain limitations and properties. In applications where elevated temperature, high speed, heavy loading, high humidity, or other extreme conditions are encountered, consideration must be given to the choice of a grease. In some instances it will be found that no available grease has all the properties to satisfy the requirements and the choice must be a compromise.

It is recommended that the bearing user consult with MRC Engineering to determine the lubricant which will be most suitable for the application.

Viscosity equivalents



Viscosities based on 95 V. I. single-grade oils.
ISO grades are specified at 40° C.
AGMA grades are specified at 100°F.
SAE 75W, 80W, 85W, and 5 and 10W are specified at low temperature (below -17° F = 0° C).
Equivalent viscosities for 100° F and 210°F are shown.
SAE 90 to 250 and 20 to 50 specified at 210° F (100° C).

Comparison of various viscosity classification methods

Lubrication of anti-friction bearings

Grease characteristics

Consistency

Greases vary in consistency from semi-fluids to hard, brick type greases which are cut with a knife. The method for measuring grease consistency (ASTM D-217), established by the American Society for Testing and Materials, uses a penetrometer with which a cone of standard shape and weight is dropped into the grease and the depth of penetration in five seconds at 77° F (25° C) is measured in tenths of a millimeter. The penetration is usually measured on both unworked grease as it comes from its shipping container and also after it has been worked 60 strokes by a perforated disc plunger.

Usually greases become softer when subjected to mechanical working action. These consistency measurements are expressed as unworked and worked. The 60 stroke working is done to minimize the effects of any previous manipulation of the grease in sampling. Also, the worked penetration indicates the relative softening after a limited amount of shear. However, this working cannot be correlated to the much more severe shearing action that occurs in a bearing.

Listed in the table below is a classification of the consistency of grease in terms of worked penetration as developed by the National Lubricating Grease Institute.

Most rolling bearing greases fall into classes 1–4. By far the greater portion of bearing applications use NLGI grade 2 grease.

NLGI no.	Worked penetration
000	445–475
00	400–430
0	355–385
1	310–340
2	265–295
3	220–250
4	175–205
5	130–160
6	85–115

Dropping point

When a grease is heated, it softens. The temperature at which a drop falls from a sample in a standard test (ASTM D-566) is called its dropping point. The dropping point cannot be used to indicate the maximum operating temperature for a grease since some greases oxidize or decompose rapidly at temperatures below the dropping point. Dropping point is of little significance to the grease user but it is of significant value to the grease maker as means of quality control.

Oxidation stability

Reaction with oxygen in the air, which is accelerated with higher temperatures, is one of the main factors limiting the life of bearing greases. This reaction ultimately results in drying and hardening of the grease with total loss of lubricating properties.

The standard test used to measure the oxidation stability of grease is the Oxygen Bomb Method (ASTM D-942). In this test, the rate of absorption of oxygen by the grease at 210° F (99° C) and 110 PSI is recorded. This test is conducted under static conditions and is intended only to be useful in estimating the shelf life of greases. However, it has been found that greases which show low oxygen absorption usually perform reasonably well in service.

Water resistance

Water resistance varies with the different types of greases. Most sodium soap greases emulsify and thin out when mixed with water. Other types are less affected but their resistance to washout varies with the viscosity of the oil and the amount and type of thickener. No lubricating grease is completely water resistant. Even those classed as water insoluble or water resistant can be washed out of a bearing if exposed to large volumes of water.

The ability of a grease to withstand water washout from a bearing is determined by ASTM Method D-1264. A ball bearing with a specified quantity of the test grease is mounted in a housing with specified clearances to allow entry of water from a jet. After one hour of operation at 600 rpm with the water at a controlled temperature impinging on the housing at a specified rate, the bearing is reweighed and the amount of grease lost is determined.

Shear stability (mechanical stability)

This is the resistance of a grease to structural breakdown when subjected to the shearing action of being worked.

Two grease working tests are used to measure softening of grease due to working. ASTM Method D-217, described earlier under Consistency, forces the grease through a perforated plate at a rate of 60 times per minute. The Shell Roll Test subjects the grease to the working action of a roll inside a rotating cylinder. Penetration values are determined before and after rolling. The degree of softening that results from working is important from the aspect of leakage from the bearing. However, the results cannot be correlated to bearing performance since greases which have appeared unsatisfactory in these tests have been found to provide very satisfactory bearing performance.

Oil separation

Most greases show some tendency to allow oil separation in certain circumstances. During storage, depressions in the grease surface or voids collect oil.

This separation increases with higher storage temperatures as the viscosity of the oil phase is lowered. Oil separation, unless excessive, is not reason for rejection of a rolling bearing grease. Five percent is typically permitted. Usually the separated oil can be easily stirred back into the grease body.

The standard test method for determining oil separation from grease during storage is ASTM D-1742. This is a simple test where the sample is placed on a sieve strainer in a pressure cell with inlet air pressure maintained at 0.25 PSI. The test is conducted at 77° F (25° C) and after 24 hours the separated oil that has collected on the bottom of the cell is weighed and expressed as a percentage by weight of the original sample. This test is only intended to measure the tendency of a grease to separate oil during storage. It is not intended to predict the stability of grease under dynamic service conditions.

Channeling

Channeling is a term referring to the tendency of a grease to separate and form a channel after the passage of the balls and cage around the ball race. Some greases channel very little and flow back rapidly to fill the voids left by the rotating elements to cause higher torque and higher operating temperatures from the shear stresses within the lubricant. Poor channeling characteristics can make some greases unsatisfactory for high speed operation when a channeling type grease will provide minimum torque and heat rise. Channeling type greases are usually of NLGI No. 3 or No. 4 consistency.

Special properties

There are many special grease formulations to meet a variety of unusual requirements. Special properties, which have been listed below, are often required in a grease. These special requirements may include:

1. Extra tackiness or adhesiveness to resist leakage or throw-out
2. Proper structure for sealing to exclude contaminates
3. Resistance to the action of certain chemicals
4. Resistance to the action of solvents
5. Electrical conductivity
6. Resistance to the effects of nuclear radiation
7. Resistance to the effects of high vacuum
8. Nontoxic for use where there may be contact with food
9. High oil bleed rates ≥ 2.5% for machined land guided cages

Operating conditions

Low temperature

Oils and greases tend to thicken and resist flow as temperatures are decreased. For oil lubricated bearings operating at cold temperatures, an oil that has a sufficiently low pour point to remain fluid at the low temperature and the proper viscosity for the operating temperature should be chosen. If the oil is subjected to low temperature start-up but operates at higher temperatures, a high viscosity index is desirable.

Usually the most important consideration in selecting a grease for low temperature operation is start-up torque. Some greases may function satisfactorily during operation but require excessive torque for start-up. Starting torque is not a function of the consistency or the channeling properties of a grease. It appears to be a function of the individual properties of the grease and is difficult to measure. Experience alone will show whether one grease is better than another in this respect. Greases formulated with synthetic oils are available which provide very low starting and running torque at temperatures as low as -100° F (-73° C). Generally, a correctly selected grease provides lower torque than an oil.

High temperature

In oil lubricated bearing applications where ambient temperatures are high, such as in ovens, some means of cooling is usually necessary to avoid excessive bearing temperatures and premature lubricant failure. Some of the commonly used methods for decreasing the oil temperature are cooling coils, water jackets, oil cooling tanks, cooling discs, and fans.

The rate of oxidation of lubricating fluids increases rapidly with temperature rise. As mentioned earlier, the rate of oxidation doubles for each 18° F (10° C) temperature rise above 140° F (60° C). Above 250° F (121° C), petroleum oils tend to oxidize rapidly and sometimes it becomes necessary to use special petroleum oils or synthetic oils to increase the service life of the lubricant.

Where the only heat is that generated by the bearing, temperature rise can usually be held to a reasonable level by the use of a suitable lubricant in proper quantity.

The high temperature limit for greases, i.e. the maximum temperature at which a grease will provide a reasonable life in a non-relubricable bearing, is largely a function of the oxidation stability of the fluid and the thickener. The oxidation process is greatly accelerated with increasing temperature. Another factor is evaporation of the fluid phase. Also, greases thin out at high temperatures. If the grease consistency becomes too soft at operating temperatures there may be leakage from the bearing.

High speeds

Small size anti-friction bearings are often successfully grease lubricated at high speeds. Larger sizes usually require oil to remove heat as well as to lubricate.

Where extensive cooling is required in high speed and heavily loaded bearings operating with high frictional heat, oil jets and circulating systems should be considered. For small and medium size bearings rotating at high speeds, an oil circulating system, drip feed or oil mist is satisfactory.

With other influences being equal, increasingly lower viscosities are needed with increasing speeds. The quantity of oil needed for successful operation becomes greater with increasing temperature, load, speed, and bearing size.

Lubrication of anti-friction bearings

Extreme pressures

Various extreme pressure agents are compounded into some greases and oils. These include additives such as sulfur, phosphorus, and chlorine compounds, graphite, and molybdenum disulfide. However, such additives are generally not required in anti-friction bearing lubricants and should be avoided unless their use is dictated by other associated equipment such as gears.

For most applications, higher viscosity oils are required to prevent metal to metal contact if pressures are higher than normal or if shock loading occurs. In cases where heavily loaded bearings operate at high speeds, the selection of oil viscosity must be a compromise between a heavy oil which is desirable for heavy loading and a light oil which is desirable for high speeds.

Wet conditions

Whenever possible, an anti-friction bearing should be protected from water and moisture to avoid corrosion. Even slight corrosion on the internal surfaces may initiate bearing failure.

Ball and roller bearings are, however, often used successfully where moisture is present. The presence of moisture will affect the choice of a grease with the selection depending upon the quantity of moisture present.

Water soluble sodium base greases will form a non-corrosive emulsion when mixed with a limited quantity of water. However, agitation is necessary to form this emulsion. If water should enter an idle bearing, the bearing may become corroded. There is a limit to the amount of water which a water soluble grease can absorb and still protect the bearing surfaces.

A water resistant grease, such as a lithium base grease that contains an effective rust inhibitor should be used where large amounts of water are present. The term "water resistant grease" is actually a misnomer since no grease will totally resist large amounts of water for extended periods.

Slow moving bearings can be packed full of a cohesive, water resistant grease formulated with a very heavy oil to afford maximum protection against large amounts of water. Where wet conditions are so severe that satisfactory protection cannot be provided by a lubricant, it is sometimes necessary to use bearings fabricated of special corrosion resistant alloys or bearings with corrosion resistant coatings.

Fretting

Anti-friction bearings are sometimes damaged by a wear effect that is variously called fretting corrosion, fretting, friction oxidation and false brinneling. This effect evidences itself by the formation of rust-like wear debris and the formation of wear spots.

Fretting can occur in bearings subjected to vibration, vibratory loads, or oscillation of small amplitudes. It is sometimes seen in the bearings of idle machinery that has been subjected to the vibrations of nearby machines. The wear spots can be recognized as depressions or indentations in the races at the points where they have been in contact with the balls or rolls. If allowed to progress, the wear in these contact areas will become so extensive as to prevent functioning of the bearings.

Fretting can be eliminated or minimized by the selection of a lubricant which has good feed ability. Low viscosity oils minimize fretting to a greater extent than oils of higher viscosities.

With grease lubrication in applications where fretting is a problem, it is good general practice to use a soft grease such as an NLGI no. 0 or 1 grade, or a harder grease, which tends to soften considerably upon working.

Dust and dirt

A high percentage of ball and roller bearing troubles can be attributed to foreign matter entering the bearing after mounting. Because anti-friction bearings are highly sensitive to dust and dirt, elaborate protective devices are necessary in some applications.

Oil lubricated bearings are generally protected from foreign particle contamination by the use of oil filters and the properly designed seals required in oil lubricated systems.

Grease in sealed and shielded bearings can provide an effective barrier against dust and dirt. Where the bearings operate in a dusty or dirty atmosphere, the grease should be chosen with its sealing properties in mind. Such a product should have good resistance to structural breakdown on working. Usually, the stiff consistency of an NLGI grade 3 grease will provide a good sealing barrier.

Operating temperature range

The temperature range over which a grease can be used depends on the type of base oil and thickener used as well as the additives. The lower temperature limit; i.e., the lowest temperature at which the grease will allow the bearing to be started up without difficulty, is determined by the base oil and its viscosity. The upper temperature limit is governed mainly by the type of thickener and indicates the maximum temperature at which the grease will provide lubrication for a bearing. It should be remembered that a grease will age (deteriorate) and oxidize with increasing rapidity as the temperature increases and that oxidation products have a detrimental effect on lubrication. The upper temperature limit should not be confused with the grease dropping point quoted by lubricant manufacturers as this value only indicates the temperature at which the grease loses its consistency and becomes fluid.

The following table gives the operating temperature ranges for the types of grease normally used for rolling bearing lubrication. The values are based on extensive testing and are valid for commonly available greases having a mineral oil base and no EP (extreme pressure) additives.

Lubrication of anti-friction bearings

Operating temperature ranges for mineral oil-based greases

Grease type recommended operating temperature range (thickener)	°C			°F		
Lithium base	-30	to	110	-22	to	230
Lithium complex	-20		140	-4		284
Sodium base	-30		80	-22		176
Sodium complex	-20		140	-4		284
Calcium base	-10		60	14		140
Calcium complex	-20		130	-4		266
Barium complex	-20		130	-4		266
Aluminum complex	-30		110	-22		230
Inorganic thickeners (bentonite, silica gel, etc.)	-30		130	-22		266
Polyurea	-30		140	-22		284

Greases based on synthetic oils; e.g., ester oils, synthetic hydrocarbons or silicone oils, may be used at temperatures above and below the operating temperature range of mineral oil-based greases. If grease-lubricated bearings are to operate at such temperatures, MRC Bearings Applications Engineering should be contacted for advice.

Grease relubrication

In order for a bearing to be properly lubricated with grease, oil must bleed from the grease. The oil that is picked up by the bearing components is gradually broken down by oxidation or lost by evaporation, centrifugal force, etc. In time, the grease will oxidize or the oil in the grease near the bearing will be depleted. Therefore, depending upon the life requirement for the bearing, relubrication may be necessary. There are two critical factors to proper relubrication: the quantity of grease supplied and the frequency at which it is supplied.

If the service life of the grease is shorter than the expected service life of the bearing, the bearing has to be relubricated. Relubrication should occur when the condition of the existing lubricant is still satisfactory. The relubrication interval depends on many related factors. These include bearing type and size, speed, operating temperature, grease type, space around the bearing, and the bearing environment. The relubrication charts and information provided are based on statistical rules. The relubrication intervals are defined as the time period, at the end of which 99% of the bearings are still reliably lubricated. This represents the L_1 grease life.

Bearings with integral seals and shields

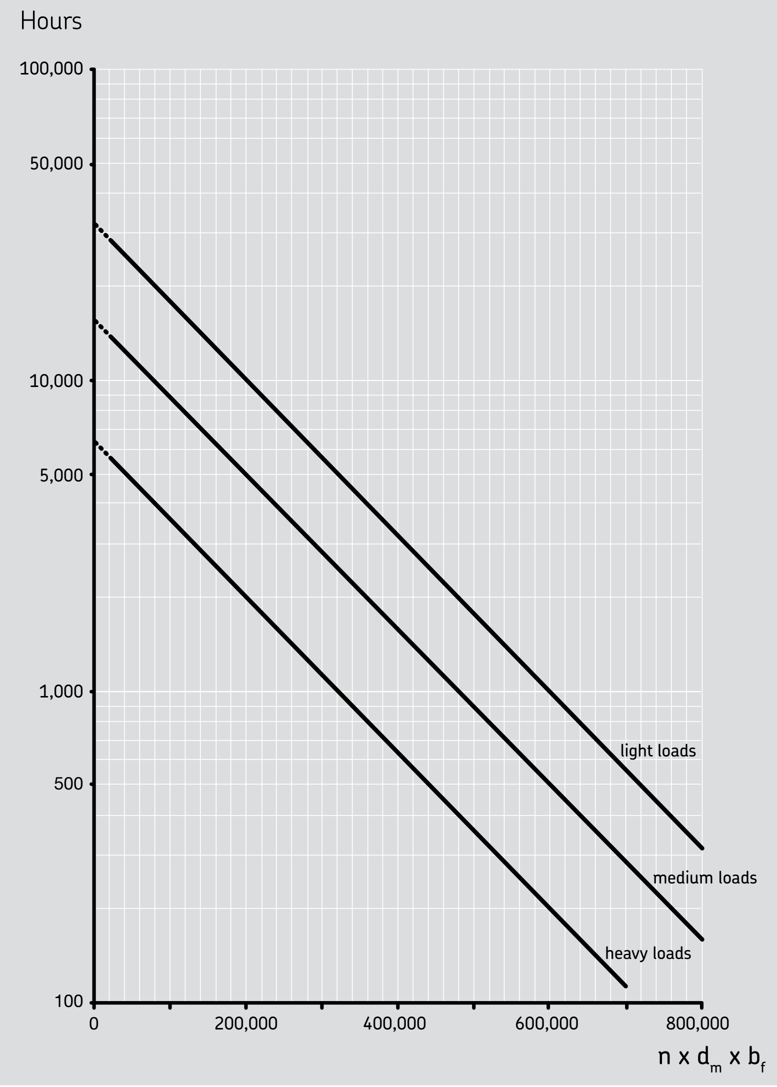
The information and recommendations to follow relate to bearings without integral seals or shields. Bearings and bearing units with integral seals and shields on both sides are typically already supplied with grease from the manufacturer. Bearings with integral seals and shields are very difficult to re-grease. Therefore, when estimating the service life of sealed or shielded bearings, consideration needs to be given to bearing fatigue life and grease life. The service life of a bearing with integral seals or shields is determined by the shorter of the two lives. For information about the grease life of a bearing with integral seals or shields, MRC Bearings Applications Engineering should be contacted.

Relubrication intervals

The relubrication intervals t_f for bearings with rotating inner ring on horizontal shafts under normal and clean conditions can be obtained from Figure 5 as a function of:

- the bearing rotational speed (n), rpm
- the bearing pitch diameter (d_m)
  d_m = [bearing bore (mm) + bearing OD (mm)]/2
- the relevant bearing factor, b_f, depending on bearing type and load conditions, (see table on page 290)
- the load ratio (dynamic capacity/applied resultant load), C/P

Figure 5 - Relubrication intervals at 158° F (70° C)



Lubrication of anti-friction bearings

The relubrication interval t_f is an estimated value based on an operating temperature of 70° C (158° F), using good quality lithium thickener/mineral oil greases. When bearing operating conditions differ, adjust the relubrication intervals obtained from Figure 5, according to the information given under "Relubrication interval adjustments", below.

If the n x d_m exceeds 70% of the recommended limit according to the table below or if ambient temperatures are high, then extra consideration should be given to the lubrication methods. When using high performance greases, a longer relubrication interval can be achieved. MRC Bearings Applications Engineering should be consulted in these instances.

Relubrication interval adjustments

Operating temperature

Since grease aging is accelerated with increasing temperature, it is recommended to halve the intervals obtained from Figure 5 for every 27° F (15° C) increase in operating temperature above 158° F (70° C). The alternate also applies for lower temperatures. The relubrication interval t_f may be extended at temperatures below 158° F (70° C) if the temperature is not so low as to prevent the grease from bleeding oil. In the case of full complement bearings and thrust roller bearings, t_f values obtained from Figure 5 should not be extended. It is also not advisable to use relubrication intervals in excess of 30,000 hours.

In general, specialty greases are required for bearing temperatures in excess of 210° F (100° C). In addition, the material limitations of the bearing components should also be taken into consideration such as the cage, seals, and the temperature stability of the bearing steel.

Vertical shaft

For bearings on vertical shafts, the intervals obtained from Figure 5 should be halved. A good seal or retaining shield below the bearing is required to prevent the grease from exiting the bearing cavity. As a reminder, NLGI no. 3 greases help reduce the amount of grease leakage and churning that occurs in vertical shaft applications.

Vibration

Moderate vibration should not have a negative effect on grease life. But high vibration and shock levels, such as those in vibrating screen applications, can cause the grease to "slump" more quickly, resulting in churning. In these cases the relubrication interval should be reduced. If the grease becomes too soft, grease with a better mechanical stability or grease with higher stiffness up to NLGI no. 3 should be used.

Outer ring rotation

In applications where the outer ring rotates or where there is an eccentric shaft weight, the speed factor n x d_m is calculated differently: in this case use the bearing outside diameter D instead of d_m. The use of a good sealing mechanism is also required to avoid grease loss.

Under conditions of high outer ring speeds (i.e. > 40% of the bearing reference speed), greases with reduced bleed rates should be selected. For spherical roller thrust bearings with a rotating housing washer, oil lubrication is recommended.

Contamination

When considering contamination, grease aging isn't as much an issue as the detrimental effects of the contaminants to the bearing surfaces. Therefore, more frequent relubrication than indicated by the relubrication interval will reduce the negative effects of foreign particles on the grease while reducing the damaging effects caused by over-rolling the particles. Fluid contaminants (water, process fluids, etc.) also call for a reduced interval. In case of severe contamination, continuous relubrication should be considered.

Since there are no formulas to determine the frequency of relubrication because of contamination, experience is the best indicator of how often to relubricate. It is generally accepted that the more frequent the relubrication the better. However, care should be taken to avoid overgreasing a bearing in an attempt to flush out contaminated grease. Using less grease on a more frequent basis rather than the full amount of grease each time is recommended. Excessive regreasing without the ability to purge will cause higher operating temperatures because of churning. The grease amount required for relubrication is discussed later in this section.

Very low speeds

Bearings that operate at very low speeds under light loads call for a grease with low consistency while bearings that operate at low speeds and heavy loads require a grease having a high viscosity, and if possible, good EP characteristics. Selecting the proper grease and grease fill is important in low speed applications. In some cases, 100% fills may be appropriate. In general, grease aging is not an issue for very low speed applications when bearing temperatures are less than 158° F (70° C), so relubrication is rarely needed unless contamination is an issue.

High speeds

Relubrication intervals for bearings used at high speeds, i.e. above the speed factor n x d_m in the table to the left, only apply when using special greases or special bearings, e.g. hybrid bearings. In these cases continuous relubrication techniques such as circulating oil, oil-spot, etc. are more suitable than grease lubrication.

Very heavy loads

For bearings operating at a speed factor n x d_m > 20,000 and with a load ratio C/P < 4, the relubrication interval should be reduced. Under these very heavy load conditions, continuous grease relubrication or oil bath lubrication is recommended.

In applications where the speed factor n x d_m < 20,000 and the load ratio C/P = 1-2, see information under "Very low speeds", above. For heavy loads and high speeds, circulating oil lubrication with cooling is generally recommended.

Bearing factors and recommended limits for n x d_m

Bearing type[1)]	Bearing factor b_f	Recommended limits for n x d_m		
		light load	medium load	heavy load
Deep groove ball bearings	1	500,000	400,000	300,000
Angular contact ball bearings	1	500,000	400,000	300,000
Self-aligning ball bearings	1	500,000	400,000	300,000

1) The bearing factors and recommended practical n x d_m limits apply to bearings with standard internal geometry and standard cage execution.

Very light loads

In many cases the relubrication interval may be extended if the loads are light (C/P = 30 to 50). Be aware that bearings do have minimum load requirements for satisfactory operation.

Misalignment

A constant misalignment within the permissible limits of the bearing does not adversely affect the grease life in self-aligning type bearings. However, misalignment in other bearing types will typically generate higher operating temperatures and require more frequent relubrication. Reference "Operating temperature" (page 274).

Very short intervals

If the determined value for the relubrication interval t_f is too short for a particular application, it is recommended to:

- check the bearing operating temperature
- check whether the grease is contaminated by solid particles or fluids
- check the bearing application conditions such as load or misalignment
- consider a more suitable grease

Relubrication quantity

The amount of grease needed for relubrication can be obtained from:

$Gp = 0.005\ D\ B$

where

Gp = grease quantity, g

D = bearing outside diameter, mm

B = total bearing width, mm

When operating conditions are such that relubrication can be carried out at infrequent intervals, it is sufficient if the bearing housing is accessible and can be opened easily. The cap of split housings and the cover of one-piece housings can usually be taken off to expose the bearing. After removing the used grease, fresh grease should first be packed between the rolling elements.

Where more frequent relubrication is required, provision should be made for regreasing; preferably a grease nipple should be fitted to the housing. A grease gun (lubricator) can then be used. To ensure that fresh grease actually reaches the bearing and replaces the old grease, the lubrication duct in the housing should either feed the grease adjacent to the outer ring side face, or, better still, into the bearing.

After a number of such relubrications the housing should be opened and the used grease removed before fresh grease is added.

Relubrication intervals—oil

The frequency at which the oil must be changed is mainly dependent on the operating conditions and on the quantity of oil used.

Where oil bath lubrication is employed it is normally sufficient to change the oil once a year, provided the bearing temperature does not exceed 50° C (120° F) and there is no contamination. Higher temperatures or more arduous running conditions necessitate more frequent changes, e.g. at a temperature of 100° C (220° F) the oil should be changed every 3 months.

For circulating oil systems the period between complete oil changes is dependent on how often the oil is circulated over a given period of time and whether it is cooled, etc. The most suitable period can generally only be determined by trial runs and frequent examination of the oil. The same practice also applies to oil jet lubrication.

In oil mist lubrication, most of the oil is lost, as it is conveyed to the bearing only once.

Bearing cleaning

New bearings should be cleaned only if they have been exposed to dirt after removal from their package or lubricated with an oil or grease that is incompatible with the preservative. (See "Compatibility and storage", page 293). Bearings which have been in service and require cleaning due to accumulated dirt or deteriorated lubricant may be cleaned as follows: all cleaning operations should be done in a dirt free area and only clean solvents of good quality should be used. Light transformer oils, spindle oils, or automotive flushing oils are suitable for cleaning bearings but oils heavier than SAE 10 motor oils are not recommended. The use of chlorinated solvents of any kind is not recommended in bearing cleaning operations because of the rust hazard involved. The use of compressed air for blowing dirt out of bearings and drying solvents is not recommended unless the air system is filtered to remove moisture and dirt. Bearings should never be spun at high speed by a stream of compressed air during cleaning as this may cause damage to the balls and raceways.

Cleaning unmounted used bearings

Place bearings in a wire or mesh basket and suspend the basket in a suitable container of clean petroleum solvent or kerosene. Allow them to soak, preferably overnight or longer, until all hard deposits have softened. Bearings which contain badly oxidized grease may require soaking in hot, light oil (200° F to 240° F) to soften the deposits. The basket should be agitated slowly through the oil from time to time. After deposits have softened, the bearings should be immersed in solvent for cleaning. In extreme cases, boiling in emulsified cleaners (i.e. grinding, cutting, or floor cleaning compounds) may be more effective to soften hard deposits. A stiff brush may be used to dislodge solid particles. If hot emulsion solutions have been used, it is important that all entrapped water be removed from the bearings. This may be accomplished by draining and slowly rotating the individual bearings while hot until the water has been completely evaporated.

A more preferable method of removing entrapped water after draining is to spin the bearings in a water displacing type rust preventive oil. After removing the water, the bearings should immediately be immersed in clean petroleum solvent for further cleaning. After the used bearings have been thoroughly cleaned, their condition may be judged by hand. A light hand thrust should be applied against one bearing ring while slowly rotating the other ring. The degree of smoothness felt in rotation will indicate whether the bearing is satisfactory for further service. Bearings which are satisfactory for further service should be immediately rotated in light oil to displace the solvent. Those which will not be installed immediately should be coated with a good rust preventive oil and wrapped in clean oil-proof paper.

Lubrication of anti-friction bearings

Cleaning mounted used bearings

For cleaning bearings without removing them from their mounted assembly, hot, light oil at 180° F (82° C) may be flushed through the housing while the shaft or spindle is slowly rotated. In cases of badly oxidized grease and oil, hot water emulsions can be used in place of flushing oil. The solution should be drained thoroughly and the housing flushed with hot, light oil. The shaft should be rotated slowly throughout these operations.

In some cases where deposits are extremely difficult to remove, an intermediate flushing with a mixture of alcohol and light petroleum solvent, after the emulsion treatment, may be helpful. The flushing oil should be drained completely and oil passages checked to make sure they are not clogged before adding new lubricant.

If the bearing is lubricated with grease, new grease may be forced through the bearing to purge the old grease and contaminates. This may be done, however, only if contamination is not severe and vent openings are provided in the housing for exhausting the old grease. After purging with grease, the bearings should be operated for about ten minutes before the vent plugs are replaced to avoid serious overheating of the bearing due to churning of excess grease.

Cleaning sealed or shielded used bearings

Bearings which have non-removable double shields or seals cannot be cleaned. These bearings are normally inspected and reused or rejected on the basis of smoothness and looseness.

Bearings having one seal or one shield may be cleaned satisfactorily by the methods outlined here. Bearings having two shields that are held in place by snap rings can be cleaned and regreased by carefully removing the shields and reinstalling them.

Bearings having two removable rubber seals can be cleaned and regreased if care is exercised in removing and reinstalling the seals. The best procedure for removing the seal is to insert a thin, knife-like blade between the O.D. of the seal and the seal groove in the outer ring, then slowly work around the periphery of the seal, working the seal from the groove. It is important to work around the periphery rather than exert too much pressure at one point, which may damage the seal. Usually the seal can be removed without damage.

Things you should know about lubrication

MRC bearings that have seals or shields are generally lubricated for the life of the bearing. Bearings that do not have seals or shields are protected from corrosion by coating the bearing with a preservative. The preservative is compatible with petroleum base oils and lubricants. It is not necessary to remove the preservative from the bearing surfaces when the bearing will be lubricated with either a petroleum base oil or grease.

It is possible that either synthetic oil or greases compounded with synthetic oils, will not be compatible with a petroleum base preservative. It is recommended that the preservative be removed from the bearing surfaces before lubricating with either of these products. Synthetic hydrocarbons are an exception. It is also possible that greases compounded with a polyurea thickener may cause excessive grease softening due to incompatibility with a petroleum base preservative.

Synthetic oils and greases compounded with synthetic oils are classified as special condition lubricants. They are usually not the best choice for operating conditions that fall within the capability of petroleum base lubricants. They are expensive and lack some of the desirable lubricating qualities of petroleum base lubricants. Synthetic hydrocarbon may be an exception.

Because machined phenolic or metal separators occupy a considerable amount of the space between the bore of the outer ring and the O.D. of the inner ring in a bearing, special care must be exercised when introducing grease into these bearings to ensure that it is uniformly distributed in the bearing. Operation of the bearing will eventually uniformly distribute the grease, but it is possible to initiate a heating-type failure or to cause damage to the active surfaces in the bearing before this occurs. This precaution is especially important when there is a close running clearance between the separator and one of the rings. One method of introducing grease between the rings and the separator is to use a plastic bag. If grease is sealed in a plastic bag and a small opening is cut across one of the corners, the bag can be inserted between the separator and either ring. Grease can then be forced into the bearing by squeezing it from the bag.

In applications where either water or air is used to dissipate heat from the bearing cavity, care must be exercised not to create a significant temperature differential between the bearing inner ring and outer ring. Some cooling methods, i.e. water jacketed housings, very efficiently dissipate heat from the housing and outer ring of the bearing, but have little effect on the shaft and bearing inner ring. Under these conditions, internal clearance in the bearing is removed as the result of thermal expansion of the inner ring and thermal contraction of the outer ring. The loss of internal clearance can result in premature bearing failures due to a significant increase in ball and race stresses, and also due to excessive heat generation. One way to avoid this problem is to circulate and cool the oil.

Lubrication of anti-friction bearings

Compatibility and storage

It is important when relubricating bearings, not to mix different types of greases or oils. Mixing greases often causes the mixture to become either softer or stiffer. Incompatibility results when the mixture is too soft or too stiff to effectively lubricate the bearing. The mixing of the same type of grease or oil from two different manufacturers can also cause a performance loss unless the manufacturers use the same additives.

There are several environmental considerations when selecting an area for storing bearings. The shelf life of the grease or preservative can be significantly shortened if bearings are stored in an unsatisfactory environment. Because both temperature and humidity accelerate the deterioration of either grease or a preservative, bearings should be stored at a temperature not greater than 80° F (27° C) and at a humidity not exceeding 55%. It is also desirable to select an area where there is not a great fluctuation in temperature that might produce condensation. Also, in order to reduce the likelihood of bearings being held in storage for excessively long periods of time, bearing stocks should be rotated to make certain that the oldest bearings in stock are used first.

Lubrication methods

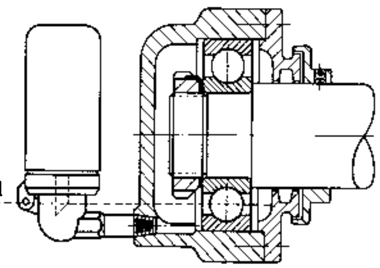


Figure 6

Oil bath lubrication

A simple oil bath method is satisfactory for low and moderate speeds. The static oil level should not exceed the center line of the lowermost ball or roller. A greater amount of oil can cause churning which results in abnormally high operating temperatures. Systems of this type generally employ sight gauges to facilitate inspection of the oil level.

Figure 6 shows a constant level arrangement for maintaining the correct oil level.

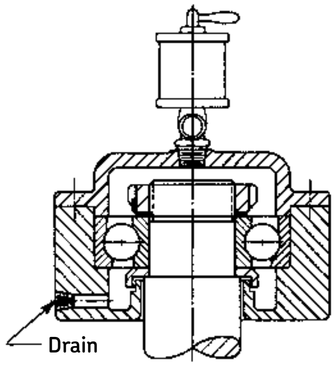


Figure 7

Drip feed lubrication

This system is widely used for small and medium ball and roller bearings operating at moderate to high speeds where extensive cooling is not required. The oil, introduced through a filter-type, sight feed oiler, has a controllable flow rate which is determined by the operating temperature of the bearings.

Figure 7 illustrates a typical design and shows the preferred location of the oiler with respect to the bearings.

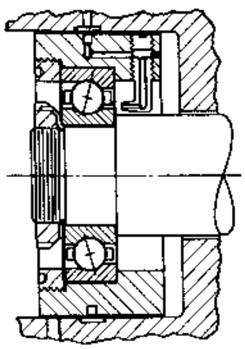


Figure 8

Forced feed circulation

This type of system uses a circulating pump and is particularly suitable for low to moderate speed, heavily loaded applications where the oil has a major function as a coolant in addition to lubrication. If necessary, the oil can be passed through a heat exchanger before returning to the bearing. Entry and exit of the oil should be on opposite sides of the bearing. An adequate drainage system must be provided to prevent an excess accumulation of oil. Oil filters and magnetic drain plugs should be used to minimize contamination.

In applications of large, heavily loaded, high speed bearings operating at high temperatures, it may be necessary to use high velocity oil jets. In such cases the use of several jets on both sides of the bearing provides more uniform cooling and minimizes the danger of complete lubrication loss from plugging. The jet stream should be directed at the opening between the cage bore and inner ring O.D., see Figure 8. Adequate scavenging drains must be provided to prevent churning of excess oil after the oil has passed through the bearing. In special cases, scavenging may be required on both sides of the bearing.

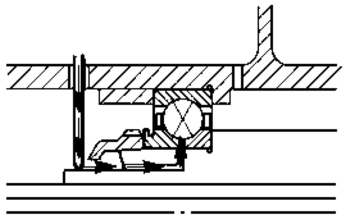


Figure 9

At extremely high speeds, the bearing tends to reject the entry of sufficient oil to provide adequate cooling and lubrication with conventional oil jet and flood systems. Figure 9 shows an under-race lubrication system with a 9000 series bearing having a split inner ring with oil slots. This method insures positive entrance of oil into the bearing to provide lubrication and cooling of the inner ring.

Lubrication of anti-friction bearings

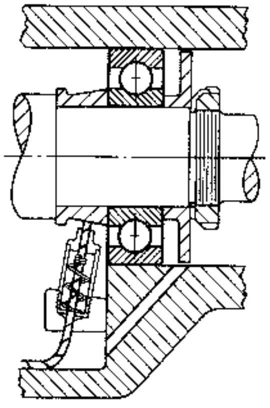


Figure 10

Wick feed lubrication

Wick oilers function either by gravity or capillary action to transfer a small quantity of filtered oil from a reservoir to the bearing. Wick feed is satisfactory for high speed operation with no danger of excessive oil churning. Attention must be given to wicks to assure that they are not clogged and they must be replaced occasionally.

Figure 10 shows an arrangement whereby the wick conveys oil by capillary action to a rotating flinger where it is thrown off by centrifugal force and drains back through the bearing.

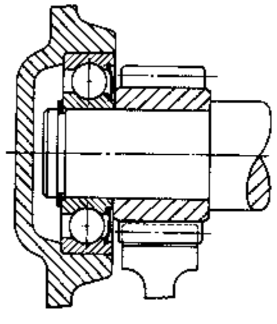


Figure 11

Oil splash lubrication

This method of lubrication is used mainly in gear boxes where the gear oil splash is used to lubricate the bearings.

In applications where the oil splash is heavy, shielded bearings are sometimes used to reduce the amount of oil reaching the bearing to prevent heating from excessive churning. See Figure 11.

In applications where normal splash does not provide adequate lubrication, oil feeder trails should be designed into the gear case to direct oil into the bearings.

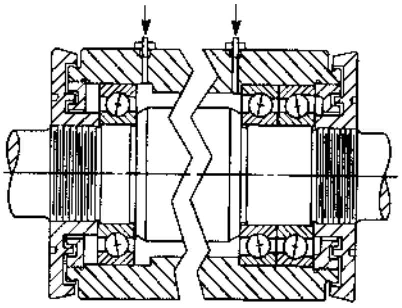


Figure 12

Oil mist lubrication

Oil mist systems, see Figure 12, are usually reserved for high speed applications. In mist lubrication systems, the oil is atomized and transported in an airstream through tubing to the bearings. Bearings are constantly fed with an optimum quantity of oil thus minimizing bearing heating due to oil churning. While not as effective as flood lubrication for heat removal, mist lubrication does provide some cooling from the continuous forced circulation of air. A rule of thumb on the use of oil mist is obtained from the formula:

$K < 10^9$

where

$K = DNL$

D = bearing bore in mm

N = inner ring speed rpm

L = load in pounds.

Systems can be designed so that a positive pressure is maintained within the housing thereby preventing the entrance of contaminates.

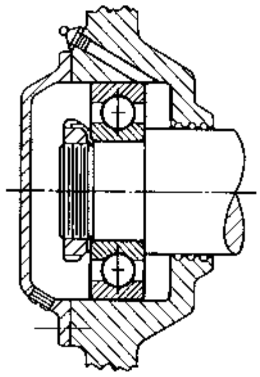


Figure 13

Regreaseable mounting

Recommended for moderate speeds and loads. Where prelubricated sealed bearings are not suitable for some reason, consideration must be given to use of an open type bearing with provision for relubrication. The grease plug at the bottom should be removed while the grease is being inserted through the fitting at the top. The direction of flow tends to remove the old grease.

Lubrication of anti-friction bearings

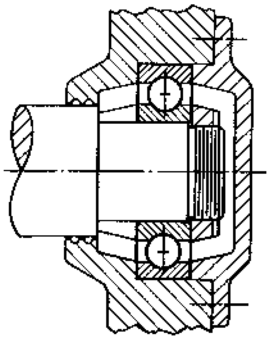


Figure 14

High temperature grease mounting

The life of permanently lubricated installations at high temperatures is a function of the volume of grease present and the design of the mounting. Note that ample grease space has been provided and that the configuration of parts adjacent to the bearing is such as to urge the lubricant into contact with the active bearing parts.

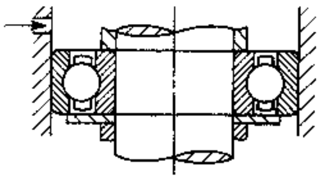


Figure 15

Deep groove ball bearings on vertical shaft

In vertical applications where grease is admitted above the bearing, the bearing should be provided with a shield on the lower side, or a separate plate, as shown in Figure 15, to retain the grease.

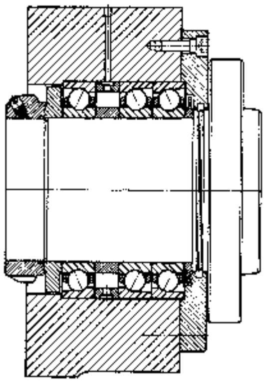


Figure 16

Grease lubrication for duplex arrangements

For duplex mountings it is important that all bearings in the set receive an adequate supply of grease. Typical arrangements to accomplish this are shown above. In Figure 16, the spacer between the outer rings is provided with a circumferential groove and radial holes so that grease applied through the grease fitting and hole in the housing is directed between the bearings.

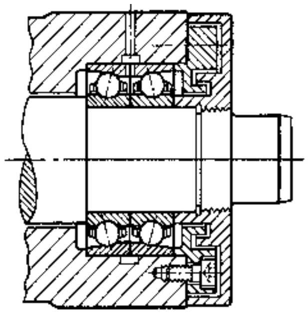


Figure 17

In Figure 17, the bearing outer rings are slotted on the mating faces while the housing has a circumferential groove, grease fitting and hole, thus allowing grease to be applied to both bearings.

Bearing vibration data

Bearing frequency data

Vibration monitoring is becoming an important tool in preventive maintenance of equipment. Vibration monitoring can detect abnormalities in equipment components and indicate their replacement before a catastrophic failure occurs. This reduces expensive unplanned breakdown and loss of production.

To assist you in this monitoring, the following pages include frequency data for many of our popular bearing sizes. The bearing suffix code, which is printed on the bearing carton, identifies particular design features of the bearing. Although a change in suffix code for a bearing size normally causes little or no change in the frequency data for that bearing, if you are unable to match your suffix code to one in the chart and your application is sensitive, please call MRC Engineering for exact values.

The frequency data in the following pages is supplied based on a speed of one rpm. To obtain the frequency at your shaft or housing speed, simply multiply the number given in the table by your speed.

Example:
What is the inner ring ball pass frequency for a 100KR with inner ring rotation of 1,000 rpm?

Inner ring frequency at 1 rpm =
5.0159 cycles/min. (CPM) (from the following tables)
Inner ring frequency at 1,000 rpm = 5.0159 CPM × 1000
Inner ring frequency at 1,000 rpm = 5015.9 CPM

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

		Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
Bearing size	Suffix	Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
100KR	0012	0.3730	0.6270	5.0159	2.9841	3.5324	3.5324
100KS	H501	0.3677	0.6323	4.4260	2.5740	3.5152	3.5152
101KR	XXXX	0.3865	0.6135	5.5216	3.4784	3.9830	3.9830
101KS	H501	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
102KR	H102	0.4034	0.5966	5.9660	4.0340	4.7502	4.7502
102KS	H501	0.3987	0.6013	5.4120	3.5880	4.7317	4.7317
102S	XXXX	0.3918	0.6082	4.8660	3.1340	4.4027	4.4027
103KR	H102	0.3974	0.6026	6.6286	4.3714	4.4812	4.4812
103KS	H501	0.4084	0.5916	5.9159	4.0841	5.2760	5.2760
103S	XXXX	0.3735	0.6265	4.3852	2.6148	3.7011	3.7011
104KR	H101	0.4017	0.5983	6.5815	4.4185	4.6932	4.6932
104KS	H501	0.3976	0.6024	5.4218	3.5782	4.6772	4.6772
104S	XXXX	0.3976	0.6024	5.4218	3.5782	4.6772	4.6772
105KR	0013	0.4153	0.5847	7.6006	5.3994	5.5070	5.5070
105KS	H501	0.4063	0.5937	5.9369	4.0631	5.1492	5.1492
105S	0005	0.4077	0.5923	5.3309	3.6691	5.2309	5.2309
106KR	0015	0.4189	0.5811	8.1350	5.8650	5.7921	5.7921
106KS	H501	0.4159	0.5841	6.4246	4.5754	5.7803	5.7803
106S	H502	0.4137	0.5863	5.8628	4.1372	5.6226	5.6226
107KR	0017	0.4213	0.5787	8.1020	5.8980	5.9590	5.9590
107KS	H502	0.4182	0.5818	6.4001	4.5999	5.9467	5.9467
107S	XXXX	0.4286	0.5714	6.8571	5.1429	6.8571	6.8571
108KR	0011	0.4293	0.5707	8.5605	6.4395	6.6672	6.6672
108KS	H501	0.4118	0.5882	5.8819	4.1181	5.4929	5.4929
108S	0C01	0.4339	0.5661	7.3599	5.6401	7.4267	7.4267
109KR	0008	0.4297	0.5703	9.1245	6.8755	6.7074	6.7074
109KS	0012	0.4203	0.5797	6.9559	5.0441	6.1172	6.1172
109S	XXXX	0.4398	0.5602	8.9638	7.0362	8.1797	8.1797
110KR	0022	0.4351	0.5649	9.6026	7.3974	7.2900	7.2900
110KS	0020	0.4267	0.5733	7.4525	5.5475	6.6777	6.6777
110M	0C01	0.4451	0.5549	10.5440	8.4560	8.9899	8.9899
110S	XXXX	0.4442	0.5558	8.8929	7.1071	8.8484	8.8484
111KR	0011	0.4317	0.5683	9.6615	7.3385	6.8942	6.8942
111KS	0020	0.4288	0.5712	7.4252	5.5748	6.8830	6.8830
111S	XXXX	0.4431	0.5569	8.9107	7.0893	8.6703	8.6703
112KR	0011	0.4361	0.5639	10.1505	7.8495	7.3870	7.3870
112KS	0017	0.4283	0.5717	7.4320	5.5680	6.8308	6.8308
112S	XXXX	0.4444	0.5556	8.8889	7.1111	8.8889	8.8889
113KR	0011	0.4400	0.5600	10.6408	8.3592	7.8791	7.8791
113KS	0015	0.4327	0.5673	7.9429	6.0571	7.2895	7.2895
113M	XXXX	0.4427	0.5573	11.7040	9.2960	8.6065	8.6065
113S	XXXX	0.4444	0.5556	8.8889	7.1111	8.8889	8.8889
114KR	0013	0.4409	0.5591	11.1818	8.8182	7.9858	7.9858
114KS	0016	0.4294	0.5706	7.4172	5.5828	6.9455	6.9455
114S	XXXX	0.4464	0.5536	8.8576	7.1424	9.2209	9.2209
115KR	0020	0.4440	0.5560	11.6756	9.3244	8.4419	8.4419
115KS	0020	0.4332	0.5668	7.9358	6.0642	7.3467	7.3467
115S	XXXX	0.4380	0.5620	7.8673	6.1327	7.9471	7.9471
116KR	0004	0.4404	0.5596	11.7522	9.2478	7.9562	7.9562
116KS	0007	0.4303	0.5697	7.4060	5.5940	7.0348	7.0348
116S	0006	0.4419	0.5581	8.3721	6.6279	8.4837	8.4837
117KR	XXXX	0.4435	0.5565	12.2427	9.7573	8.3566	8.3566
117KS	0009	0.4335	0.5665	7.9303	6.0697	7.3912	7.3912
117M	XXXX	0.4379	0.5621	11.8045	9.1955	7.9248	7.9248
117S	XXXX	0.4379	0.5621	7.8697	6.1303	7.9248	7.9248
118KR	0006	0.4403	0.5597	11.7588	9.2462	7.9243	7.9243
118KS	0010	0.4310	0.5690	7.3973	5.6027	7.1061	7.1061
118S	XXXX	0.4405	0.5595	7.8334	6.1666	8.2799	8.2799
119KR	XXXX	0.4362	0.5638	11.2766	8.7234	7.4360	7.4360
119KS	XXXX	0.4372	0.5628	8.4425	6.5575	7.8319	7.8319
119S	XXXX	0.4378	0.5622	7.8704	6.1296	7.9182	7.9182
120KR	XXXX	0.4451	0.5549	12.7633	10.2367	8.6434	8.6434

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
		Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
120KS	H502	0.4365	0.5635	7.8890	6.1110	7.7471	7.7471
120M	XXXX	0.4194	0.5806	10.4509	7.5491	6.0419	6.0419
120R	0011	0.4347	0.5653	11.3056	8.6944	7.2895	7.2895
121KR	XXXX	0.4425	0.5575	12.2652	9.7348	8.2361	8.2361
121KS	XXXX	0.4371	0.5629	8.4434	6.5566	7.8238	7.8239
122KR	0010	0.4399	0.5601	11.7621	9.2379	7.9013	7.9013
122KS	H501	0.4348	0.5652	7.9129	6.0871	7.5376	7.5376
122R	0008	0.4351	0.5649	11.2971	8.7029	7.3267	7.3267
124KR	0008	0.4439	0.5561	12.2340	9.7660	8.4817	8.4817
124KS	H501	0.4391	0.5609	8.4129	6.5871	8.0941	8.0941
124M	XXXX	0.4283	0.5717	10.8622	8.1378	6.8308	6.8308
124R	0012	0.4352	0.5648	11.8600	9.1400	7.3573	7.3573
126KR	0012	0.4398	0.5602	12.3250	9.6750	7.8792	7.8792
126KS	H501	0.4375	0.5625	8.4381	6.5619	7.8701	7.8701
126M	0001	0.4289	0.5711	10.8506	8.1494	6.8920	6.8920
126R	0012	0.4404	0.5596	12.3105	9.6895	7.9689	7.9688
128KR	XXXX	0.4432	0.5568	12.2493	9.7507	8.3704	8.3704
128KS	XXXX	0.4365	0.5635	7.8890	6.1110	7.7471	7.7471
128M	XXXX	0.4294	0.5706	10.8406	8.1594	6.9455	6.9455
128R	0006	0.4401	0.5599	12.3168	9.6832	7.9514	7.9514
130KR	0004	0.4430	0.5570	12.2535	9.7465	8.3269	8.3269
130KS	XXXX	0.4323	0.5677	7.3805	5.6195	7.2464	7.2464
130R	0005	0.4401	0.5599	12.3168	9.6832	7.9373	7.9373
132KR	XXXX	0.4426	0.5574	12.2625	9.7375	8.2883	8.2883
132KS	XXXX	0.4365	0.5635	7.8890	6.1110	7.7470	7.7470
132M	0004	0.4303	0.5697	11.3939	8.6061	7.0347	7.0347
132R	0010	0.4399	0.5601	12.3220	9.6780	7.9239	7.9239
134KR	0006	0.4395	0.5605	11.7707	9.2293	7.8500	7.8500
134KS	XXXX	0.4299	0.5701	7.4119	5.5881	6.9878	6.9878
134R	0006	0.4400	0.5600	12.3209	9.6791	7.9131	7.9131
136KR	XXXX	0.4400	0.5600	12.3209	9.6791	7.9330	7.9330
136KS	XXXX	0.4379	0.5621	7.8697	6.1303	7.9247	7.9247
136R	0005	0.4398	0.5602	12.3252	9.6748	7.9026	7.9026
138KR	XXXX	0.4428	0.5572	12.8152	10.1848	8.2891	8.2891
138KS	XXXX	0.4355	0.5645	7.9029	6.0971	7.6242	7.6242
138R	0003	0.4373	0.5627	12.3802	9.6198	7.5663	7.5663
140KR	XXXX	0.4400	0.5600	12.3210	9.6790	7.9157	7.9157
140KS	XXXX	0.4315	0.5685	7.3902	5.6098	7.1644	7.1644
140R	XXXX	0.4381	0.5619	12.3624	9.6376	7.6794	7.6794
142R	XXXX	0.4359	0.5641	11.8466	9.1534	7.4078	7.4078
144KR	XXXX	0.4342	0.5658	11.8817	9.1183	7.2218	7.2218
144KS	XXXX	0.4348	0.5652	7.9128	6.0872	7.5385	7.5385
144R	0005	0.4379	0.5621	12.3663	9.6337	7.6544	7.6544
146R	XXXX	0.4387	0.5613	12.3494	9.6506	7.7555	7.7555
148KR	XXXX	0.4389	0.5611	12.3440	9.6560	7.7565	7.7565
148KS	XXXX	0.4378	0.5622	7.8705	6.1295	7.9169	7.9169
148R	XXXX	0.4391	0.5609	12.3387	9.6613	7.8195	7.8195
150R	XXXX	0.4396	0.5604	12.3290	9.6710	7.8784	7.8784
152KR	XXXX	0.4352	0.5648	11.8613	9.1387	7.2993	7.2993
152KS	XXXX	0.4375	0.5625	7.8755	6.1245	7.8701	7.8701
152R	XXXX	0.4400	0.5600	12.3201	9.6799	7.9331	7.9331
156KR	XXXX	0.4392	0.5608	12.3377	9.6623	7.7576	7.7576
156KS	XXXX	0.4388	0.5612	7.8573	6.1427	8.0432	8.0432
156R	XXXX	0.4399	0.5601	12.3220	9.6780	7.9208	7.9208
160KR	XXXX	0.4360	0.5640	11.8445	9.1555	7.3577	7.3577
160KS	XXXX	0.4373	0.5627	7.8773	6.1227	7.8537	7.8537
164KR	XXXX	0.4396	0.5604	12.3293	9.6707	7.7590	7.7590
164KS	XXXX	0.4405	0.5595	8.3930	6.6070	8.2799	8.2799
164R	XXXX	0.4402	0.5598	12.3165	9.6835	7.9552	7.9552
1800S	H501	0.4178	0.5822	6.4037	4.5963	5.9221	5.9221
1801S	H501	0.4278	0.5722	6.8666	5.1334	6.7788	6.7788
1802S	H501	0.4389	0.5611	7.8553	6.1447	8.0623	8.0623

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
		Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
1803S	H501	0.4446	0.5554	8.8865	7.1135	8.9137	8.9137
1804S	H501	0.4389	0.5611	7.8548	6.1452	8.0667	8.0667
1805S	H501	0.4432	0.5568	8.3523	6.6477	8.6861	8.6861
1806S	H501	0.4559	0.5441	9.7938	8.2062	11.2502	11.2502
1807S	H501	0.4613	0.5387	10.7744	9.2256	12.8362	12.8362
1808S	H501	0.4655	0.5345	11.7592	10.2408	14.4190	14.4190
1809S	H501	0.4615	0.5385	10.7709	9.2291	12.8954	12.8954
1810S	H501	0.4655	0.5345	11.7595	10.2405	14.4146	14.4146
1811S	H501	0.4625	0.5375	10.7500	9.2500	13.2583	13.2583
1812S	H501	0.4655	0.5345	11.7592	10.2408	14.4190	14.4190
1813S	H501	0.4630	0.5370	11.8151	10.1849	13.4213	13.4213
1814S	H501	0.4653	0.5347	12.8336	11.1664	14.3254	13.3254
1815S	H501	0.4673	0.5327	13.8500	12.1500	15.2294	15.2294
1816S	H501	0.4691	0.5309	13.8028	12.1972	16.1325	16.1325
1817S	H501	0.4634	0.5366	12.8794	11.1206	13.5726	13.5726
1818S	H501	0.4651	0.5349	13.3714	11.6286	14.2758	14.2758
1819S	H501	0.4668	0.5332	13.8640	12.1360	14.9790	14.9790
1820S	H501	0.4682	0.5318	14.3574	12.6426	15.6816	15.6816
1821S	H501	0.4696	0.5304	15.3817	13.6183	16.3843	16.3843
1822S	H501	0.4651	0.5349	13.3732	11.6268	14.2446	14.2446
1824S	H501	0.4677	0.5323	14.3732	12.6268	15.3949	15.3949
1826S	H501	0.4650	0.5350	13.3746	11.6254	14.2227	14.2227
1828S	H501	0.4672	0.5328	14.3846	12.6154	15.1961	15.1961
1830S	H501	0.4650	0.5350	13.3756	11.6244	14.2066	14.2066
1832S	H501	0.4669	0.5331	13.8600	12.1400	15.0503	15.0503
1834S	H501	0.4649	0.5351	13.3763	11.6237	14.1943	14.1943
1836S	H501	0.4667	0.5333	13.8664	12.1336	14.9388	14.9388
1838S	H501	0.4649	0.5351	13.3769	11.6231	14.1848	14.1848
1840S	H501	0.4665	0.5335	13.8714	12.1286	14.8510	14.8510
1844S	H501	0.4692	0.5308	14.8619	13.1381	16.1825	16.1825
1848S	H501	0.4662	0.5338	13.8791	12.1209	14.7208	14.7208
1852S	H501	0.4685	0.5315	14.8814	13.1186	15.8209	15.8209
1856S	H501	0.4672	0.5328	14.3845	12.6155	15.1980	15.1980
1860S	H501	0.4650	0.5350	13.3755	11.6245	14.2081	14.2081
1864S	H501	0.4669	0.5331	13.8599	12.1401	15.0519	15.0519
1868S	H501	0.4687	0.5313	14.8773	13.1227	15.8953	15.8953
1872S	H501	0.4702	0.5298	15.3632	13.6368	16.7383	16.7383
1876S	H501	0.4649	0.5351	13.3768	11.6232	14.1859	14.1859
1880S	H501	0.4665	0.5335	13.8714	12.1286	14.8521	14.8521
1884S	H501	0.4679	0.5321	14.3664	12.6336	15.5181	15.5181
1888S	H501	0.4692	0.5308	14.8618	13.1382	16.1837	16.1837
1892S	H501	0.4649	0.5351	13.3777	11.6223	14.1715	14.1715
1896S	H501	0.4662	0.5338	13.8790	12.1210	14.7218	14.7218
1900R	XXXX	0.4067	0.5933	6.5268	4.4732	4.8597	4.8597
1900S	H501	0.4008	0.5992	4.7938	3.2062	4.8408	4.8408
1901R	XXXX	0.4180	0.5820	6.9842	5.0158	5.5171	5.5171
1901S	H501	0.4118	0.5882	5.8819	4.1181	5.4932	5.4932
1902R	XXXX	0.4129	0.5871	7.0452	4.9548	5.2549	5.2549
1902S	H101	0.4077	0.5923	5.3309	3.6691	5.2312	5.2312
1902S	H501	0.4077	0.5923	5.3309	3.6691	5.2312	5.2312
1903R	XXXX	0.4203	0.5797	7.5360	5.4640	5.7727	5.7727
1903S	H501	0.4155	0.5845	5.8447	4.1553	5.7504	5.7504
1904R	XXXX	0.4070	0.5930	7.7095	5.2905	4.9509	4.9509
1904S	H501	0.4165	0.5835	6.4190	4.5810	5.8174	5.8174
1905R	XXXX	0.4327	0.5673	8.5093	6.4907	6.9067	6.9067
1905S	H501	0.4289	0.5711	6.8530	5.1470	6.8920	6.8920
1906R	XXXX	0.4363	0.5637	9.5829	7.4171	7.3422	7.3422
1906S	H501	0.4330	0.5670	6.2369	4.7631	7.3293	7.3293
1907R	XXXX	0.4416	0.5584	10.0512	7.9488	7.9869	7.9869
1907S	H501	0.4338	0.5662	6.7938	5.2062	7.4261	7.4261
1908R	XXXX	0.4407	0.5593	10.0673	7.9327	7.9186	7.9186
1908S	H501	0.4300	0.5700	6.8406	5.1594	6.9978	6.9978

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
		Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
1909R	XXXX	0.4468	0.5532	11.0648	8.9352	8.7971	8.7971
1909S	H501	0.4438	0.5562	6.1181	4.8819	8.7856	8.7856
1910R	XXXX	0.4442	0.5558	11.6725	9.3275	8.4310	8.4310
1910S	H501	0.4414	0.5586	7.2613	5.7387	8.4204	8.4204
1911R	XXXX	0.4443	0.5557	11.1148	8.8852	8.3983	8.3982
1911S	H501	0.4471	0.5529	8.8468	7.1532	9.3414	9.3414
1912R	XXXX	0.4481	0.5519	12.1416	9.8584	9.0357	9.0357
1912S	H501	0.4507	0.5493	9.3377	7.6623	10.0486	10.0486
1913R	XXXX	0.4515	0.5485	12.6166	10.3834	9.6718	9.6718
1913S	H501	0.4539	0.5461	10.3758	8.6242	10.7546	10.7546
1914R	XXXX	0.4468	0.5532	12.1710	9.8290	8.8229	8.8229
1914S	H501	0.4486	0.5514	9.3732	7.6268	9.6311	9.6311
1915R	XXXX	0.4497	0.5503	12.6562	10.3438	9.3535	9.3535
1915S	XXXX	0.4515	0.5485	9.8782	8.1268	10.2095	10.2095
1916R	XXXX	0.4524	0.5476	13.1430	10.8570	9.8834	9.8834
1916S	H501	0.4540	0.5460	10.3732	8.6268	10.7871	10.7871
1917R	XXXX	0.4485	0.5515	12.6844	10.3156	9.1262	9.1262
1917S	H501	0.4497	0.5503	9.3558	7.6442	9.8316	9.8316
1918R	XXXX	0.4472	0.5528	13.2672	10.7328	8.9273	8.9273
1918S	XXXX	0.4520	0.5480	9.8640	8.1360	10.3207	10.3207
1919R	XXXX	0.4531	0.5469	13.6730	11.3270	10.0347	10.0347
1919S	XXXX	0.4541	0.5459	10.3715	8.6285	10.8096	10.8096
1920R	XXXX	0.4494	0.5506	13.2144	10.7856	9.3520	9.3520
1920S	XXXX	0.4504	0.5496	9.8931	8.1069	9.9784	9.9784
1921R	XXXX	0.4517	0.5483	13.7065	11.2935	9.7509	9.7509
1921S	XXXX	0.4524	0.5476	10.4050	8.5950	10.4024	10.4024
1922R	XXXX	0.4566	0.5434	14.6706	12.3294	10.8354	10.8354
1922S	XXXX	0.4542	0.5458	10.3702	8.6298	10.8259	10.8259
1924R	XXXX	0.4521	0.5479	13.6975	11.3025	9.8823	9.8823
1924S	H501	0.4499	0.5501	10.4525	8.5475	9.8736	9.8736
1926R	XXXX	0.4512	0.5488	13.7188	11.2812	9.6710	9.6710
1926S	XXXX	0.4514	0.5486	9.8756	8.1244	10.1813	10.1813
1928R	XXXX	0.4542	0.5458	14.1907	11.8093	10.3066	10.3066
1928S	XXXX	0.4543	0.5457	10.3682	8.6318	10.8503	10.8503
1930R	XXXX	0.4495	0.5505	13.7634	11.2366	9.3523	9.3523
1930S	XXXX	0.4515	0.5485	10.4216	8.5784	10.2108	10.2108
1932R	XXXX	0.4521	0.5479	14.2448	11.7552	9.8823	9.8823
1932S	XXXX	0.4520	0.5480	9.8647	8.1353	10.3120	10.3120
1934R	XXXX	0.4548	0.5452	15.2657	12.7343	10.4129	10.4129
1934S	XXXX	0.4544	0.5456	10.3671	8.6329	10.8646	10.8646
1936R	XXXX	0.4506	0.5494	14.2853	11.7147	9.5793	9.5793
1936S	XXXX	0.4520	0.5480	10.4119	8.5881	10.3220	10.3220
1938R	XXXX	0.4531	0.5469	14.7658	12.2342	10.0348	10.0348
1938S	XXXX	0.4541	0.5459	10.3714	8.6286	10.8108	10.8108
1940R	XXXX	0.4494	0.5506	14.3148	11.6852	9.3521	9.3521
1940S	XXXX	0.4504	0.5496	9.8930	8.1070	9.9795	9.9795
1944S	H501	0.4542	0.5458	10.3701	8.6299	10.8270	10.8270
1948S	H501	0.4575	0.5425	11.3930	9.6070	11.6735	11.6735
1952S	H501	0.4514	0.5486	9.8757	8.1243	10.1803	10.1803
1956S	H501	0.4543	0.5457	10.3683	8.6317	10.8493	10.8493
1960S	H501	0.4493	0.5507	9.3621	7.6379	9.7582	9.7582
1964S	H501	0.4520	0.5480	9.8648	8.1352	10.3113	10.3113
1968S	H501	0.4544	0.5456	10.3672	8.6328	10.8638	10.8638
1972S	H501	0.4565	0.5435	10.8693	9.1307	11.4160	11.4160
1976S	H501	0.4541	0.5459	10.3714	8.6286	10.8107	10.8107
1980S	H501	0.4561	0.5439	10.8782	9.1218	11.2992	11.2992
1984S	H501	0.4579	0.5421	11.3845	9.6155	11.7873	11.7873
1988S	H501	0.4542	0.5458	10.3701	8.6299	10.8270	10.8270
1992S	H501	0.4559	0.5441	10.8819	9.1181	11.2504	11.2504
200R	XXXX	0.3460	0.6540	4.5779	2.4221	2.8509	2.8509
200S	H501	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
200SZZC	H401	0.3838	0.6162	4.9293	3.0707	4.0722	4.0722

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
		Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
201R	XXXX	0.3607	0.6393	5.1142	2.8858	3.1956	3.1956
201S	H501	0.3636	0.6364	4.4545	2.5455	3.3941	3.3941
201SZZC	H401	0.3647	0.6353	4.4472	2.5528	3.4243	3.4243
202M	XXXX	0.3730	0.6270	6.2699	3.7301	3.6832	3.6832
202R	H102	0.3872	0.6128	5.5154	3.4846	4.0490	4.0490
202S	H501	0.3812	0.6188	4.9500	3.0500	3.9729	3.9729
202SZZC	H401	0.3833	0.6167	4.9340	3.0660	4.0494	4.0494
203M	XXXX	0.3886	0.6114	6.7254	4.2746	4.2656	4.2656
203R	H102	0.3875	0.6125	5.5124	3.4876	4.0810	4.0810
203S	H501	0.3817	0.6183	4.9468	3.0532	3.9881	3.9881
203SZZC	H401	0.3837	0.6163	4.9305	3.0695	4.0659	4.0659
204M	0001	0.3815	0.6185	6.1847	3.8153	3.9835	3.9835
204R	0022	0.3971	0.6029	7.2342	4.7658	4.4902	4.4902
204R	0C02	0.3971	0.6029	7.2342	4.7658	4.4902	4.4902
204RDS	0022	0.3971	0.6029	6.6314	4.3686	4.4902	4.4902
204S	H501	0.3815	0.6185	4.9478	3.0522	3.9835	3.9835
204SFFC	H401	0.3850	0.6150	4.9203	3.0797	4.1165	4.1165
204SZZC	H401	0.3850	0.6150	4.9203	3.0797	4.1165	4.1165
205M	XXXX	0.3866	0.6134	6.7475	4.2525	4.1821	4.1821
205R	0032	0.4002	0.5998	7.1974	4.8026	4.6574	4.6574
205R	0028	0.4002	0.5998	7.1974	4.8026	4.6574	4.6574
205RDS	0028	0.4002	0.5998	6.5976	4.4024	4.6574	4.6574
205S	H501	0.3983	0.6017	5.4149	3.5851	4.7151	4.7151
205SFFC	0099	0.3866	0.6134	4.9072	3.0928	4.1821	4.1821
205SZZC	0027	0.3866	0.6134	4.9072	3.0928	4.1821	4.1821
206M	0012	0.3878	0.6122	7.3461	4.6539	4.2329	4.2329
206R	0014	0.4165	0.5835	8.1693	5.8307	5.6335	5.6335
206RDS	0032	0.4165	0.5835	8.1693	5.8307	5.6335	5.6335
206S	0129	0.3878	0.6122	4.8974	3.1026	4.2329	4.2329
206S	0055	0.3878	0.6122	4.8974	3.1026	4.2329	4.2329
206S	H501	0.3965	0.6035	5.4318	3.5682	4.6223	4.6223
206SFFC	0250	0.3878	0.6122	5.4318	3.5682	4.6223	4.6223
206SZZC	0025	0.3878	0.6122	5.4318	3.5682	4.6223	4.6223
207M	0022	0.3887	0.6113	7.3354	4.6646	4.2704	4.2704
207R	0020	0.4138	0.5862	8.2068	5.7932	5.4499	5.4499
207RDS	0017	0.4138	0.5862	8.2068	5.7932	5.4499	5.4499
207S	0118	0.3887	0.6113	4.8903	3.1097	4.2704	4.2704
207S	H201	0.3961	0.6039	5.4347	3.5653	4.6067	4.6067
207SFFC	0131	0.3887	0.6113	4.8903	3.1097	4.2704	4.2704
207SZZC	0024	0.3887	0.6113	4.8903	3.1097	4.2704	4.2704
208M	0012	0.3942	0.6058	7.2700	4.7300	4.5127	4.5127
208R	0024	0.4099	0.5901	8.2613	5.7387	5.2240	5.2240
208S	0154	0.3942	0.6058	5.4525	3.5475	4.5127	4.5127
208S	H201	0.3975	0.6025	5.4228	3.5772	4.6715	4.6715
208SFFC	0147	0.3942	0.6058	5.4525	3.5475	4.5127	4.5127
208SZZC	0017	0.3942	0.6058	5.4525	3.5475	4.5127	4.5127
209M	0022	0.3962	0.6038	7.8495	5.1505	4.6091	4.6091
209R	0023	0.4171	0.5829	8.1609	5.8391	5.6885	5.6885
209RDS	0025	0.4171	0.5829	8.7438	6.2562	5.6885	5.6885
209S	0071	0.3962	0.6038	5.4343	3.5657	4.6091	4.6091
209S	H201	0.4054	0.5946	5.9464	4.0536	5.0937	5.0937
209SFFC	0058	0.3962	0.6038	5.4343	3.5657	4.6091	4.6091
209SZZC	0018	0.3962	0.6038	5.4343	3.5657	4.6091	4.6091
210M	0016	0.4093	0.5907	8.8607	6.1393	5.3304	5.3304
210R	0014	0.4230	0.5770	9.2320	6.7680	6.1498	6.1498
210S	0071	0.4093	0.5907	5.9071	4.0929	5.3304	5.3304
210S	H201	0.4093	0.5907	5.9071	4.0929	5.3304	5.3304
210SFFC	0157	0.4093	0.5907	5.9071	4.0929	5.3304	5.3304
210SZZC	0009	0.4093	0.5907	5.9071	4.0929	5.3304	5.3304
211M	0017	0.4078	0.5922	8.8827	6.1173	5.2400	5.2400
211R	0C01	0.4105	0.5895	8.2532	5.7468	5.2505	5.2505
211S	0057	0.4078	0.5922	5.9218	4.0782	5.2400	5.2400

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
211S	H201	0.4078	0.5922	5.9218	4.0782	5.2400	5.2400
211SZZC	0004	0.4078	0.5922	5.9218	4.0782	5.2400	5.2400
212M	0005	0.4066	0.5934	8.3073	5.6927	5.1676	5.1676
212R	0012	0.4184	0.5816	9.3058	6.6942	5.7908	5.7908
212S	0064	0.4066	0.5934	5.9338	4.0662	5.1676	5.1676
212S	H201	0.4108	0.5892	5.8924	4.1076	5.4241	5.4241
213M	0001	0.4056	0.5944	8.9159	6.0841	5.1084	5.1084
213M	H201	0.4099	0.5901	8.8516	6.1484	5.3686	5.3686
213R	0016	0.4164	0.5836	9.3372	6.6618	5.6641	5.6641
213RDS	0013	0.4168	0.5832	8.7485	6.2515	5.6641	5.6641
213S	0010	0.4056	0.5944	5.9439	4.0561	5.1084	5.1084
213S	H201	0.4145	0.5855	6.4409	4.5591	5.6745	5.6745
213SFFC	0026	0.4056	0.5944	5.9439	4.0561	5.1084	5.1084
214M	0001	0.4186	0.5814	9.3026	6.6974	5.9789	5.9789
214M	H201	0.4104	0.5896	8.8433	6.1567	5.4043	5.4043
214R	0014	0.4210	0.5790	10.4214	7.5786	5.9886	5.9886
214RDS	0010	0.4210	0.5790	9.2635	6.7365	5.9886	5.9886
214S	0037	0.4104	0.5896	5.8955	4.1045	5.4043	5.4043
214S	H201	0.4145	0.5855	6.4404	4.5596	5.6779	5.6779
214SFFC	0034	0.4104	0.5896	5.8955	4.1045	5.4043	5.4043
215M	0003	0.4109	0.5891	8.8359	6.1641	5.4361	5.4361
215M	H201	0.4148	0.5852	9.3629	6.6371	5.6993	5.6993
215R	0015	0.4171	0.5829	9.9086	7.0914	5.7086	5.7086
215RDS	0013	0.4171	0.5829	9.3257	6.6743	5.7086	5.7086
215S	0024	0.4148	0.5852	6.4370	4.5630	5.6995	5.6995
215S	H201	0.4148	0.5852	6.4370	4.5630	5.6995	5.6995
216M	0004	0.4098	0.5902	8.8531	6.1469	5.3625	5.3625
216R	0018	0.4228	0.5772	9.2354	6.7646	6.1490	6.1490
216RDM	0001	0.4228	0.5772	9.8126	7.1874	6.1490	6.1490
216RDS	0018	0.4228	0.5772	9.8126	7.1874	6.1490	6.1490
216S	0015	0.4134	0.5866	5.8659	4.1341	5.6011	5.6011
216SFFC	0031	0.4134	0.5866	5.8659	4.1341	5.6011	5.6011
216SZZC	0005	0.4134	0.5866	5.8659	4.1341	5.6011	5.6011
217M	0001	0.4189	0.5811	9.8781	7.1219	6.0059	6.0059
217R	0012	0.4213	0.5787	9.8379	7.1621	6.0152	6.0152
217S	0022	0.4122	0.5878	5.8782	4.1218	5.5179	5.5179
218M	H501	0.4111	0.5889	9.4224	6.5776	5.4465	5.4465
218R	0014	0.4133	0.5867	9.3868	6.6132	5.4553	5.4553
218RDM	0001	0.4133	0.5867	8.8001	6.1999	5.4553	5.4553
218RDS	0007	0.4133	0.5867	8.8001	6.1999	5.4553	5.4553
218S	H501	0.4145	0.5855	6.4408	4.5592	5.6752	5.6752
219M	H501	0.4101	0.5899	8.8479	6.1521	5.3847	5.3847
219R	XXXX	0.4182	0.5818	9.8901	7.1099	5.8024	5.8024
219RDM	XXXX	0.4188	0.5812	9.2996	6.7004	5.8434	5.8434
219RDS	H701	0.4195	0.5805	9.2875	6.7125	5.8464	5.8464
219S	H501	0.4101	0.5899	5.8986	4.1014	5.3847	5.3847
220M	H501	0.4093	0.5907	8.8607	6.1393	5.3304	5.3304
220R	0016	0.4169	0.5831	9.9120	7.0880	5.7170	5.7170
220R-BKE	0015	0.4169	0.5831	9.3290	6.6710	5.7170	5.7170
220RDM	XXXX	0.4169	0.5831	9.3290	6.6710	5.7170	5.7170
220S	H501	0.4093	0.5907	5.9071	4.0929	5.3304	5.3304
221M	0002	0.4139	0.5861	9.3776	6.6224	5.6349	5.6349
221R	XXXX	0.4160	0.5840	9.3432	6.6568	5.6434	5.6434
221RDM	XXXX	0.4160	0.5840	9.3432	6.6568	5.6434	5.6434
221S	H501	0.4085	0.5915	5.9148	4.0852	5.2825	5.2825
222M	XXXX	0.4078	0.5922	9.3929	6.6071	5.5693	5.5693
222R	0007	0.4150	0.5850	9.3601	6.6399	5.5774	5.5774
222S	H501	0.4078	0.5922	5.9218	4.0782	5.2400	5.2400
224M	0001	0.4100	0.5900	8.8506	6.1494	5.3732	5.3732
224R	0013	0.4166	0.5834	9.3345	6.6655	5.6987	5.6987
224S	XXXX	0.4147	0.5853	6.4383	4.5617	5.6912	5.6912
226M	0001	0.4162	0.5838	9.3406	6.6594	5.8001	5.8001

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

		Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
Bearing size	Suffix	Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
226R	0008	0.4183	0.5817	9.8883	7.1117	5.8085	5.8085
226RDM	XXXX	0.4183	0.5817	9.8883	7.1117	5.8085	5.8085
228R	0006	0.4205	0.5795	9.8507	7.1493	5.9867	5.9867
230R	0003	0.4189	0.5811	9.8789	7.1211	5.8546	5.8546
232R	0007	0.4172	0.5828	9.9069	7.0931	5.7437	5.7437
234R	XXXX	0.4160	0.5840	9.3435	6.6565	5.8001	5.8001
236R	0003	0.4194	0.5806	9.8704	7.1296	5.8995	5.8995
238R	0001	0.4213	0.5787	10.4174	7.5826	6.0292	6.0292
240R	XXXX	0.4226	0.5774	10.3925	7.6075	6.1484	6.1484
242R	XXXX	0.4214	0.5786	10.4147	7.5853	6.0412	6.0412
244R	XXXX	0.4201	0.5799	9.8585	7.1415	5.9465	5.9465
246R	XXXX	0.4192	0.5808	9.8738	7.1262	5.8640	5.8640
248R	XXXX	0.4181	0.5819	9.8926	7.1074	5.7895	5.7895
250R	XXXX	0.4174	0.5826	9.9045	7.0955	5.7241	5.7241
252R	XXXX	0.4164	0.5836	9.9205	7.0795	5.6640	5.6640
256R	XXXX	0.4210	0.5790	10.4218	7.5782	5.9884	5.9884
260R	XXXX	0.4232	0.5768	10.3828	7.6172	6.1505	6.1505
264R	XXXX	0.4251	0.5749	10.3478	7.6522	6.2979	6.2979
300S	H501	0.3391	0.6609	3.9656	2.0344	2.7851	2.7851
301R	XXXX	0.3425	0.6575	4.6021	2.3979	2.7806	2.7806
301S	H501	0.3380	0.6620	3.9719	2.0281	2.7628	2.7628
302R	XXXX	0.3786	0.6214	6.2145	3.7855	3.7536	3.7536
302S	H501	0.3608	0.6392	4.4747	2.5253	3.3122	3.3122
303M	XXXX	0.3512	0.6488	5.1906	2.8094	3.0621	3.0621
303R	XXXX	0.3795	0.6205	6.2055	3.7945	3.7973	3.7973
303S	H501	0.3636	0.6364	4.4551	2.5449	3.3918	3.3918
304M	XXXX	0.3677	0.6323	5.6906	3.3094	3.5149	3.5149
304R	0013	0.3712	0.6288	6.2877	3.7123	3.5288	3.5288
304S	H501	0.3677	0.6323	4.4261	2.5739	3.5149	3.5149
304SFFC	H401	0.3677	0.6323	4.4261	2.5739	3.5149	3.5149
304SZZC	H401	0.3677	0.6323	4.4261	2.5739	3.5149	3.5149
305M	0006	0.3723	0.6277	6.2773	3.7227	3.6591	3.6591
305R	0019	0.3934	0.6066	7.2788	4.7212	4.3595	4.3595
305S	0059	0.3723	0.6277	4.3941	2.6059	3.6591	3.6591
305SFFC	0091	0.3723	0.6277	4.3936	2.6064	3.6615	3.6615
305SWI	0011	0.3845	0.6155	4.9239	3.0761	4.0983	4.0983
305SZZC	0012	0.3723	0.6277	4.3936	2.6064	3.6615	3.6615
306M	0009	0.3755	0.6245	6.2451	3.7549	3.7668	3.7668
306R	0020	0.3935	0.6065	7.2775	4.7225	4.3814	4.3814
306S	0104	0.3755	0.6245	4.9961	3.0039	3.7668	3.7668
306S	H201	0.3817	0.6183	4.9465	3.0535	3.9896	3.9896
305S	0059	0.3723	0.6277	4.4254	2.5746	3.5179	3.5179
306SFFC	0092	0.3755	0.6245	4.9961	3.0039	3.7668	3.7668
306SWI	0005	0.3761	0.6239	4.9912	3.0088	3.7878	3.7878
306SZZC	0034	0.3755	0.6245	4.9961	3.0039	3.7668	3.7668
307M	0014	0.3688	0.6312	6.3115	3.6885	3.5501	3.5501
307R	0014	0.3922	0.6078	7.2937	4.7063	4.3171	4.3171
307RDM	XXXX	0.3922	0.6078	7.2937	4.7063	4.3171	4.3171
307S	0091	0.3688	0.6312	4.4181	2.5819	3.5501	3.5501
307S	H201	0.3827	0.6173	4.9388	3.0612	4.0262	4.0262
307SFFC	0094	0.3688	0.6312	4.4181	2.5819	3.5501	3.5501
307SWI	0006	0.3758	0.6242	4.9939	3.0061	3.7761	3.7761
307SZZC	0023	0.3688	0.6312	4.4181	2.5819	3.5501	3.5501
308M	0006	0.3779	0.6221	6.8432	4.1568	3.8503	3.8503
308R	0021	0.3924	0.6076	7.2910	4.7090	4.3389	4.3389
308S	0058	0.3779	0.6221	4.9769	3.0231	3.8503	3.8503
308S	H201	0.3840	0.6160	4.9281	3.0719	4.0777	4.0777
308SFFC	0096	0.3779	0.6221	4.9769	3.0231	3.8503	3.8503
308SZZC	0025	0.3779	0.6221	4.9769	3.0231	3.8503	3.8503
308WI	XXXX	0.3779	0.6221	6.8433	4.1567	3.8502	3.8502
309M	0002	0.3741	0.6259	6.8850	4.1150	3.7192	3.7192
309R	0019	0.3928	0.6072	7.2862	4.7138	4.3572	4.3572
309RDM	XXXX	0.3928	0.6072	7.2862	4.7138	4.3572	4.3572

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
309S	0069	0.3741	0.6259	4.3814	2.6186	3.7192	3.7192
309S	H201	0.3796	0.6204	4.9635	3.0365	3.9108	3.9108
309SFFC	0075	0.3741	0.6259	4.3814	2.6186	3.7192	3.7192
309SWI	0005	0.3796	0.6204	4.9635	3.0365	3.9108	3.9108
309SZZC	0021	0.3741	0.6259	4.3814	2.6186	3.7192	3.7192
310M	0004	0.3809	0.6191	6.8097	4.1903	3.9613	3.9613
310R	0015	0.3830	0.6170	7.4038	4.5962	3.9696	3.9696
310RDS	0005	0.3830	0.6170	6.7868	4.2132	3.9696	3.9696
310S	0088	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
310S	H201	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
310SFFC	0091	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
310SWI	0013	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
310SZZC	0011	0.3809	0.6191	4.9525	3.0475	3.9613	3.9613
311M	0018	0.3775	0.6225	6.8472	4.1528	3.8377	3.8377
311M	H201	0.3821	0.6179	7.4151	4.5849	4.0040	4.0040
311R	0016	0.3844	0.6156	7.3868	4.6132	4.0134	4.0134
311RDM	XXXX	0.3844	0.6156	6.7713	4.2287	4.0134	4.0134
311RDS	H701	0.3844	0.6156	6.7713	4.2287	4.0134	4.0134
311S	0052	0.3821	0.6179	4.9434	3.0566	4.0040	4.0040
311S	H201	0.3821	0.6179	4.9434	3.0566	4.0040	4.0040
311SFFC	0052	0.3821	0.6179	4.9434	3.0566	4.0040	4.0040
311SWI	0003	0.3821	0.6179	4.9434	3.0566	4.0040	4.0040
311SZZC	0027	0.3821	0.6179	4.9434	3.0566	4.0040	4.0040
311WI	0014	0.3791	0.6209	6.8296	4.1704	3.8949	3.8949
312M	0002	0.3830	0.6170	6.7867	4.2133	4.0406	4.0406
312M	H201	0.3830	0.6170	7.4037	4.5963	4.0406	4.0406
312R	0019	0.3852	0.6148	7.3776	4.6224	4.0492	4.0492
312RDM	XXXX	0.3852	0.6148	6.7628	4.2372	4.0492	4.0492
312RDS	0006	0.3852	0.6148	6.7628	4.2372	4.0492	4.0492
312S	0013	0.3830	0.6170	4.9358	3.0642	4.0406	4.0406
312S	H201	0.3830	0.6170	4.9358	3.0642	4.0406	4.0406
312SFFC	0046	0.3830	0.6170	4.9358	3.0642	4.0406	4.0406
312SZZC	0017	0.3830	0.6170	4.9358	3.0642	4.0406	4.0406
312WI	XXXX	0.3801	0.6199	6.8186	4.1814	3.9315	3.9315
313M	0002	0.3838	0.6162	7.3939	4.6061	4.0722	4.0722
313M	H201	0.3838	0.6162	7.3939	4.6061	4.0722	4.0722
313R	0012	0.3936	0.6064	8.4896	5.5104	4.4032	4.4032
313RDM	0001	0.3936	0.6064	7.2768	4.7232	4.4032	4.4032
313RDU	H701	0.3936	0.6064	7.2768	4.7232	4.4032	4.4032
313S	0030	0.3838	0.6162	4.9293	3.0707	4.0722	4.0722
313S	H201	0.3838	0.6162	4.9293	3.0707	4.0732	4.0732
313SFFC	0057	0.3838	0.6162	4.9293	3.0707	4.0732	4.0732
313SWI	0003	0.3816	0.6184	4.9470	3.0530	3.9873	3.9873
314M	0001	0.3845	0.6155	7.3855	4.6145	4.0998	4.0998
314M	H201	0.3845	0.6155	7.3855	4.6145	4.0998	4.0998
314R	0012	0.3939	0.6061	7.2729	4.7271	4.4115	4.4115
314S	0022	0.3845	0.6155	4.9236	3.0764	4.0998	4.0998
314S	H201	0.3845	0.6155	4.9236	3.0764	4.0998	4.0998
314SFFC	0052	0.3845	0.6155	4.9236	3.0764	4.0998	4.0998
314WI	XXXX	0.3846	0.6154	7.3854	4.6146	4.1000	4.1000
315M	H501	0.3852	0.6148	7.3781	4.6219	4.1242	4.1242
315R	0024	0.3939	0.6061	8.4848	5.5152	4.4179	4.4179
315R-BKE	0025	0.3939	0.6061	7.8788	5.1212	4.4179	4.4179
315RDM	0003	0.3939	0.6061	7.8788	5.1212	4.4179	4.4179
315S	H501	0.3852	0.6148	4.9187	3.0813	4.1242	4.1242
315SWI	0005	0.3787	0.6213	4.9707	3.0293	3.8782	3.8782
315SZZC	0013	0.3784	0.6216	4.9728	3.0272	3.8688	3.8688
315WI	XXXX	0.3854	0.6146	7.3751	4.6249	4.1341	4.1341
316M	H501	0.3857	0.6143	7.3716	4.6284	4.1459	4.1459
316R	0009	0.3940	0.6060	7.8786	5.1214	4.4235	4.4235
316RDM	0001	0.3940	0.6060	7.8786	5.1214	4.4235	4.4235
316S	H501	0.3857	0.6143	4.9144	3.0856	4.1459	4.1459

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

		Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
Bearing size	Suffix	Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
316SZZC	0015	0.3794	0.6206	4.9652	3.0348	3.9030	3.9030
316WI	XXXX	0.3921	0.6079	7.9033	5.0967	4.4162	4.4162
317M	H501	0.3862	0.6138	7.3659	4.6341	4.1652	4.1652
317R	0007	0.3943	0.6057	8.4803	5.5197	4.4295	4.4295
317RDU	H701	0.3943	0.6057	7.8746	5.1254	4.4295	4.4295
317S	H501	0.3862	0.6138	4.9106	3.0894	4.1652	4.1652
318M	H501	0.3866	0.6134	7.3607	4.6393	4.1827	4.1827
318R	0011	0.3943	0.6057	7.8746	5.1254	4.4339	4.4339
318RDM	0003	0.3943	0.6057	7.8746	5.1254	4.4339	4.4339
318S	H501	0.3866	0.6134	4.9071	3.0929	4.1827	4.1827
318SFFC	H501	0.3866	0.6134	4.9071	3.0929	4.1827	4.1827
318SWI	H501	0.3923	0.6077	4.8618	3.1382	4.4261	4.4261
318WI	XXXX	0.3866	0.6134	7.3607	4.6393	4.1827	4.1827
319M	0001	0.3924	0.6076	7.8991	5.1009	4.4304	4.4304
319R	0014	0.3943	0.6057	7.8747	5.1253	4.4379	4.4379
319S	H501	0.3870	0.6130	4.9041	3.0959	4.1984	4.1984
320M	0001	0.3841	0.6159	7.3909	4.6091	4.0818	4.0818
320R	XXXX	0.3959	0.6041	7.8529	5.1471	4.5198	4.5198
320RDM	0001	0.3959	0.6041	7.8529	5.1471	4.5198	4.5198
320S	XXXX	0.3790	0.6210	4.9676	3.0324	3.8920	3.8920
320SWI	H501	0.3790	0.6210	4.9676	3.0324	3.8920	3.8920
321M	0001	0.3845	0.6155	7.3854	4.6146	4.0998	4.0998
321R	0006	0.3961	0.6039	7.8508	5.1492	4.5204	4.5204
321RDM	XXXX	0.3961	0.6039	7.8508	5.1492	4.5204	4.5204
321S	XXXX	0.3845	0.6155	4.9236	3.0764	4.0998	4.0998
322M	0001	0.3866	0.6134	7.3607	4.6393	4.1827	4.1827
322R	0004	0.3930	0.6070	7.8915	5.1085	4.3827	4.3827
322RDM	XXXX	0.3930	0.6070	7.8915	5.1085	4.3827	4.3827
322S	XXXX	0.3821	0.6179	4.9434	3.0566	4.0040	4.0040
323S	XXXX	0.3994	0.6006	5.4057	3.5943	4.7670	4.7670
324R	0010	0.3930	0.6070	7.8903	5.1097	4.3927	4.3927
324RDM	XXXX	0.3930	0.6070	7.8903	5.1097	4.3927	4.3927
326R	XXXX	0.3934	0.6066	7.8852	5.1148	4.4025	4.4025
326RDM	XXXX	0.3934	0.6066	7.8852	5.1148	4.4025	4.4025
328R	XXXX	0.3935	0.6065	7.8852	5.1148	4.4025	4.4025
328RDM	XXXX	0.3935	0.6065	7.8852	5.1148	4.4025	4.4025
330R	XXXX	0.3971	0.6029	8.4404	5.5596	4.5730	4.5730
330RDM	XXXX	0.3971	0.6029	8.4404	5.5596	4.5730	4.5730
332R	XXXX	0.3969	0.6031	8.4404	5.5572	4.5694	4.5694
332RDM	XXXX	0.3969	0.6031	8.4404	5.5572	4.5694	4.5694
334R	XXXX	0.4000	0.6000	8.4002	5.5998	4.7133	4.7133
336R	XXXX	0.3997	0.6003	8.4046	5.5954	4.7021	4.7021
338R	XXXX	0.3997	0.6003	8.4046	5.5954	4.7021	4.7021
34	H001	0.3449	0.6551	3.9303	2.0697	2.8511	2.8511
340R	XXXX	0.3994	0.6006	8.4084	5.5916	4.6842	4.6842
342R	XXXX	0.3992	0.6008	8.4118	5.5882	4.6761	4.6761
344R	XXXX	0.3991	0.6009	8.4118	5.5882	4.6761	4.6761
348R	XXXX	0.4033	0.5967	8.3542	5.6458	4.8771	4.8771
35	XXXX	0.3449	0.6551	3.9303	2.0697	2.8511	2.8511
352R	XXXX	0.4068	0.5932	8.8975	6.1025	5.0671	5.0671
356R	XXXX	0.4062	0.5938	8.9069	6.0931	5.0257	5.0257
36	H401	0.3440	0.6560	3.9362	2.0638	2.8418	2.8418
37	H503	0.3697	0.6303	4.4123	2.5877	3.4045	3.4045
37	H501	0.3664	0.6336	4.4352	2.5648	3.3918	3.3918
38	H501	0.3682	0.6318	4.4226	2.5774	3.4452	3.4452
38	H503	0.3682	0.6318	4.4266	2.5774	3.4452	3.4452
38ZZC	0016	0.3656	0.6344	4.4410	2.5590	3.4507	3.4507
39	H502	0.3689	0.6311	4.4177	2.5823	3.4806	3.4806
403M	XXXX	0.3392	0.6608	5.2861	2.7139	2.7887	2.7887
403R	XXXX	0.3417	0.6583	5.2666	2.7334	2.7984	2.7984
403S	H501	0.3392	0.6608	3.9646	2.0354	2.7887	2.7887
404M	0001	0.3447	0.6553	5.2424	2.7576	2.9090	2.9090

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
		Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
404R	XXXX	0.3471	0.6529	5.8765	3.1235	2.9183	2.9183
404S	H501	0.3361	0.6639	3.9837	2.0163	2.7220	2.7220
405M	0002	0.3488	0.6512	5.2095	2.7905	3.0048	3.0048
405R	XXXX	0.3511	0.6489	5.8400	3.1600	3.0139	3.0139
405S	H501	0.3608	0.6392	4.4746	2.5254	3.3128	3.3128
406M	0C01	0.3779	0.6221	6.8432	4.1568	3.8503	3.8503
406R	0009	0.3566	0.6434	6.4341	3.5659	3.1533	3.1533
406S	H501	0.3611	0.6389	4.4724	2.5276	3.3214	3.3214
407M	0001	0.3741	0.6259	6.8850	4.1150	3.7192	3.7192
407R	0014	0.3611	0.6389	6.3888	3.6112	3.2700	3.2700
407S	H501	0.3609	0.6391	4.4734	2.5266	3.3173	3.3173
408M	0001	0.3624	0.6376	6.3758	3.6242	3.3591	3.3591
408R	0011	0.3644	0.6356	6.3557	3.6443	3.3670	3.3670
408S	H501	0.3624	0.6376	4.4631	2.5369	3.3591	3.3591
409M	0001	0.3653	0.6347	6.3469	3.6531	3.4427	3.4427
409R	XXXX	0.3674	0.6326	6.3265	3.6735	3.4508	3.4508
409S	H501	0.3605	0.6395	4.4766	2.5234	3.3049	3.3049
410M	0001	0.3677	0.6323	6.3229	3.6771	3.5149	3.5149
410R	XXXX	0.3697	0.6303	6.9331	4.0669	3.5229	3.5229
410S	XXXX	0.3589	0.6411	4.4878	2.5122	3.2611	3.2611
411M	0002	0.3697	0.6303	6.3026	3.6974	3.5781	3.5781
411R	XXXX	0.3717	0.6283	6.9110	4.0890	3.5859	3.5859
411S	H501	0.3616	0.6384	4.4688	2.5312	3.3360	3.3360
412M	0001	0.3715	0.6285	6.9136	4.0864	3.6337	3.6337
412R	XXXX	0.3734	0.6266	6.8921	4.1079	3.6415	3.6415
412S	H501	0.3639	0.6361	4.4525	2.5475	3.4024	3.4024
413M	0001	0.3784	0.6216	6.8375	4.1625	3.8688	3.8688
413R	0015	0.3748	0.6252	6.8768	4.1232	3.6904	3.6904
413S	H501	0.3659	0.6341	4.4384	2.5616	3.4617	3.4617
414M	0001	0.3794	0.6206	7.4478	4.5522	3.9030	3.9030
414R	XXXX	0.3687	0.6313	6.9446	4.0554	3.4909	3.4909
414S	H501	0.3603	0.6397	4.4779	2.5221	3.2997	3.2997
415M	0001	0.3862	0.6138	7.3658	4.6342	4.1653	4.1653
415R	XXXX	0.3702	0.6298	6.9277	4.0723	3.5383	3.5383
415S	H501	0.3622	0.6378	4.4645	2.5355	3.3534	3.3534
416M	0001	0.3809	0.6191	7.4288	4.5712	3.9613	3.9613
416R	XXXX	0.3716	0.6284	6.9126	4.0874	3.5814	3.5814
416S	H501	0.3639	0.6361	4.4525	2.5475	3.4024	3.4024
417M	0001	0.3816	0.6184	7.4207	4.5793	3.9866	3.9866
417R	XXXX	0.3728	0.6272	6.8991	4.1009	3.6209	3.6209
417S	H502	0.3655	0.6345	4.4417	2.5583	3.4475	3.4475
418M	0001	0.3790	0.6210	7.4514	4.5486	3.8920	3.8920
418R	XXXX	0.3710	0.6290	6.9194	4.0806	3.5617	3.5617
418S	XXXX	0.3639	0.6361	4.4525	2.5475	3.4024	3.4024
419M	XXXX	0.3666	0.6334	6.3344	3.6656	3.4801	3.4801
419R	XXXX	0.3731	0.6269	6.8957	4.1043	3.6309	3.6309
419S	XXXX	0.3712	0.6288	4.4019	2.5981	3.6231	3.6231
420M	XXXX	0.3652	0.6348	6.3483	3.6517	3.4388	3.4388
420R	XXXX	0.3715	0.6285	6.9135	4.0865	3.5790	3.5790
420S	XXXX	0.3695	0.6305	4.4133	2.5867	3.5711	3.5711
421R	XXXX	0.3654	0.6346	6.3457	3.6543	3.3941	3.3941
421S	XXXX	0.3714	0.6286	4.4003	2.5997	3.6306	3.6306
422R	XXXX	0.3655	0.6345	6.3452	3.6548	3.3954	3.3954
422S	XXXX	0.3745	0.6255	4.3787	2.6213	3.7323	3.7323
5200SB	H301	0.3969	0.6031	4.2218	2.7782	4.0209	4.0209
5200SB	H501	0.3881	0.6119	4.8951	3.1049	3.9892	3.9892
5201SB	H301	0.3906	0.6094	4.2657	2.7343	3.7689	3.7689
5201SB	H501	0.3873	0.6127	4.9014	3.0986	3.8177	3.8177
5202SB	H501	0.3849	0.6151	4.3057	2.6943	3.7286	3.7286
5202SB	H301	0.4037	0.5963	4.7700	3.2300	4.3319	4.3319
5203SB	H501	0.3966	0.6034	4.8268	3.1732	4.1975	4.1975
5204C	H501	0.3956	0.6044	4.8349	3.1651	3.9684	3.9684

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
5204M	H501	0.3956	0.6044	6.6480	4.3520	3.9684	3.9684
5205C	H501	0.4088	0.5912	5.3207	3.6793	4.5905	4.5905
5205M	H501	0.4088	0.5912	7.6855	5.3145	4.5905	4.5905
5206C	H501	0.4103	0.5897	5.3070	3.6930	4.6740	4.6740
5206M	H501	0.4103	0.5897	7.0760	4.9240	4.6740	4.6740
5207C	H501	0.4083	0.5917	5.3251	3.6749	4.5642	4.5642
5207M	H501	0.4083	0.5917	7.1002	4.8998	4.5642	4.5642
5208C	H501	0.4093	0.5907	5.3164	3.6836	4.6162	4.6162
5208M	H501	0.4093	0.5907	7.6793	5.3207	4.6162	4.6162
5209C	H501	0.4180	0.5820	5.8196	4.1804	5.1411	5.1411
5209M	H501	0.4180	0.5820	8.1475	5.8525	5.1411	5.1411
5210C	H501	0.4226	0.5774	5.7738	4.2262	5.4620	5.4620
5210M	H501	0.4226	0.5774	8.6607	6.3393	5.4620	5.4620
5211C	H501	0.4225	0.5775	5.7751	4.2249	5.4524	5.4524
5211M	H501	0.4225	0.5775	9.2401	6.7599	5.4524	5.4524
5212C	H501	0.4208	0.5792	5.7920	4.2080	5.3300	5.3300
5212M	H501	0.4208	0.5792	8.6880	6.3120	5.3300	5.3300
5213C	H501	0.4265	0.5735	6.3086	4.6914	5.7636	5.7636
5213M	H501	0.4265	0.5735	9.1761	6.8239	5.7636	5.7636
5214C	H501	0.4260	0.5740	6.3144	4.6856	5.7206	5.7206
5214M	H501	0.4260	0.5740	9.7586	7.2414	5.7206	5.7206
5215C	H501	0.4255	0.5745	6.3196	4.6804	5.6826	5.6826
5215M	H501	0.4255	0.5745	9.7666	7.2334	5.6826	5.6826
5216C	H501	0.4239	0.5761	5.7608	4.2392	5.5596	5.5596
5216M	H501	0.4239	0.5761	9.7934	7.2066	5.5596	5.5596
5217C	H501	0.4227	0.5773	5.7732	4.2268	5.4663	5.4663
5217M	H501	0.4227	0.5773	9.2371	6.7629	5.4663	5.4663
5218C	H501	0.4249	0.5751	5.7514	4.2486	5.6330	5.6330
5218M	H501	0.4249	0.5751	9.2022	6.7978	5.6330	5.6330
5220	H501	0.4250	0.5750	9.1993	6.8007	5.6470	5.6470
5222	H501	0.4232	0.5768	9.2282	6.7718	5.5082	5.5082
5300SB	H501	0.3832	0.6168	4.9344	3.0656	3.8034	3.8034
5302SB	H502	0.3967	0.6033	4.8265	3.1735	4.1991	4.1991
5303SB	H501	0.3910	0.6090	4.8717	3.1283	3.9612	3.9612
5304C	H501	0.3966	0.6034	4.8267	3.1733	4.0112	4.0112
5304M	H501	0.3966	0.6034	6.6480	4.3520	3.9684	3.9684
5305C	H501	0.3973	0.6027	4.8218	3.1782	4.0372	4.0372
5305M	H501	0.3973	0.6027	7.2327	4.7673	4.0372	4.0372
5306C	H501	0.3962	0.6038	4.8301	3.1699	3.9935	3.9935
5306M	H501	0.3962	0.6038	7.2451	4.7549	3.9935	3.9935
5307C	H501	0.3961	0.6039	4.8314	3.1686	3.9868	3.9868
5307M	H501	0.3961	0.6039	6.6431	4.3569	3.9868	3.9868
5308C	H501	0.3963	0.6037	4.8298	3.1702	3.9952	3.9952
5308M	H501	0.3963	0.6037	7.2446	4.7554	3.9952	3.9952
5309C	H501	0.3968	0.6032	4.8254	3.1746	4.0182	4.0182
5309M	H501	0.3968	0.6032	7.2381	4.7619	4.0182	4.0182
5310C	H501	0.3980	0.6020	4.8161	3.1839	4.0682	4.0682
5310M	H501	0.3980	0.6020	7.2241	4.7759	4.0682	4.0682
5311C	H501	0.3964	0.6036	4.8291	3.1709	3.9988	3.9988
5311M	H501	0.3964	0.6036	7.2436	4.7564	3.9988	3.9988
5312C	H501	0.3970	0.6030	4.8242	3.1758	4.0246	4.0246
5312M	H501	0.3970	0.6030	7.2363	4.7637	4.0246	4.0246
5313C	H501	0.3979	0.6021	4.8169	3.1831	4.0636	4.0636
5313M	H501	0.3979	0.6021	7.2254	4.7746	4.0636	4.0636
5314C	H501	0.3992	0.6008	4.8065	3.1935	4.1208	4.1208
5314M	H501	0.3992	0.6008	7.2097	4.7903	4.1208	4.1208
5315C	H501	0.3974	0.6026	4.8203	3.1797	4.0455	4.0455
5315M	H501	0.3974	0.6026	7.2304	4.7696	4.0455	4.0455
5316M	H501	0.4002	0.5998	7.1978	4.8022	4.1652	4.1652
5317	H501	0.4014	0.5986	7.1828	4.8172	4.2222	4.2222
5318	H501	0.4018	0.5982	7.1784	4.8216	4.2394	4.2394
5319	H501	0.4068	0.5932	7.7117	5.2883	4.4842	4.4842

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
5320	H501	0.3996	0.6004	7.2046	4.7954	4.1397	4.1397
5321	H501	0.4000	0.6000	7.1998	4.8002	4.1576	4.1576
5322	H501	0.4018	0.5982	7.1784	4.8216	4.2394	4.2394
5406C	H501	0.3748	0.6252	4.3767	2.6233	3.4184	3.4184
5407C	H501	0.3711	0.6289	3.7735	2.2265	3.3078	3.3078
5408C	H501	0.3743	0.6257	3.7541	2.2459	3.4046	3.4046
5409C	H501	0.3776	0.6225	4.3572	2.6428	3.5063	3.5063
5410C	H502	0.3722	0.6278	4.3946	2.6054	3.3405	3.3405
5411C	H501	0.3810	0.6190	4.3329	2.6671	3.6212	3.6212
5412C	H501	0.3826	0.6174	4.3218	2.6782	3.6762	3.6762
5413C	H501	0.3722	0.6278	4.3943	2.6057	3.3417	3.3417
5414C	H502	0.3840	0.6160	4.3121	2.6879	3.7251	3.7251
5415C	H501	0.3742	0.6258	4.3806	2.6194	3.7229	3.7229
5416C	H501	0.3753	0.6247	4.3731	2.6269	3.7591	3.7591
5417C	H501	0.3709	0.6292	4.4041	2.5960	3.6130	3.6130
5418C	H501	0.3690	0.6310	4.4172	2.5828	3.5538	3.5538
7100KR	XXXX	0.3843	0.6157	4.9256	3.0744	3.5773	3.5773
7101KR	XXXX	0.3959	0.6041	5.4372	3.5628	4.0173	4.0173
7102KR	XXXX	0.4114	0.5886	5.8862	4.1138	4.7794	4.7794
7103KR	XXXX	0.4065	0.5935	6.5281	4.4719	4.5152	4.5152
7104KR	XXXX	0.4104	0.5896	6.4853	4.5147	4.7253	4.7253
7105KR	XXXX	0.4229	0.5771	7.5027	5.4973	5.5347	5.5347
7106KR	XXXX	0.4265	0.5735	8.0292	5.9708	5.8199	5.8199
7107KR	XXXX	0.4284	0.5716	8.0020	5.9980	5.9852	5.9852
7108KR	XXXX	0.4357	0.5643	8.4642	6.5358	6.6908	6.6908
7109KR	XXXX	0.4363	0.5637	9.0183	6.9817	6.7598	6.7598
7110KR	XXXX	0.4412	0.5588	9.4987	7.5013	7.3408	7.3408
7111KR	XXXX	0.4377	0.5623	9.5582	7.4418	6.9165	6.9165
7112KR	XXXX	0.4418	0.5582	10.0482	7.9518	7.4079	7.4079
7113KR	XXXX	0.4453	0.5547	10.5393	8.4607	7.8987	7.8987
7114KR	XXXX	0.4460	0.5540	11.0799	8.9201	8.0045	8.0045
7115KR	XXXX	0.4488	0.5512	11.5742	9.4258	8.4595	8.4595
7116KR	XXXX	0.4458	0.5542	11.6378	9.3622	7.9762	7.9762
7117KR	XXXX	0.4483	0.5517	12.1366	9.8634	8.3742	8.3742
7118KR	XXXX	0.4457	0.5543	11.6409	9.3591	7.9540	7.9540
7119KR	XXXX	0.4421	0.5579	11.1570	8.8430	7.4580	7.4580
7120	XXXX	0.4410	0.5590	11.1794	8.8206	7.3127	7.3127
7120KR	XXXX	0.4500	0.5500	12.6496	10.3504	8.6615	8.6615
7121KR	XXXX	0.4476	0.5524	12.1527	9.8473	8.2549	8.2549
7122	XXXX	0.4413	0.5587	11.7323	9.2677	7.3495	7.3495
7122KR	XXXX	0.4454	0.5546	11.6455	9.3545	7.9217	7.9217
7124	XXXX	0.4418	0.5582	11.7227	9.2773	7.4088	7.4088
7124KR	XXXX	0.4491	0.5509	12.1200	9.8800	8.5008	8.5008
7126	XXXX	0.4461	0.5539	12.1854	9.8146	8.0221	8.0221
7126KR	XXXX	0.4453	0.5547	12.2033	9.7967	7.8995	7.8995
7128	XXXX	0.4458	0.5542	12.1926	9.8074	7.9721	7.9721
7128KR	XXXX	0.4484	0.5516	12.1346	9.8654	8.3895	8.3895
7130	XXXX	0.4457	0.5543	12.1947	9.8053	7.9577	7.9577
7130KR	XXXX	0.4482	0.5518	12.1404	9.8596	8.3458	8.3458
7132	XXXX	0.4458	0.5542	12.1920	9.8080	7.9761	7.9761
7132KR	XXXX	0.4479	0.5521	12.1455	9.8545	8.3079	8.3079
7134	XXXX	0.4457	0.5543	12.1938	9.8062	7.9644	7.9644
7134KR	XXXX	0.4451	0.5549	11.6527	9.3473	7.8707	7.8707
7136	XXXX	0.4457	0.5543	12.1953	9.8047	7.9539	7.9539
7136KR	XXXX	0.4457	0.5543	12.1953	9.8047	7.9539	7.9539
7138	XXXX	0.4433	0.5567	12.2468	9.7532	7.6174	7.6174
7138KR	XXXX	0.4479	0.5521	12.6975	10.3025	8.3079	8.3079
7140	XXXX	0.4439	0.5561	12.2336	9.7664	7.7009	7.7009
7140KR	XXXX	0.4455	0.5545	12.1979	9.8021	7.9363	7.9363
7142	XXXX	0.4419	0.5581	11.7193	9.2807	7.4301	7.4301
7144	XXXX	0.4440	0.5560	12.2326	9.7674	7.7076	7.7076
7144KR	XXXX	0.4405	0.5595	11.7496	9.2504	7.2450	7.2450
7146	XXXX	0.4445	0.5555	12.2218	9.7782	7.7769	7.7769
7148	XXXX	0.4449	0.5551	12.2121	9.7879	7.8406	7.8406
7148KR	XXXX	0.4445	0.5555	12.2218	9.7782	7.7769	7.7769
7152	XXXX	0.4457	0.5543	12.1953	9.8047	7.9540	7.9540
7152KR	XXXX	0.4411	0.5589	11.7370	9.2630	7.3210	7.3210
7156	XXXX	0.4456	0.5544	12.1971	9.8029	7.9417	7.9417
7156KR	XXXX	0.4445	0.5555	12.2218	9.7782	7.7769	7.7769
7160KR	XXXX	0.4415	0.5585	11.7277	9.2723	7.3780	7.3780
7164	XXXX	0.4458	0.5542	12.1920	9.8080	7.9761	7.9761
7164KR	XXXX	0.4445	0.5555	12.2218	9.7782	7.7769	7.7769
7200P	XXXX	0.3784	0.6216	4.9729	3.0271	2.9633	2.9633
7200S	0003	0.3741	0.6259	4.3814	2.6186	3.3705	3.3705
7201P	XXXX	0.3894	0.6106	5.4950	3.5050	3.2950	3.2950

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
7201S	0001	0.3705	0.6295	4.4063	2.5937	3.2653	3.2653
7202	H401	0.3855	0.6145	6.1449	3.8551	3.7505	3.7505
7202P	XXXX	0.3905	0.6095	4.8757	3.1243	3.3314	3.3314
7203	H401	0.3858	0.6142	6.1419	3.8581	3.7614	3.7614
7203P	XXXX	0.3933	0.6067	5.4600	3.5400	3.4273	3.4273
7204	0001	0.4038	0.5962	6.5578	4.4422	4.5381	4.5381
7204-BKE	XXXX	0.4038	0.5962	6.5578	4.4422	4.5381	4.5381
7204P	XXXX	0.4001	0.5999	5.9984	4.0016	3.6833	3.6833
7205	H501	0.4079	0.5921	7.1051	4.8949	4.5874	4.5874
7205DU	0004	0.4079	0.5921	6.5130	4.4870	4.5874	4.5874
7205P	XXXX	0.4131	0.5869	7.0425	4.9575	4.2759	4.2759
7205P-BKE	XXXX	0.4131	0.5869	6.4553	4.5447	4.2772	4.2772
7205PJ	H501	0.4210	0.5790	8.1055	5.8945	4.7296	4.7296
7206	0C01	0.4249	0.5751	8.0512	5.9488	5.6930	5.6930
7206	0001	0.4249	0.5751	8.0512	5.9488	5.6930	5.6930
7206P	XXXX	0.4140	0.5860	6.4452	4.5548	4.3256	4.3256
7206PJ	H501	0.4140	0.5860	7.6171	5.3829	4.3256	4.3256
7207	0001	0.4225	0.5775	8.0846	5.9154	5.5093	5.5093
7207P	XXXX	0.4147	0.5853	7.0230	4.9770	4.3624	4.3624
7207PJ	H501	0.4147	0.5853	7.6082	5.3918	4.3624	4.3624
7208	0C01	0.4190	0.5810	8.1339	5.8661	5.2576	5.2576
7208P	XXXX	0.4189	0.5811	6.9729	5.0271	4.6002	4.6002
7208PJ	H501	0.4194	0.5806	8.1275	5.8725	4.6324	4.6324
7209	0C01	0.4252	0.5748	8.0467	5.9533	5.7186	5.7186
7209-BKE	XXXX	0.4252	0.5748	8.6214	6.3786	5.7186	5.7186
7209P	XXXX	0.4205	0.5795	7.5338	5.4662	4.6948	4.6948
7209PJ	H501	0.4251	0.5749	8.6225	6.3775	5.0035	5.0035
7210	0001	0.4309	0.5691	9.1052	6.8948	6.2099	6.2099
7210P	XXXX	0.4261	0.5739	8.0338	5.9662	5.0740	5.0740
7210PJ	H501	0.4305	0.5695	9.1119	6.8881	5.4053	5.4053
7211	0001	0.4183	0.5817	8.1441	5.8559	5.2082	5.2082
7211P	XXXX	0.4254	0.5746	8.0434	5.9566	5.0251	5.0251
7211PJ	H501	0.4294	0.5706	9.1297	6.8703	5.3165	5.3165
7212	0001	0.4268	0.5732	9.1703	6.8297	5.8511	5.8511
7212P	XXXX	0.4249	0.5751	8.0516	5.9484	4.9840	4.9840
7212PJ	H501	0.4274	0.5726	8.5885	6.4115	5.1672	5.1672
7213	0001	0.4249	0.5751	9.2008	6.7992	5.6954	5.6954
7213-BKE	XXXX	0.4249	0.5751	8.6258	6.3742	5.6954	5.6954
7213DB	H701	0.3977	0.6023	6.6254	4.3746	4.0954	4.0954
7213P	XXXX	0.4277	0.5723	8.0123	5.9877	5.1864	5.1864
7213PJ	H501	0.4277	0.5723	8.5846	6.4154	5.1864	5.1864
7214	0004	0.4291	0.5709	9.1336	6.8664	6.0485	6.0485
7214P	XXXX	0.4283	0.5717	8.0041	5.9959	5.2304	5.2304
7214PJ	H501	0.4305	0.5695	9.1124	6.8876	5.4024	5.4024
7215	0001	0.4255	0.5745	9.7666	7.2334	5.7393	5.7393
7215-BKE	XXXX	0.4255	0.5745	9.1921	6.8079	5.7393	5.7393
7215P	XXXX	0.4318	0.5682	8.5234	6.4766	5.5097	5.5097
7215PJ	H501	0.4338	0.5662	9.6243	7.3757	5.6902	5.6902
7216	0001	0.4306	0.5694	9.1108	6.8892	6.1778	6.1778
7216-BKE	XXXX	0.4306	0.5694	9.6802	7.3198	6.1778	6.1778
7216P	XXXX	0.4336	0.5664	9.0613	6.9387	5.6726	5.6726
7216PJ	H501	0.4336	0.5664	9.6277	7.3723	5.6726	5.6726
7217	0001	0.4291	0.5709	9.7053	7.2947	6.0440	6.0440
7217P	XXXX	0.4301	0.5699	8.5480	6.4520	5.3753	5.3753
7217PJ	H501	0.4315	0.5685	9.0953	6.9047	5.4902	5.4902
7218	0001	0.4222	0.5778	9.2441	6.7559	5.4882	5.4882
7218DT	0001	0.4222	0.5778	8.6663	6.3337	5.4882	5.4882
7218P	XXXX	0.4294	0.5706	8.5581	6.4419	5.3220	5.3220
7218PJ	H501	0.4310	0.5690	9.1031	6.8969	5.4501	5.4501
7219	0001	0.4266	0.5734	9.7470	7.2530	5.8334	5.8334
7219-BKE	XXXX	0.4266	0.5734	9.1736	6.8264	5.8334	5.8334
7219P	XXXX	0.4306	0.5694	9.1101	6.8899	5.4144	5.4144

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
7220	0001	0.4260	0.5740	9.7582	7.2418	5.7792	5.7792
7220-BKE	XXXX	0.4214	0.5786	9.2575	6.7425	5.4268	5.4268
7220P	XXXX	0.4305	0.5695	9.1119	6.8881	5.4053	5.4053
7221	0003	0.4251	0.5749	9.1989	6.8011	5.7050	5.7050
7221P	XXXX	0.4299	0.5701	8.5512	6.4488	5.3581	5.3581
7222	0002	0.4238	0.5762	9.2183	6.7817	5.6102	5.6102
7222P	XXXX	0.4294	0.5706	8.5592	6.4408	5.3162	5.3162
7224	0002	0.4250	0.5750	9.1991	5.8009	5.7042	5.7042
7224P	XXXX	0.4311	0.5689	8.5331	6.4669	5.4557	5.4557
7226	0001	0.4268	0.5732	9.7436	7.2564	5.8499	5.8499
7226P	XXXX	0.4325	0.5675	9.0795	6.9205	5.5738	5.5738
7228	XXXX	0.4284	0.5716	9.7163	7.2837	5.9873	5.9873
7228P	XXXX	0.4345	0.5655	9.0477	6.9523	5.7490	5.7490
7230	XXXX	0.4273	0.5727	9.7364	7.2636	5.8857	5.8857
7230P	XXXX	0.4334	0.5666	9.0655	6.9345	5.6494	5.6494
7232	XXXX	0.4259	0.5741	9.7589	7.2411	5.7760	5.7760
7232P	XXXX	0.4351	0.5649	9.0377	6.9623	5.8062	5.8062
7234	XXXX	0.4248	0.5752	9.2033	6.7967	5.6831	5.6831
7234P	XXXX	0.4341	0.5659	9.0540	6.9460	5.7137	5.7137
7236	XXXX	0.4278	0.5722	9.7274	7.2726	5.9306	5.9306
7236P	XXXX	0.4367	0.5633	9.5750	7.4250	5.9600	5.9600
7238	XXXX	0.4293	0.5707	10.2732	7.7268	6.0588	6.0588
7238P	XXXX	0.4380	0.5620	10.1151	7.8849	6.0877	6.0877
7240	XXXX	0.4306	0.5694	10.2496	7.7504	6.1778	6.1778
7240P	XXXX	0.4370	0.5630	9.5706	7.4294	5.9855	5.9855
7242	XXXX	0.4294	0.5706	10.2708	7.7292	6.0707	6.0707
7244	XXXX	0.4283	0.5717	9.7183	7.2817	5.9770	5.9770
7246	XXXX	0.4274	0.5726	9.7347	7.2653	5.8943	5.8943
7248	XXXX	0.4265	0.5735	9.7496	7.2504	5.8207	5.8207
7250	XXXX	0.4257	0.5743	9.7633	7.2367	5.7548	5.7548
7252	XXXX	0.4249	0.5751	9.7759	7.2241	5.6955	5.6955
7256	XXXX	0.4288	0.5712	10.2817	7.7183	6.0172	6.0172
7260	XXXX	0.4306	0.5694	10.2496	7.7504	6.1778	6.1778
7264	XXXX	0.4321	0.5679	10.2218	7.7782	6.3236	6.3236
7300P	XXXX	0.3648	0.6352	4.4458	2.5542	2.6279	2.6279
7300S	XXXX	0.3705	0.6295	4.4063	2.5937	3.2653	3.2653
7301P	XXXX	0.3634	0.6366	4.4556	2.5444	2.5965	2.5965
7301S	XXXX	0.3777	0.6223	6.2228	3.7772	3.4843	3.4843
7302P	XXXX	0.3826	0.6174	4.9388	3.0612	3.0840	3.0840
7303	XXXX	0.3915	0.6085	6.0847	3.9153	3.8419	3.8419
7303P	XXXX	0.3764	0.6236	4.9882	3.0118	2.9117	2.8117
7304	0001	0.3834	0.6166	6.1654	3.8346	3.5487	3.5487
7304P	XXXX	0.3947	0.6053	5.4470	3.5530	3.4789	3.4789
7304PJ	H501	0.3947	0.6053	6.0522	3.9478	3.4789	3.4789
7305	0001	0.4047	0.5953	7.1433	4.8567	4.4232	4.4232
7305P	XXXX	0.3951	0.6049	5.4436	3.5564	3.4925	3.4925
7305PJ	H501	0.3987	0.6013	6.6140	4.3860	3.6271	3.6271
7306	0001	0.4052	0.5948	7.1378	4.8622	4.4465	4.4465
7306P	XXXX	0.3986	0.6014	6.0135	3.9865	3.6239	3.6239
7306PJ	H501	0.3986	0.6014	6.6148	4.3852	3.6239	3.6239
7307	0C01	0.4039	0.5961	7.1533	4.8467	4.3821	4.3821
7307P	XXXX	0.3995	0.6005	6.0047	3.9953	3.6585	3.6585
7307PJ	H501	0.4048	0.5952	6.5469	4.4531	3.8787	3.8787
7308	0001	0.4043	0.5957	7.1477	4.8523	4.4050	4.4050
7308P	XXXX	0.4064	0.5936	6.5290	4.4710	3.9512	3.9512
7308PJ	H501	0.4064	0.5936	7.1225	4.8775	3.9512	3.9512
7309	0001	0.4047	0.5953	7.1433	4.8567	4.4233	4.4233
7309P	XXXX	0.4035	0.5965	6.5610	4.4390	3.8233	3.8233
7309PJ	H501	0.4065	0.5935	7.1221	4.8779	3.9530	3.9530
7310	0001	0.3959	0.6041	7.2496	4.7504	4.0173	4.0173
7310DU	0002	0.3959	0.6041	6.6455	4.3545	4.0173	4.0173
7310P	XXXX	0.4055	0.5945	7.1331	4.8669	3.9118	3.9118

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
7310PJ	XXXX	0.4055	0.5945	7.1331	4.8669	3.9118	3.9118
7311	0002	0.3943	0.6057	7.2686	4.7314	3.9517	3.9517
7311P	XXXX	0.4063	0.5937	6.5308	4.4692	3.9436	3.9436
7311PJ	H501	0.4063	0.5937	7.1245	4.8755	3.9436	3.9436
7312	0001	0.3977	0.6023	7.2277	4.7723	4.0954	4.0954
7312P	XXXX	0.4072	0.5928	6.5209	4.4791	3.9847	3.9847
7312PJ	H501	0.4073	0.5927	7.1126	4.8874	3.9891	3.9891
7313	0001	0.4056	0.5944	8.3209	5.6791	4.4700	4.4700
7313P	XXXX	0.4080	0.5920	7.1034	4.8966	4.0246	4.0246
7313PJ	H501	0.4080	0.5920	7.1034	4.8966	4.0246	4.0246
7314	0001	0.4053	0.5947	7.1360	4.8640	4.4538	4.4538
7314P	XXXX	0.4088	0.5912	7.0945	4.9055	4.0595	4.0595
7314PJ	H501	0.4088	0.5912	7.0945	4.9055	4.0595	4.0595
7315	0004	0.4059	0.5941	8.3169	5.6831	4.4846	4.4846
7315DT	0003	0.4059	0.5941	8.3169	5.6831	4.4846	4.4846
7315P	XXXX	0.4068	0.5932	6.5246	4.4754	3.9693	3.9693
7315PJ	H501	0.4120	0.5880	7.6436	5.3564	4.2191	4.2191
7316	0001	0.4056	0.5944	7.7274	5.2726	4.4666	4.4666
7316P	XXXX	0.4124	0.5876	7.0507	4.9493	4.2403	4.2403
7316PJ	H501	0.4124	0.5876	7.6383	5.3617	4.2403	4.2403
7317	0001	0.4061	0.5939	8.3138	5.6862	4.4960	4.4960
7317DU	0004	0.4061	0.5939	7.7199	5.2801	4.4960	4.4960
7317P	XXXX	0.4128	0.5872	7.0463	4.9537	4.2593	4.2593
7317PJ	H501	0.4128	0.5872	7.6335	5.3665	4.2593	4.2593
7318	0003	0.4058	0.5942	7.7248	5.2752	4.4767	4.4767
7318P	XXXX	0.4131	0.5869	7.0424	4.9576	4.2764	4.2764
7318PJ	H501	0.4131	0.5869	7.6292	5.3708	4.2764	4.2764
7319	0002	0.4059	0.5941	7.7237	5.2763	4.4810	4.4810
7319P	XXXX	0.4134	0.5866	7.0388	4.9612	4.2918	4.2918
7319PJ	H501	0.4134	0.5866	7.6254	5.3746	4.2918	4.2918
7320	0002	0.4074	0.5926	7.7033	5.2967	4.5624	4.5624
7320P	XXXX	0.4077	0.5923	7.1077	4.8923	4.0080	4.0080
7321	0004	0.4074	0.5926	7.7033	5.2967	4.5624	4.5624
7321P	XXXX	0.4115	0.5885	7.0613	4.9387	4.1952	4.1952
7322	0001	0.4053	0.5947	7.7316	5.2684	4.4504	4.4504
7322P	XXXX	0.4098	0.5902	7.0820	4.9180	4.1099	4.1099
7324	XXXX	0.4044	0.5956	7.7425	5.2575	4.4083	4.4083
7324P	XXXX	0.4104	0.5896	7.0753	4.9247	4.1372	4.1372
7326	XXXX	0.4046	0.5954	7.7401	5.2599	4.4175	4.4175
7326P	XXXX	0.4110	0.5890	7.0678	4.9322	4.1682	4.1682
7328	XXXX	0.4048	0.5952	7.7380	5.2620	4.4256	4.4256
7328P	XXXX	0.4115	0.5885	7.0613	4.9387	4.1952	4.1952
7330	0004	0.4078	0.5922	8.2900	5.7100	4.5849	4.5849
7330P	XXXX	0.4120	0.5880	7.0557	4.9443	4.2191	4.2191
7332	XXXX	0.4078	0.5922	8.2907	5.7093	4.5822	4.5822
7332P	XXXX	0.4148	0.5852	7.0215	4.9785	4.3690	4.3690
7334	XXXX	0.4103	0.5897	8.2551	5.7449	4.7210	4.7210
7334P	XXXX	0.4174	0.5826	7.5738	5.4262	4.5104	4.5104
7336	XXXX	0.4107	0.5893	8.2496	5.7504	4.7432	4.7432
7336P	XXXX	0.4175	0.5825	7.5728	5.4272	4.5151	4.5151
7338	XXXX	0.4106	0.5894	8.2520	5.7480	4.7338	4.7338
7338P	XXXX	0.4196	0.5804	7.5450	5.4550	4.6416	4.6416
7340	XXXX	0.4104	0.5896	8.2541	5.7459	4.7252	4.7252
7340P	XXXX	0.4215	0.5785	8.0984	5.9016	4.7617	4.7617
7342	XXXX	0.4103	0.5897	8.2560	5.7440	4.7175	4.7175
7344	XXXX	0.4101	0.5899	8.2578	5.7422	4.7104	4.7104
7348	XXXX	0.4137	0.5863	8.2083	5.7917	4.9158	4.9158
7352	XXXX	0.4167	0.5833	8.7496	6.2504	5.1036	5.1036
7356	XXXX	0.4160	0.5840	8.7593	6.2407	5.0621	5.0621
7403	XXXX	0.3594	0.6406	5.1248	2.8752	2.8642	2.8642
7404	0002	0.3648	0.6352	5.0812	2.9188	2.9993	2.9993
7405	XXXX	0.3678	0.6322	5.6901	3.3099	3.0759	3.0759

MRC ball bearing vibration data based on a speed of 1 rpm

Values in cycles per minute

		Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
Bearing size	Suffix	Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
7405P	H501	0.3936	0.6064	6.0639	3.9361	3.4372	3.4372
7406	0001	0.3733	0.6267	6.2664	3.7336	3.2316	3.2316
7406P	H501	0.3938	0.6062	6.0615	3.9385	3.4456	3.4456
7407	XXXX	0.3772	0.6228	6.2280	3.7720	3.3463	3.3463
7407P	H501	0.3937	0.6063	6.0627	3.9373	3.4413	3.4413
7408	0001	0.3803	0.6197	6.1973	3.8027	3.4430	3.4430
7408P	H501	0.3948	0.6052	6.0514	3.9486	3.4817	3.4817
7409	XXXX	0.3822	0.6178	6.1781	3.8219	3.5060	3.5060
7409P	H501	0.3934	0.6066	6.0662	3.9338	3.4292	3.4292
7410	XXXX	0.3843	0.6157	6.7728	4.2272	3.5771	3.5771
7410P	H501	0.3955	0.6045	6.0448	3.9552	3.5059	3.5059
7411	XXXX	0.3861	0.6139	6.7532	4.2468	3.6393	3.6393
7411P	H501	0.3942	0.6058	6.0576	3.9424	3.4596	3.4596
7412	XXXX	0.3876	0.6124	6.7364	4.2636	3.6941	3.6941
7412P	H501	0.3960	0.6040	6.0399	3.9601	3.5240	3.5240
7413	XXXX	0.3889	0.6111	6.7218	4.2782	3.7428	3.7428
7413P	H501	0.3975	0.6025	6.0245	3.9755	3.5815	3.5815
7414	XXXX	0.3834	0.6166	6.7829	4.2171	3.5455	3.5455
7414P	H501	0.3932	0.6068	6.0676	3.9324	3.4241	3.4241
7415	XXXX	0.3847	0.6153	6.7679	4.2321	3.5923	3.5923
7415P	H501	0.3947	0.6053	6.0530	3.9470	3.4760	3.4760
7416	XXXX	0.3859	0.6141	6.7546	4.2454	3.6348	3.6348
7416P	H501	0.3957	0.6043	6.0424	3.9576	3.5146	3.5146
7417	XXXX	0.3870	0.6130	6.7425	4.2575	3.6738	3.6738
7417P	XXXX	0.3971	0.6029	6.0286	3.9714	3.5660	3.5660
7418	XXXX	0.3854	0.6146	6.7606	4.2394	3.6154	3.6154
7418P	XXXX	0.3957	0.6043	6.0424	3.9576	3.5146	3.5146
7419	XXXX	0.3873	0.6127	6.7395	4.2605	3.6837	3.6837
7419P	H501	0.3897	0.6103	6.1025	3.8975	3.4457	3.4457
7420	XXXX	0.3859	0.6141	6.7553	4.2447	3.6324	3.6324
7420P	H501	0.3888	0.6112	6.1116	3.8884	3.4147	3.4147
7421	XXXX	0.3805	0.6195	6.1951	3.8049	3.4500	3.4500
7422	XXXX	0.3805	0.6195	6.1947	3.8053	3.4514	3.4514
8008	H401	0.3806	0.6194	4.3360	2.6640	3.7585	3.7585
8013	H401	0.3726	0.6274	4.3916	2.6084	3.5338	3.5338
8014	H401	0.3830	0.6170	4.9357	3.0643	3.8900	3.8900
8016	H401	0.3876	0.6124	4.8990	3.1010	4.0669	4.0669
8026	H401	0.4015	0.5985	5.3866	3.6134	4.7226	4.7226
8038	H401	0.3740	0.6260	4.3818	2.6182	3.5388	3.5388
8218A	0001	0.4297	0.5703	8.5542	6.4458	5.3424	5.3424
8218B	0001	0.4144	0.5856	8.7842	6.2158	5.4760	5.4760
8219A	0001	0.4291	0.5709	8.5630	6.4370	5.2960	5.2960
8219B	0001	0.4195	0.5805	9.2875	6.7125	5.8464	5.8464
8220A	XXXX	0.4307	0.5693	8.5386	6.4614	5.4257	5.4257
8220B	XXXX	0.4188	0.5812	9.2990	6.7010	5.7917	5.7917
8222A	0001	0.4296	0.5704	8.5553	6.4447	5.3365	5.3365
8222B	0001	0.4169	0.5831	9.3295	6.6705	5.6516	5.6516
8224A	0001	0.4313	0.5687	8.5308	6.4692	5.4681	5.4681
8224B	0001	0.4178	0.5822	9.3153	6.6847	5.7164	5.7164
8238A	XXXX	0.4382	0.5618	9.5498	7.4502	6.1079	6.1079
8238B	XXXX	0.4220	0.5780	9.8258	7.1742	6.0419	6.0419
8308A	0C01	0.4017	0.5983	5.9823	4.0177	3.7488	3.7488
8308B	0C01	0.3944	0.6056	7.2675	4.7325	4.3682	4.3682
8309A	0C01	0.4035	0.5965	6.5610	4.4390	3.8233	3.8233
8309B	0C01	0.3948	0.6052	7.2627	4.7373	4.3866	4.3866
8310A	0C01	0.4050	0.5950	6.5451	4.4549	3.8857	3.8857
8310B	0C01	0.3832	0.6168	6.7843	4.2157	3.9111	3.9111
8311A	0001	0.4062	0.5938	6.5320	4.4680	3.9389	3.9389
8311B	0001	0.3832	0.6168	6.7843	4.2157	3.9111	3.9111
8312A	0001	0.4072	0.5928	6.5209	4.4791	3.9847	3.9847
8312B	0001	0.3870	0.6130	6.7429	4.2571	4.0561	4.0561
8313A	0001	0.4080	0.5920	6.5115	4.4885	4.0246	4.0246

MRC ball bearing vibration data
Data based on a speed of 1 rpm

Values in cycles per minute

		Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
Bearing size	Suffix	Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
8313B	0001	0.3958	0.6042	7.2504	4.7496	4.4338	4.4338
8314A	0001	0.4060	0.5940	6.5337	4.4663	3.9320	3.9320
8314B	0001	0.3960	0.6040	7.2484	4.7516	4.4416	4.4416
8315A	0001	0.4068	0.5932	6.5246	4.4754	3.9693	3.9693
8315B	0001	0.3961	0.6039	7.8505	5.1495	4.4484	4.4484
8316A	0001	0.4076	0.5924	6.5166	4.4834	4.0027	4.0027
8316B	0001	0.3962	0.6038	7.8488	5.1512	4.4545	4.4545
8317A	0001	0.4082	0.5918	6.5096	4.4904	4.0327	4.0327
8317B	0001	0.3964	0.6036	7.8473	5.1527	4.4600	4.4600
8318A	0001	0.4088	0.5912	6.5033	4.4967	4.0597	4.0597
8318B	0001	0.3959	0.6041	7.8527	5.1473	4.4405	4.4405
8319A	0001	0.4093	0.5907	6.4976	4.5024	4.0844	4.0844
8319B	0001	0.3966	0.6034	7.8448	5.1552	4.4690	4.4690
8320A	0001	0.4112	0.5888	7.0655	4.9345	4.1776	4.1776
8320B	0001	0.3983	0.6017	7.8223	5.1777	4.5515	4.5515
8322A	0001	0.4131	0.5869	7.0424	4.9576	4.2764	4.2764
8322B	0001	0.3954	0.6046	7.8601	5.1399	4.4140	4.4140
8326A	0001	0.4110	0.5890	7.0678	4.9322	4.1682	4.1682
8326B	0001	0.3946	0.6054	7.8695	5.1305	4.3809	4.3809
8330A	0002	0.4120	0.5880	7.0557	4.9443	4.2191	4.2191
8330B	0002	0.3982	0.6018	7.8229	5.1771	4.5495	4.5495
8336A	0002	0.4175	0.5825	7.5728	5.4272	4.5151	4.5151
8500	H401	0.3885	0.6115	4.8921	3.1079	4.0904	4.0904
8501	H401	0.3517	0.6483	4.5379	2.4621	2.9741	2.9741
8502	H401	0.3876	0.6124	4.8991	3.1009	4.0665	4.0665
8503	H401	0.3875	0.6125	4.8999	3.1001	4.0810	4.0810
8504	H401	0.3886	0.6114	4.8908	3.1092	4.1310	4.1310
8505	H401	0.4015	0.5985	5.3866	3.6134	4.7226	4.7226
8506	H401	0.3992	0.6008	5.4070	3.5930	4.6332	4.6332
8507	H401	0.3990	0.6010	5.4093	3.5907	4.6178	4.6178
8508	H401	0.4033	0.5967	5.3705	3.6295	4.8503	4.8503
8605	H401	0.3712	0.6288	4.4014	2.5986	3.5288	3.5288
87007	H401	0.3781	0.6219	4.3534	2.6466	3.6726	3.6726
87008	H401	0.3819	0.6181	4.3267	2.6733	3.8058	3.8058
87013	H401	0.3726	0.6274	4.3916	2.6084	3.5338	3.5338
87014	H401	0.3830	0.6170	4.9357	3.0643	3.8900	3.8900
87016	H401	0.3876	0.6124	4.8990	3.1010	4.0669	4.0669
87026	H401	0.4015	0.5985	5.3866	3.6134	4.7226	4.7226
87036	H401	0.3488	0.6512	3.9071	2.0929	2.8606	2.8606
87037	H401	0.3697	0.6303	4.4123	2.5877	3.4045	3.4045
87038	H401	0.3740	0.6260	4.3818	2.6182	3.5388	3.5388
87500	H401	0.3885	0.6115	4.8921	3.1079	4.0904	4.0904
87501	H401	0.3697	0.6303	4.4119	2.5881	3.4441	3.4441
87502	H401	0.3876	0.6124	4.8991	3.1009	4.0665	4.0665
87503	H401	0.3875	0.6125	4.8999	3.1001	4.0810	4.0810
87504	H401	0.3886	0.6114	4.8908	3.1092	4.1310	4.1310
87505	H401	0.4015	0.5985	5.3866	3.6134	4.7226	4.7226
87506	H401	0.3992	0.6008	5.4070	3.5930	4.6332	4.6332
87507	H401	0.3990	0.6010	5.4093	3.5907	4.6178	4.6178
87508	H401	0.4033	0.5967	5.3705	3.6295	4.8503	4.8503
88007	H401	0.3781	0.6219	4.3534	2.6466	3.6726	3.6726
88008	H401	0.3819	0.6181	4.3267	2.6733	3.8058	3.8058
88009	H401	0.3828	0.6172	4.3206	2.6794	3.8693	3.8693
88011	H401	0.3667	0.6333	4.4330	2.5670	3.3547	3.3547
88013	H401	0.3726	0.6274	4.3916	2.6084	3.5338	3.5333
88016	H401	0.3882	0.6118	4.2824	2.7176	4.0688	4.0683
88500	H401	0.3885	0.6115	4.8921	3.1079	4.0904	4.0904
88501	H401	0.3697	0.6303	4.4119	2.5881	3.4441	3.4441
88502	H401	0.3876	0.6124	4.8991	3.1009	4.0665	4.0665
88503	H401	0.3875	0.6125	4.8999	3.1001	4.0810	4.0810
88504	H401	0.3886	0.6114	4.8908	3.1092	4.1310	4.1310
88505	H401	0.4015	0.5985	5.3866	3.6134	4.7226	4.7226

MRC ball bearing vibration data
Data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Inner or outer ring rotation Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
88506	H401	0.3992	0.6008	5.4070	3.5930	4.6332	4.6332
88507	H401	0.3990	0.6010	5.4093	3.5907	4.6178	4.6178
88508	H401	0.4033	0.5967	5.3705	3.6295	4.8503	4.8503
9202U	XXXX	0.3889	0.6111	6.1107	3.8893	3.7429	3.7429
9202UP	XXXX	0.3905	0.6095	4.8757	3.1243	3.3314	3.3314
9203U	XXXX	0.3904	0.6096	6.0959	3.9041	3.7987	3.7987
9203UP	XXXX	0.3933	0.6067	5.4600	3.5400	3.4273	3.4273
9204U	XXXX	0.4067	0.5933	7.1189	4.8811	4.5272	4.5272
9204UP	XXXX	0.4001	0.5999	5.9984	4.0016	3.6833	3.6833
9205U	XXXX	0.4098	0.5902	7.0819	4.9181	4.6925	4.6925
9205UP	XXXX	0.4131	0.5869	7.0425	4.9575	4.2759	4.2759
9206U	XXXX	0.4245	0.5755	8.0564	5.9436	5.6632	5.6632
9206UP	XXXX	0.4140	0.5860	6.4452	4.5548	4.3256	4.3256
9207U	XXXX	0.4221	0.5779	8.0900	5.9100	5.4806	5.4806
9207UP	XXXX	0.4147	0.5853	7.0230	4.9770	5.3624	5.3624
9208U	0005	0.4190	0.5810	8.1339	5.8661	5.2576	5.2576
9208UP	XXXX	0.4189	0.5811	6.9729	5.0271	4.6002	4.6002
9209U	XXXX	0.4252	0.5748	8.0467	5.9533	5.7186	5.7186
9209UP	XXXX	0.4205	0.5795	7.5338	5.4662	4.6948	4.6948
9210U	XXXX	0.4306	0.5694	9.1108	6.8892	6.1778	6.1778
9210UP	XXXX	0.4261	0.5739	8.0338	5.9662	5.0740	5.0740
9211U	0003	0.4194	0.5806	8.1287	5.8713	5.2833	5.2833
9211UP	XXXX	0.4254	0.5746	8.0436	5.9564	5.0242	5.0242
9212U	XXXX	0.4265	0.5735	9.1761	6.8239	5.8208	5.8208
9212UP	XXXX	0.4249	0.5751	8.0516	5.9484	4.9840	4.9840
9213U	XXXX	0.4249	0.5751	9.2008	6.7992	5.6956	5.6956
9213UP	XXXX	0.4277	0.5723	8.0123	5.9877	5.1864	5.1864
9214U	XXXX	0.4288	0.5712	9.1392	6.8608	6.0172	6.0172
9214UP	XXXX	0.4283	0.5717	8.0041	5.9959	5.2304	5.2304
9215U	0002	0.4255	0.5745	9.7665	7.2335	5.7395	5.7395
9215UP	XXXX	0.4317	0.5683	8.5239	6.4761	5.5069	5.5069
9216U	XXXX	0.4306	0.5694	9.1108	6.8892	6.1778	6.1778
9216UP	XXXX	0.4309	0.5691	8.5365	6.4635	5.4371	5.4371
9217U	XXXX	0.4291	0.5709	9.7053	7.2947	6.0440	6.0440
9217UP	XXXX	0.4301	0.5699	8.5480	6.4520	5.3753	5.3753
9218U	XXXX	0.4222	0.5778	9.2441	6.7559	5.4882	5.4882
9218UP	XXXX	0.4294	0.5706	8.5581	6.4419	5.3220	5.3220
9219U	XXXX	0.4266	0.5734	9.7470	7.2530	5.8335	5.8335
9219UP	XXXX	0.4288	0.5712	8.5670	6.4330	5.2756	5.2756
9220U	XXXX	0.4256	0.5744	9.7645	7.2355	5.7491	5.7491
9220UP	XXXX	0.4305	0.5695	8.5424	6.4576	5.4053	5.4053
9221U	XXXX	0.4247	0.5753	9.2049	6.7951	5.6754	5.6754
9221UP	XXXX	0.4299	0.5701	8.5512	6.4488	5.3581	5.3581
9222U	0002	0.4238	0.5762	9.2183	6.7817	5.6102	5.6102
9222UP	XXXX	0.4294	0.5706	8.5592	6.4408	5.3162	5.3162
9302U	XXXX	0.3904	0.6096	6.0963	3.9037	3.7972	3.7972
9302UP	XXXX	0.3826	0.6174	4.9388	3.0612	3.0840	3.0840
9303U	XXXX	0.3915	0.6085	6.0847	3.9153	3.8419	3.8419
9303UP	XXXX	0.3764	0.6236	4.9882	3.0118	2.9117	2.9117
9304U	XXXX	0.3843	0.6157	6.1571	3.8429	3.5771	3.5771
9304UP	XXXX	0.3902	0.6098	5.4882	3.5118	3.3200	3.3201
9305U	0008	0.4042	0.5958	7.1491	4.8509	4.3994	4.3994
9305UP	XXXX	0.3951	0.6049	5.4436	3.5564	3.4925	3.4925
9306U	XXXX	0.4047	0.5953	7.1434	4.8566	4.4228	4.4228
9306UP	XXXX	0.3986	0.6014	6.0135	3.9865	3.6239	3.6239
9307U	0C01	0.4034	0.5966	7.1591	4.8409	4.3586	4.3586
9307UP	XXXX	0.3995	0.6005	6.0047	3.9953	3.6585	3.6585
9308U	XXXX	0.4039	0.5961	7.1535	4.8465	4.3814	4.3814
9308UP	XXXX	0.4017	0.5983	5.9823	4.0177	3.7488	3.7488
9309U	0C01	0.4042	0.5958	7.1490	4.8510	4.3995	4.3995
9309UP	XXXX	0.4035	0.5965	6.5610	4.4390	3.8233	3.8233
9310U	0001	0.3959	0.6041	7.2496	4.7504	4.0173	4.0173

MRC ball bearing vibration data
Data based on a speed of 1 rpm

Values in cycles per minute

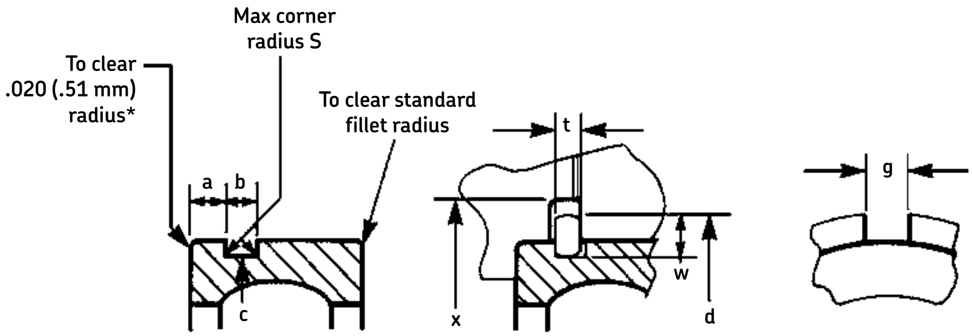
		Inner rotation	Outer rotation	Inner or outer ring rotation		Inner rotation	Outer rotation
Bearing size	Suffix	Cage speed frequency (rpm)	Cage speed frequency (rpm)	Inner ring frequency	Outer ring frequency	Rolling element frequency	Rolling element frequency
9310UP	XXXX	0.4050	0.5950	6.5451	4.4549	3.8857	3.8857
9311U	0002	0.3968	0.6032	7.2377	4.7623	4.0595	4.0595
9311UP	XXXX	0.4062	0.5938	6.5320	4.4680	3.9389	3.9389
9312U	XXXX	0.3977	0.6023	7.2277	4.7723	4.0956	4.0956
9312UP	XXXX	0.4072	0.5928	6.5209	4.4791	3.9847	3.9847
9313U	XXXX	0.4052	0.5948	8.3275	5.6725	4.4461	4.4461
9313UP	XXXX	0.4080	0.5920	6.5115	4.4885	4.0246	4.0246
9314U	0006	0.4053	0.5947	7.1360	4.8640	4.4538	4.4538
9314UP	XXXX	0.4060	0.5940	6.5337	4.4663	3.9320	3.9320
9315U	XXXX	0.4055	0.5945	8.3235	5.6765	4.4606	4.4606
9315UP	XXXX	0.4068	0.5932	6.5246	4.4754	3.9693	3.9693
9316U	XXXX	0.4056	0.5944	7.7274	5.2726	4.4667	4.4667
9316UP	XXXX	0.4076	0.5924	6.5166	4.4834	4.0027	4.0027
9317U	XXXX	0.4057	0.5943	8.3203	5.6797	4.4720	4.4720
9317UP	XXXX	0.4082	0.5918	6.5096	4.4904	4.0327	4.0327
9318U	0004	0.4058	0.5942	7.7248	5.2752	4.4767	4.4767
9318UP	0001	0.4088	0.5912	6.5033	4.4967	4.0597	4.0597
9319U	XXXX	0.4059	0.5941	7.7237	5.2763	4.4810	4.4810
9319UP	XXXX	0.4093	0.5907	6.4976	4.5024	4.0844	4.0844
9320U	0001	0.4074	0.5926	7.7033	5.2967	4.5625	4.5625
9320UP	XXXX	0.4112	0.5888	7.0655	4.9345	4.1776	4.1776
9321U	XXXX	0.4074	0.5926	7.7033	5.2967	4.5625	4.5625
9321UP	XXXX	0.4115	0.5885	7.0613	4.9387	4.1952	4.1952
9322U	0002	0.4048	0.5952	7.7377	5.2623	4.4267	4.4267
9322UP	XXXX	0.4131	0.5869	7.0424	4.9576	4.2764	4.2764
J078DF	0002	0.4539	0.5461	8.1909	6.8091	5.3819	5.3819
J093DF	XXXX	0.4669	0.5331	11.1938	9.8062	7.5338	7.5338
J098DF	XXXX	0.4669	0.5331	11.1938	9.8062	7.5338	7.5338
J150DF	0004	0.4711	0.5289	12.6921	11.3079	8.6404	8.6404
J175DF	0002	0.4737	0.5263	13.6841	12.3159	9.4757	9.4757
J225DF	XXXX	0.4784	0.5216	16.6905	15.3095	11.5648	11.5648
J300DF	XXXX	0.4829	0.5171	21.1991	19.8009	14.6445	14.6445
J400DF	XXXX	0.4807	0.5193	19.2146	17.7854	12.9258	12.9258
R10	H401	0.4125	0.5875	5.8746	4.1254	5.3940	5.3940
R10	H501	0.3906	0.6094	4.8752	3.1248	4.3516	4.3516
R12	H401	0.4001	0.5999	5.3987	3.6013	4.6873	4.6873
R12	H501	0.3947	0.6053	5.4474	3.5536	4.5395	4.5395
R14	H401	0.4128	0.5872	5.8720	4.1280	5.4204	5.4204
R14	H501	0.3977	0.6023	4.8183	3.1817	4.6834	4.6834
R16	H401	0.4174	0.5826	5.8255	4.1745	5.7446	5.7446
R16	H501	0.4167	0.5833	5.8333	4.1667	5.8333	5.8333
R18	H401	0.4178	0.5822	5.8219	4.1781	5.7874	5.7874
R18	H501	0.4134	0.5866	5.8655	4.1345	5.6036	5.6036
R2	H501	0.3866	0.6134	4.2939	2.7061	3.9308	3.9308
R20	H401	0.4216	0.5784	6.9409	5.0591	6.0816	6.0816
R20	H501	0.4196	0.5804	6.3841	4.6159	6.0604	6.0604
R24	XXXX	0.4284	0.5716	6.8593	5.1407	6.6884	6.6884
R24	H501	0.4167	0.5833	6.4168	4.5832	5.8324	5.8324
R2A	H401	0.3866	0.6134	4.2939	2.7061	3.9308	3.9308
R3	H401	0.3685	0.6315	4.4202	2.5798	3.3990	3.3990
R4	H501	0.3971	0.6029	4.8233	3.1767	4.4666	4.4666
R4A	H501	0.3787	0.6213	4.3487	2.6513	3.7648	3.7648
R6	H401	0.3782	0.6218	4.3529	2.6471	3.7673	3.7673
R8	H501	0.3869	0.6131	4.9045	3.0955	4.0844	4.0844
WC87008	H401	0.3819	0.6181	4.3267	2.6733	3.8058	3.8058
WC87016	H401	0.3876	0.6124	4.8990	3.1010	4.0669	4.0669
WC87500	H401	0.3885	0.6115	4.8921	3.1079	4.0904	4.0904
WC87501	H401	0.3697	0.6303	4.4119	2.5881	3.4441	3.4441
WC87502	H401	0.3876	0.6124	4.8991	3.1009	4.0665	4.0665
WC87503	H401	0.3875	0.6125	4.8999	3.1001	4.0810	4.0810
WC87504	H401	0.3886	0.6114	4.8908	3.1092	4.1310	4.1310
XLS10	0007	0.4651	0.5349	18.7216	16.2784	13.1869	13.1869

MRC ball bearing vibration data
Data based on a speed of 1 rpm

Values in cycles per minute

Bearing size	Suffix	Inner rotation Cage speed frequency (rpm)	Outer rotation Cage speed frequency (rpm)	Inner or outer ring rotation Inner ring frequency	Outer ring frequency	Inner rotation Rolling element frequency	Outer rotation Rolling element frequency
XLS11V2	0003	0.4204	0.5796	8.6947	6.3053	5.9073	5.9073
XLS13V4	0003	0.4319	0.5681	9.6573	7.3427	6.9336	6.9336
XLS13V8	XXXX	0.4157	0.5843	8.1802	5.8198	5.5638	5.5638
XLS15V8	0008	0.4261	0.5739	9.1816	6.8184	6.3699	6.3699
XLS17V8	XXXX	0.4295	0.5705	9.6984	7.3016	6.7054	6.7054
XLS2	0007	0.4322	0.5678	10.2207	7.7793	6.9236	6.9236
XLS21V2	XXXX	0.4437	0.5563	11.6818	9.3182	8.3923	8.3923
XLS21V2S	0003	0.4435	0.5565	8.3474	6.6526	8.3586	8.3586
XLS21V4	0C01	0.4380	0.5620	10.6772	8.3228	7.6015	7.6015
XLS21V8	0002	0.4339	0.5661	10.1900	7.8100	7.2575	7.2575
XLS23V4	0004	0.4389	0.5611	11.2217	8.7783	7.7174	7.7174
XLS25V8	XXXX	0.4380	0.5620	11.2407	8.7593	7.5955	7.5955
XLS3	0007	0.4440	0.5560	12.2324	9.7676	8.4346	8.4346
XLS31V2	0008	0.4510	0.5490	13.7261	11.2739	9.5925	9.5925
XLS31V4	0004	0.4479	0.5521	12.6987	10.3013	9.0153	9.0153
XLS33V4	0006	0.4537	0.5463	14.2041	11.7959	10.1692	10.1692
XLS41V2	0006	0.4557	0.5443	14.6964	12.3036	10.6358	10.6358
XLS41V4	0015	0.4535	0.5465	14.2084	11.7916	10.1317	10.1317
XLS43V4	0008	0.4581	0.5419	15.1729	12.8271	11.1412	11.1412
XLS5	0009	0.4555	0.5445	14.7016	12.2984	10.5513	10.5513
XLS51V2	0006	0.4589	0.5411	15.6911	13.3089	11.4467	11.4467
XLS6	0010	0.4621	0.5379	16.6737	14.3263	12.3422	12.3422
XLS61V2	0005	0.4614	0.5386	16.6961	14.3039	12.0955	12.0955
XLS61V4	0008	0.4598	0.5402	16.2058	13.7942	11.6920	11.6920
XLS7	0007	0.4605	0.5395	16.7234	14.2766	11.8927	11.8927
XLS71V4	0007	0.4621	0.5379	17.2138	14.7862	12.2599	12.2599
XLS73V4	XXXX	0.4613	0.5387	16.6987	14.3013	12.0939	12.0939
XLS8	0005	0.4625	0.5375	17.1989	14.8011	12.3967	12.3967
XLS81V2	XXXX	0.4618	0.5382	17.2215	14.7785	12.2360	12.2360
XLS81V4	XXXX	0.4636	0.5364	17.7010	15.2990	12.7653	12.7653
XLS9	0002	0.4609	0.5391	16.7106	14.2894	11.8984	11.8984
X0155RBDS	0002	0.4276	0.5724	9.1591	6.8409	6.5267	6.5267
X0155RBDS	0001	0.4276	0.5724	9.1591	6.8409	6.5267	6.5267
X0155RBDS	0004	0.4276	0.5724	9.1591	6.8409	6.5267	6.5267
X0165RBDS	0002	0.4138	0.5862	8.7936	6.2064	5.4336	5.4336
X030RBDS	0002	0.3864	0.6136	5.5227	3.4773	4.0305	4.0305
X057RBDS	0002	0.3991	0.6009	7.2103	4.7897	4.5937	4.5937
X057RBDS	0001	0.3991	0.6009	7.2103	4.7897	4.5937	4.5937
X067RBDS	0005	0.4095	0.5905	7.6771	5.3229	5.1590	5.1590
X067RBDS	0001	0.4095	0.5905	7.6771	5.3229	5.1590	5.1590
X090RBDS	0005	0.4062	0.5938	7.7191	5.2809	4.9688	4.9688
X090RBDS	0003	0.4062	0.5938	7.7191	5.2809	4.9688	4.9688
X090RBDS	0002	0.4062	0.5938	7.7191	5.2809	4.9688	4.9688
X090RBDS	0001	0.4062	0.5938	7.7191	5.2809	4.9688	4.9688

Snap-ring, groove and housing dimensions



Snap-ring mounting data on these pages conforms to ABMA Standard 20.

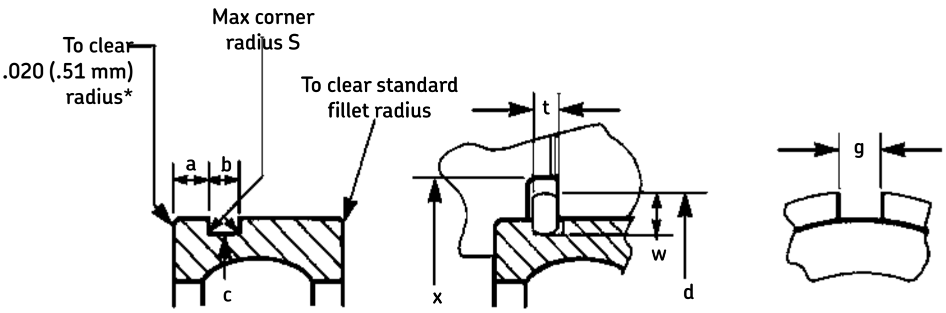
5200 and 5300 series—use dimensions listed for 200 and 300 series.

Cartridge width bearings—"a" dimension varies depending on bearing size. Dimensions shown on page 321.

* Where standard bearing corner is .020 (.51 mm) or less, the corner remains same as standard.

Basic bearing				Dimensions of ring, groove and housing																							
				Groove														Ring								Counterbore	
1900	100K	200	300	a				b				c				s		d		t		w		g		x	
				inch		mm		inch		mm		inch		mm						±.002	±.05	±.003	±.08			Minimum	
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1900				**.041**	**.035**	1.05	.90	**.041**	**.031**	1.05	.80	**.819**	**.807**	20.8	20.5	**.008**	.20	**.984**	25.0	**.026**	.65	**.076**	1.93	**.094**	2.5	**1.016**	25.8
1901				**.041**	**.035**	1.05	.90	**.041**	**.031**	1.05	.80	**.898**	**.888**	22.8	22.5	**.008**	.20	**1.06**	27.0	**.026**	.65	**.076**	1.93	**.094**	2.5	**1.094**	27.8
1902				**.051**	**.045**	1.30	1.15	**.047**	**.037**	1.20	.95	**1.051**	**1.039**	26.7	26.4	**.010**	.25	**1.20**	30.6	**.031**	.80	**.078**	1.98	**.125**	3.0	**1.234**	31.3
	101K			**.068**	**.062**	1.73	1.57	**.047**	**.037**	1.20	.95	**1.050**	**1.040**	26.7	26.4	**.016**	.40	**1.20**	30.6	**.031**	.80	**.078**	1.98	**.125**	3.0	**1.234**	31.3
1903				**.051**	**.045**	1.30	1.15	**.047**	**.037**	1.20	.95	**1.130**	**1.118**	28.7	28.4	**.010**	.25	**1.28**	32.5	**.031**	.80	**.078**	1.98	**.125**	3.0	**1.312**	33.3
		200		**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.109**	**1.099**	28.2	27.9	**.016**	.40	**1.36**	34.5	**.042**	1.07	**.125**	3.18	**.125**	3.0	**1.391**	35.3
	102K	201		**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.187**	**1.177**	30.2	29.0	**.016**	.40	**1.44**	36.5	**.042**	1.07	**.125**	3.18	**.125**	3.0	**1.469**	37.3
	103K	202	300	**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.306**	**1.296**	33.2	32.9	**.016**	.40	**1.55**	39.3	**.042**	1.07	**.125**	3.18	**.125**	3.0	**1.578**	40.0
1904				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**1.406**	**1.394**	35.7	35.4	**.010**	.25	**1.56**	39.7	**.031**	.80	**.078**	1.98	**.125**	3.0	**1.594**	40.5
			301	**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.369**	**1.359**	34.8	34.5	**.016**	.40	**1.61**	40.9	**.042**	1.07	**.125**	3.18	**.125**	3.0	**1.641**	41.7
		203		**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.500**	**1.490**	38.1	37.9	**.016**	.40	**1.75**	44.5	**.042**	1.07	**.125**	3.18	**.125**	3.0	**1.781**	45.2
1905				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**1.602**	**1.590**	40.7	40.4	**.010**	.25	**1.75**	44.5	**.031**	.80	**.078**	1.98	**.125**	3.0	**1.781**	45.2
	104K		302	**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.565**	**1.555**	39.8	38.5	**.016**	.40	**1.81**	46.0	**.042**	1.07	**.125**	3.18	**.125**	3.0	**1.844**	46.8
1906				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**1.799**	**1.787**	45.7	45.4	**.010**	.25	**1.95**	49.6	**.031**	.80	**.078**	1.98	**.125**	3.0	**1.984**	50.4
	105K			**.081**	**.075**	2.06	1.90	**.065**	**.053**	1.65	1.35	**1.756**	**1.746**	44.6	44.4	**.016**	.40	**2.06**	52.4	**.042**	1.07	**.156**	3.96	**.125**	3.0	**2.094**	53.2
		204	303	**.097**	**.091**	2.46	2.31	**.065**	**.053**	1.65	1.35	**1.756**	**1.746**	44.6	44.4	**.016**	.40	**2.06**	52.4	**.042**	1.07	**.156**	3.96	**.125**	3.0	**2.094**	53.2
		205	304	**.097**	**.091**	2.46	2.31	**.065**	**.053**	1.65	1.35	**1.958**	**1.948**	49.7	49.5	**.016**	.40	**2.27**	57.6	**.042**	1.07	**.156**	3.96	**.188**	5.0	**2.297**	58.3
1907				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**2.114**	**2.102**	53.7	53.4	**.010**	.25	**2.28**	57.9	**.031**	.80	**.078**	1.98	**.188**	5.0	**2.312**	58.7
	106K			**.082**	**.074**	2.08	1.88	**.065**	**.053**	1.65	1.35	**2.071**	**2.061**	52.8	52.4	**.016**	.40	**2.38**	60.3	**.042**	1.07	**.156**	3.96	**.188**	5.0	**2.406**	61.1
1908				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**2.390**	**2.374**	60.7	60.3	**.010**	.25	**2.56**	65.1	**.031**	.80	**.078**	1.98	**.188**	5.0	**2.594**	65.9
	107K			**.082**	**.074**	2.08	1.88	**.087**	**.075**	2.20	1.90	**2.347**	**2.327**	59.6	59.1	**.024**	.60	**2.66**	67.5	**.065**	1.65	**.156**	3.96	**.188**	5.0	**2.688**	68.3
		206	305	**.129**	**.121**	3.28	3.07	**.087**	**.075**	2.20	1.90	**2.347**	**2.327**	59.6	59.1	**.024**	.60	**2.66**	67.5	**.065**	1.65	**.156**	3.96	**.188**	5.0	**2.688**	68.3
1909				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**2.626**	**2.610**	66.7	66.3	**.010**	.25	**2.80**	71.0	**.031**	.80	**.078**	1.98	**.188**	5.0	**2.828**	71.8
	108K			**.098**	**.090**	2.49	2.20	**.087**	**.075**	2.20	1.90	**2.552**	**2.532**	64.8	61.3	**.024**	.60	**2.92**	74.2	**.065**	1.65	**.156**	3.96	**.188**	5.0	**2.984**	75.8
1910				**.067**	**.061**	1.70	1.55	**.047**	**.037**	1.20	.95	**2.783**	**2.769**	70.7	70.3	**.010**	.25	**2.95**	75.0	**.031**	.80	**.078**	1.98	**.188**	5.0	**2.984**	75.8
		207	306	**.129**	**.121**	3.28	3.07	**.087**	**.075**	2.20	1.90	**2.709**	**2.689**	68.8	68.3	**.024**	.60	**3.08**	78.2	**.065**	1.65	**.188**	4.78	**.188**	5.0	**3.141**	79.8
	109K			**.098**	**.090**	2.49	2.20	**.087**	**.075**	2.20	1.90	**2.828**	**2.808**	71.8	71.3	**.024**	.60	**3.20**	81.4	**.065**	1.65	**.188**	4.78	**.188**	5.0	**3.266**	83.0
1911				**.083**	**.075**	2.11	1.90	**.063**	**.051**	1.60	1.30	**3.067**	**3.051**	77.9	77.5	**.016**	.40	**3.31**	84.1	**.042**	1.07	**.125**	3.18	**.188**	5.0	**3.375**	85.7
	110K			**.098**	**.090**	2.49	2.20	**.087**	**.075**	2.20	1.90	**3.024**	**3.004**	76.8	76.3	**.024**	.60	**3.40**	86.5	**.065**	1.65	**.188**	4.78	**.188**	5.0	**3.469**	88.1
		208	307	**.129**	**.121**	3.28	3.07	**.087**	**.075**	2.20	1.90	**3.024**	**3.004**	76.8	76.3	**.024**	.60	**3.40**	86.5	**.065**	1.65	**.188**	4.78	**.188**	5.0	**3.469**	88.1
1912				**.083**	**.075**	2.10	1.90	**.063**	**.051**	1.60	1.30	**3.264**	**3.248**	82.9	82.5	**.016**	.40	**3.52**	89.3	**.042**	1.07	**.125**	3.18	**.188**	5.0	**3.578**	90.9
		209		**.129**	**.121**	3.28	3.07	**.087**	**.075**	2.20	1.90	**3.221**	**3.201**	81.8	81.3	**.024**	.60	**3.59**	91.3	**.065**	1.65	**.188**	4.78	**.188**	5.0	**3.656**	92.9
1913				**.083**	**.075**	2.10	1.90	**.063**	**.051**	1.60	1.30	**3.461**	**3.445**	87.9	87.5	**.016**	.40	**3.70**	94.1	**.042**	1.07	**.125**	3.18	**.188**	5.0	**3.766**	95.7
	111K			**.113**	**.105**	2.87	2.67	**.118**	**.106**	3.00	2.70	**3.417**	**3.397**	86.8	86.3	**.024**	.60	**3.80**	96.4	**.095**	2.41	**.188**	4.78	**.188**	5.0	**3.859**	98.0
		210	308	**.129**	**.121**	3.28	3.07	**.118**	**.106**	3.00	2.70	**3.417**	**3.397**	86.8	86.3	**.024**	.60	**3.80**	96.4	**.095**	2.41	**.188**	4.78	**.188**	5.0	**3.859**	98.0
	112K			**.113**	**.105**	2.87	2.67	**.118**	**.106**	3.00	2.70	**3.615**	**3.595**	91.8	91.3	**.024**	.60	**3.98**	101.2	**.095**	2.41	**.188**	4.78	**.188**	5.0	**4.047**	102.9
1914				**.098**	**.090**	2.50	2.30	**.063**	**.051**	1.60	1.30	**3.854**	**3.838**	97.9	97.5	**.016**	.40	**4.11**	104.4	**.042**	1.07	**.125**	3.18	**.188**	5.0	**4.172**	106.0
	113K			**.113**	**.105**	2.87	2.67	**.118**	**.106**	3.00	2.70	**3.811**	**3.791**	96.8	96.3	**.024**	.60	**4.19**	106.4	**.095**	2.41	**.188**	4.78	**.188**	5.0	**4.250**	108.0
		211	309	**.129**	**.121**	3.28	3.07	**.118**	**.106**	3.00	2.70	**3.811**	**3.791**	96.8	96.3	**.024**	.60	**4.19**	106.4	**.095**	2.41	**.188**	4.78	**.188**	5.0	**4.250**	108.0

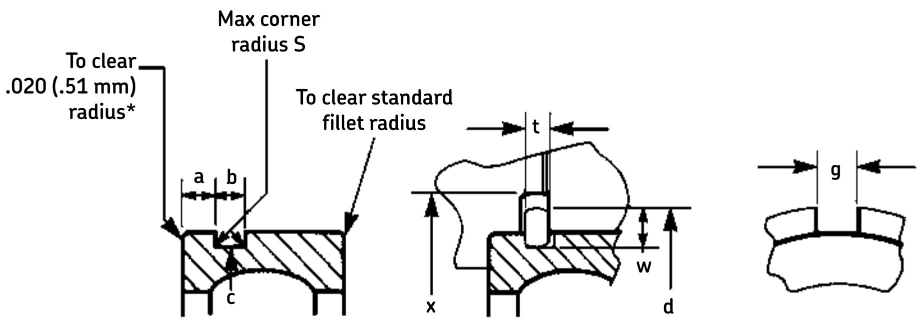
Snap-ring, groove and housing dimensions



* Where standard bearing corner is .020 (.51 mm) or less, the corner remains same as standard.

Basic bearing				Dimensions of ring, groove and housing																							
				Groove														Ring								Counterbore	
1900	100K	200	300	a				b				c				s		d		t		w		g		x	
				inch		mm		inch		mm		inch		mm						±.002	±.05	±.003	±.08			Minimum	
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1915				.098	.090	2.50	2.30	.063	.051	1.60	1.30	4.039	4.019	102.6	102.1	.016	.40	4.36	110.7	.042	1.07	.156	3.96	.188	5.0	4.422	112.3
1916				.098	.090	2.50	2.30	.063	.051	1.60	1.30	4.236	4.216	107.6	107.1	.016	.40	4.55	115.5	.042	1.07	.156	3.96	.188	5.0	4.609	117.1
	114K			.113	.105	2.87	2.67	.118	.106	3.00	2.70	4.205	4.185	106.8	106.3	.024	.60	4.58	116.3	.095	2.41	.188	4.78	.188	5.0	4.641	117.9
		212	310	.129	.121	3.28	3.07	.118	.106	3.00	2.70	4.205	4.185	106.8	106.3	.024	.60	4.58	116.3	.095	2.41	.188	4.78	.188	5.0	4.641	117.9
	115K			.113	.105	2.87	2.67	.118	.106	3.00	2.70	4.402	4.382	111.9	111.3	.024	.60	4.78	121.4	.095	2.41	.188	4.78	.188	5.0	4.844	123.0
1917				.130	.122	3.30	3.10	.063	.051	1.60	1.30	4.630	4.610	117.6	117.1	.016	.40	4.94	125.4	.042	1.07	.156	3.96	.281	7.0	5.000	127.0
		213	311	.160	.152	4.06	3.86	.134	.122	3.40	3.10	4.536	4.516	115.2	114.7	.024	.60	5.09	129.4	.109	2.77	.281	7.14	.281	7.0	5.156	131.0
1918				.130	.122	3.30	3.10	.063	.051	1.60	1.30	4.827	4.807	122.6	122.1	.016	.40	5.14	130.6	.042	1.07	.156	3.96	.281	7.0	5.203	132.2
	116K			.113	.105	2.87	2.67	.134	.122	3.40	3.10	4.733	4.713	120.2	119.7	.024	.60	5.30	134.5	.109	2.77	.281	7.14	.281	7.0	5.359	136.1
		214		.160	.152	4.06	3.86	.134	.122	3.40	3.10	4.733	4.713	120.2	119.7	.024	.60	5.30	134.5	.109	2.77	.281	7.14	.281	7.0	5.359	136.1
1919				.130	.122	3.30	3.10	.063	.051	1.60	1.30	5.024	5.004	127.6	127.1	.016	.40	5.33	135.3	.042	1.07	.156	3.96	.281	7.0	5.391	136.9
	117K			.113	.105	2.87	2.67	.134	.122	3.40	3.10	4.930	4.910	125.2	124.7	.024	.60	5.50	139.7	.109	2.77	.281	7.14	.281	7.0	5.562	141.3
		215	312	.160	.152	4.06	3.86	.134	.122	3.40	3.10	4.930	4.910	125.2	124.7	.024	.60	5.50	139.7	.109	2.77	.281	7.14	.281	7.0	5.562	141.3
1920				.130	.122	3.30	3.10	.087	.075	2.20	1.90	5.417	5.397	137.6	137.1	.024	.60	5.73	145.7	.065	1.65	.156	3.96	.281	7.0	5.797	147.2
	118K			.146	.136	3.71	3.45	.134	.122	3.40	3.10	5.324	5.304	135.2	134.7	.024	.60	5.89	149.6	.109	2.77	.281	7.14	.281	7.0	5.953	151.2
		216	313	.193	.183	4.90	4.65	.134	.122	3.40	3.10	5.324	5.304	135.2	134.7	.024	.60	5.89	149.6	.109	2.77	.281	7.14	.281	7.0	5.953	151.2
1921				.130	.122	3.30	3.10	.087	.075	2.20	1.90	5.614	5.594	142.6	142.1	.024	.60	5.92	150.4	.065	1.65	.156	3.96	.281	7.0	5.984	152.0
	119K			.146	.136	3.71	3.45	.134	.122	3.40	3.10	5.521	5.501	140.2	139.7	.024	.60	6.08	154.4	.109	2.77	.281	7.14	.281	7.0	6.141	156.0
1922				.130	.122	3.30	3.10	.087	.075	2.20	1.90	5.811	5.791	147.6	147.1	.024	.60	6.13	155.6	.065	1.65	.156	3.96	.281	7.0	6.188	157.2
	120K			.146	.136	3.71	3.45	.134	.122	3.40	3.10	5.718	5.698	145.2	144.7	.024	.60	6.28	159.5	.109	2.77	.281	7.14	.281	7.0	6.344	161.1
		217	314	.193	.183	4.90	4.65	.134	.122	3.40	3.10	5.718	5.698	145.2	144.7	.024	.60	6.28	159.5	.109	2.77	.281	7.14	.281	7.0	6.344	161.1
	121K			.146	.136	3.71	3.45	.134	.122	3.40	3.10	6.111	6.091	155.2	154.7	.024	.60	6.67	169.5	.109	2.77	.281	7.14	.281	7.0	6.734	171.0
		218	315	.193	.183	4.90	4.65	.134	.122	3.40	3.10	6.111	6.091	155.2	154.7	.024	.60	6.67	169.5	.109	2.77	.281	7.14	.281	7.0	6.734	171.0
1924				.146	.138	3.70	3.50	.087	.075	2.20	1.90	6.370	6.350	161.8	161.3	.024	.60	6.75	171.5	.065	1.65	.188	4.78	.281	7.0	6.812	173.0
	122K			.146	.136	3.70	3.45	.150	.138	3.80	3.50	6.443	6.423	163.7	163.1	.024	.60	7.19	182.6	.120	3.05	.375	9.53	.375	10.0	7.250	184.2
		219	316	.224	.214	5.69	5.44	.150	.138	3.80	3.50	6.443	6.423	163.7	163.1	.024	.60	7.19	182.6	.120	3.05	.375	9.53	.375	10.0	7.250	184.2
1926				.146	.138	3.70	3.50	.087	.075	2.20	1.90	6.961	6.941	176.8	176.3	.024	.60	7.34	186.5	.065	1.65	.188	4.78	.375	10.0	7.406	188.0
	124K			.146	.136	3.70	3.45	.150	.138	3.80	3.50	6.837	6.817	173.7	173.2	.024	.60	7.59	192.9	.120	3.05	.375	9.53	.375	10.0	7.656	194.5
		220	317	.224	.214	5.69	5.44	.150	.138	3.80	3.50	6.837	6.817	173.7	173.2	.024	.60	7.59	192.9	.120	3.05	.375	9.53	.375	10.0	7.656	194.5
1928				.146	.138	3.70	3.50	.087	.075	2.20	1.90	7.354	7.334	186.8	186.3	.024	.60	7.73	196.5	.065	1.65	.188	4.78	.375	10.0	7.797	198.0
		221	318	.224	.214	5.69	5.44	.150	.138	3.80	3.50	7.230	7.210	183.6	183.1	.024	.60	7.98	202.8	.120	3.05	.375	9.53	.375	10.0	8.047	204.4
	126K	222	319	.224	.214	5.69	5.44	.150	.138	3.80	3.50	7.624	7.604	193.7	193.1	.024	.60	8.38	212.7	.120	3.05	.375	9.53	.375	10.0	8.438	214.3
	128K			.224	.214	5.69	5.44	.150	.138	3.80	3.50	8.018	7.998	203.7	203.2	.024	.60	8.77	222.7	.120	3.05	.375	9.53	.375	10.0	8.828	224.2
		224	320	.224	.214	5.69	5.44	.150	.138	3.80	3.50	8.215	8.195	208.7	208.2	.024	.60	8.97	227.8	.120	3.05	.375	9.53	.375	10.0	9.031	229.4
	130K		321	.224	.214	5.69	5.44	.150	.138	3.80	3.50	8.608	8.588	218.6	218.1	.024	.60	9.36	237.7	.120	3.05	.375	9.53	.375	10.0	9.422	239.3
		226		.224	.214	5.69	5.44	.150	.138	3.80	3.50	8.805	8.785	223.7	223.1	.024	.60	9.56	242.9	.120	3.05	.375	9.53	.375	10.0	9.625	244.5
	132K		322	.224	.214	5.69	5.44	.150	.138	3.80	3.50	9.199	9.179	233.7	233.2	.024	.60	9.95	252.8	.120	3.05	.375	9.53	.375	10.0	10.020	254.4
		228		.224	.214	5.69	5.44	.150	.138	3.80	3.50	9.589	9.569	243.6	243.1	.024	.60	10.3	262.7	.120	3.05	.375	9.53	.375	10.0	10.410	264.3
		230		.224	.214	5.69	5.44	.150	.138	3.80	3.50	10.38	10.36	263.6	263.0	.024	.60	11.1	282.6	.120	3.05	.375	9.53	.375	10.0	11.200	284.6

Snap-ring, groove and housing dimensions

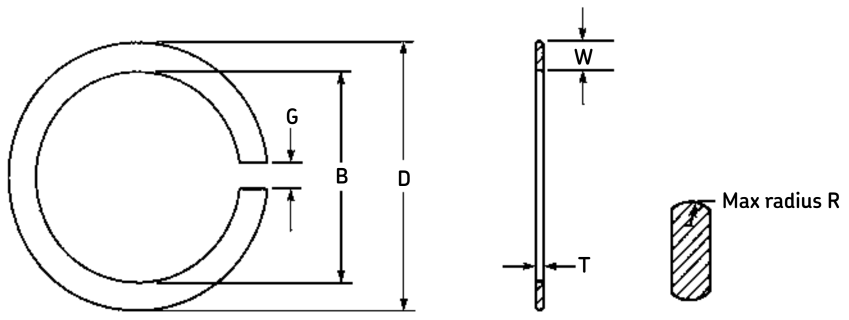


* Where standard bearing corner is .020 (.51 mm) or less, the corner remains same as standard

Cartridge width bearings

Basic bearing		Dimensions of ring, groove and housing																							
		Groove														Ring								Counterbore	
200	300	a				b				c				s		d		t		w		g		x	
		inch		mm		inch		mm		inch		mm						±.002	±.05	±.003	±.08			Minimum	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
203		.147	.139	3.73	3.53	.065	.053	1.65	1.35	1.500	1.490	38.1	37.9	.016	.40	1.75	44.5	.042	1.07	.125	3.18	.125	3	1.781	45.2
204		.187	.179	4.75	4.55	.065	.053	1.65	1.35	1.756	1.746	44.6	44.4	.016	.40	2.06	52.4	.042	1.07	.156	3.96	.125	3	2.094	53.2
205	304	.187	.179	4.75	4.55	.065	.053	1.65	1.35	1.958	1.948	49.7	49.5	.016	.40	2.27	57.6	.042	1.07	.156	3.96	.188	5	2.297	58.3
206	305	.181	.173	4.60	4.40	.087	.075	2.20	1.90	2.347	2.327	59.6	59.1	.024	.60	2.66	67.5	.065	1.65	.156	3.96	.188	5	2.688	68.3
207	306	.181	.173	4.60	4.40	.087	.075	2.20	1.90	2.709	2.689	68.8	68.3	.024	.60	3.08	78.2	.065	1.65	.188	4.78	.188	5	3.141	79.8
208	307	.181	.173	4.60	4.40	.087	.075	2.20	1.90	3.024	3.004	76.8	76.3	.024	.60	3.40	86.5	.065	1.65	.188	4.78	.188	5	3.469	88.1
209		.181	.173	4.60	4.40	.087	.075	2.20	1.90	3.221	3.201	81.8	81.3	.024	.60	3.59	91.3	.065	1.65	.188	4.78	.188	5	3.656	92.9
210	308	.179	.171	4.55	4.35	.118	.106	3.00	2.70	3.417	3.397	86.8	86.3	.024	.60	3.80	96.4	.095	2.41	.188	4.78	.188	5	3.859	98.0
211	309	.179	.171	4.55	4.35	.118	.106	3.00	2.70	3.811	3.791	96.8	96.3	.024	.60	4.19	106.4	.095	2.41	.188	4.78	.188	5	4.250	108.0
212	310	.179	.171	4.55	4.35	.118	.106	3.00	2.70	4.205	4.185	106.8	106.3	.024	.60	4.58	116.3	.095	2.41	.188	4.78	.188	5	4.641	117.9
213	311	.291	.283	7.39	7.19	.134	.122	3.40	3.10	4.536	4.516	115.2	114.7	.024	.60	5.09	129.4	.109	2.77	.281	7.14	.281	7	5.156	131.0
214		.291	.283	7.39	7.19	.134	.122	3.40	3.10	4.733	4.713	120.2	119.7	.024	.60	5.30	134.5	.109	2.77	.281	7.14	.281	7	5.359	136.1
215	312	.291	.283	7.39	7.19	.134	.122	3.40	3.10	4.930	4.910	125.2	124.7	.024	.60	5.50	139.7	.109	2.77	.281	7.14	.281	7	5.562	141.3
	313	.315	.307	8.00	7.80	.134	.122	3.40	3.10	5.324	5.304	135.2	134.7	.024	.60	5.89	149.6	.109	2.77	.281	7.14	.281	7	5.953	151.2
	314	.315	.307	8.00	7.80	.134	.122	3.40	3.10	5.718	5.698	145.2	144.7	.024	.60	6.28	159.5	.109	2.77	.281	7.14	.281	7	6.344	161.1
	315	.315	.307	8.00	7.80	.134	.122	3.40	3.10	6.111	6.091	155.2	154.7	.024	.60	6.67	169.5	.109	2.77	.281	7.14	.281	7	6.784	171.0

Snap ring dimensions



Ring section[1] gauge T	(Typical R)
.042	.035
.065	.050
.095	.060
.109	.075
.120	.090

	Bearing number				Snap ring dimensions						
									Thickness	Radial thick	Radial[2] gap
Snap-ring number	Extra light (KR-KS)	Light	Medium	Heavy	Bearing O.D.	Groove dia. C	Bore B + .000	O.D. D	T ±.002	W + .003	G
0		200			1.1811	1.109	1.094–.020	1.344	.042	.125	3/32 ± 1/32
1	102	201			1.2598	1.187	1.172–.020	1.422	.042	.125	3/32 ± 1/32
2	103	202	300		1.3780	1.306	1.291–.020	1.541	.042	.125	3/32 ± 1/32
2a			301		1.4567	1.369	1.354–.020	1.604	.042	.125	3/32 ± 1/32
3		203			1.5748	1.500	1.485–.020	1.735	.042	.125	3/32 ± 1/32
3a	104		302		1.6535	1.565	1.550–.020	1.800	.042	.125	3/32 ± 1/32
4	105	204	303		1.8504	1.756	1.741–.030	2.053	.042	.156	1/8 ± 1/32
5		205	304		2.0472	1.958	1.943–.030	2.255	.042	.156	1/8 ± 1/32
5a	106				2.1654	2.071	2.056–.030	2.368	.042	.156	1/8 ± 1/32
6	107	206	305	403	2.4409	2.347	2.322–.030	2.634	.065	.156	1/8 ± 1/32
6b	108				2.6772	2.616	2.591–.030	2.922	.065	.156	1/8 ± 1/32
7		207	306	404	2.8346	2.709	2.684–.030	3.060	.065	.188	1/8 ± 1/32
7a	109				2.9528	2.828	2.803–.030	3.179	.065	.188	1/8 ± 1/32
8	110	208	307	405	3.1496	3.024	2.999–.046	3.375	.065	.188	5/32 ± 3/64
9		209			3.3465	3.221	3.196–.046	3.572	.065	.188	5/32 ± 3/64
10	111	210	308	406	3.5433	3.417	3.392–.046	3.768	.095	.188	5/32 ± 3/64
10a	112				3.7402	3.615	3.590–.046	3.966	.095	.188	5/32 ± 3/64
11	113	211	309	407	3.9370	3.811	3.786–.046	4.162	.095	.188	5/32 ± 3/64
12	114	212	310	408	4.3307	4.205	4.180–.062	4.556	.095	.188	3/16 ± 1/16
12a	115				4.5276	4.402	4.377–.062	4.753	.095	.188	3/16 ± 1/16
13		213	311	409	4.7244	4.536	4.506–.062	5.068	.109	.281	3/16 ± 1/16
14	116	214			4.9213	4.733	4.703–.062	5.265	.109	.281	3/16 ± 1/16
15	117	215	312	410	5.1181	4.930	4.900–.062	5.462	.109	.281	3/16 ± 1/16
16	118	216	313	411	5.5118	5.324	5.294–.093	5.856	.109	.281	3/16 ± 1/16
16a	119				5.7087	5.521	5.491–.093	6.053	.109	.281	9/32 ± 1/16
17	120	217	314	412	5.9055	5.718	5.688–.093	6.250	.109	.281	9/32 ± 1/16
18	121	218	315	413	6.2992	6.111	6.081–.093	6.643	.109	.281	9/32 ± 1/16
19	122	219	316		6.6929	6.443	6.413–.125	7.163	.120	.375	3/8 ± 1/16
20	124	220	317	414	7.0866	6.837	6.807–.125	7.557	.120	.375	3/8 ± 1/16
21		221	318	415	7.4803	7.230	7.200–.125	7.950	.120	.375	3/8 ± 1/16
22	126	222	319	416	7.8740	7.624	7.594–.125	8.344	.120	.375	3/8 ± 1/16
23	128			417	8.2677	8.018	7.987–.125	8.737	.120	.375	3/8 ± 1/16
24		224	320		8.4646	8.215	8.184–.125	8.934	.120	.375	3/8 ± 1/16
25	130		321	418	8.8583	8.608	8.578–.156	9.328	.120	.375	15/32 ± 3/32
26		226			9.0551	8.805	8.775–.156	9.525	.120	.375	15/32 ± 3/32
27	132		322		9.4488	9.199	9.168–.156	9.918	.120	.375	15/32 ± 3/32

1) Snap-ring need not conform to cross section shown but all 4 corners must clear .016 Max. fillet (snap rings 0 through 5a) or .024 (snap rings 6 through 27).
2) Gap dimension and tolerance apply when snap ring bore B is nominal diameter shown (Max. bore).

Break all sharp corners and remove all burs.

Bearing accessories

Lock nuts, lock washers and lock plates

Lock nuts and lock washers are commonly used as effective means for holding bearing inner rings axially on the shaft. They are also frequently used to secure gears, belt pulleys and other machine components. The lock nuts are accurately made to insure that the abutment face will be square with the shaft axis, thus avoiding distortion of the shaft during tightening.

The lock washers are made from selected high quality steel, heat treated, and they must pass a final inspection that requires their finish to be smooth and free from burrs.

The lock plate is a steel stamping that engages the slot of the sleeve and is secured to the end face of larger nuts by two screws. This unit is used in place of lock washers.

Wherever bearings must be held in permanent or correct position, use lock nuts, lock washers and lock plates.

Removable sleeves and removal nuts

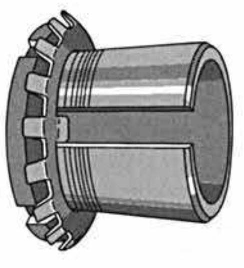
Removable sleeves have a taper on the outside diameter corresponding to the taper in the bore of the bearings. These sleeves are used for applications where bearings must be removed occasionally for the inspection of machine parts and at the same time will be positively located on the shaft with the equivalent of a press fit. A removal nut is used to remove the sleeve from the bearing. In assembling, the sleeve is locked on a threaded shaft by means of lock nuts, lock washers and lock plates.

Adapters

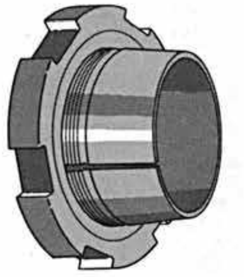
The adapter is used to hold and locate a tapered bore bearing on a cylindrical seat. It permits relatively wide tolerances for the shaft diameter and makes it unnecessary to heat the bearing or use a press when mounting in order to obtain an interference fit of the inner race on the shaft. Adapters are manufactured with the same precise techniques and care used in the manufacture of bearings.

Lock nuts

Lock washers

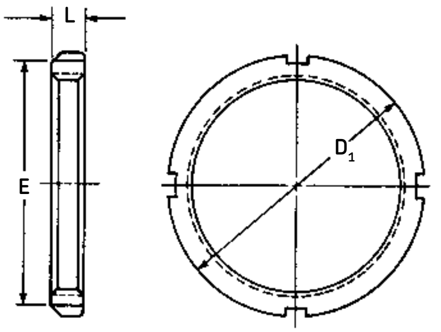


Adapters

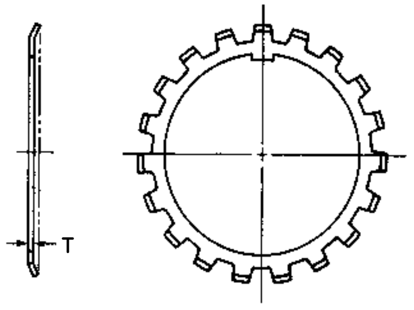


Removable sleeves and removable nuts

Lock nuts and lock washers for ball bearings
ABMA standards



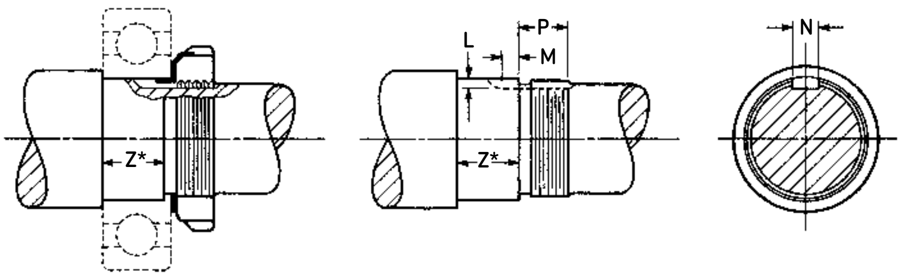
Lock nut



Lock washer

Lock nut number	Nominal bearing bore diameter		Lock nut Outside diameter D_1		Thickness L				Face diameter E				Lock washer Lock washer number	Thickness T	
			+.13 -.38	+.005 -.015	Minimum		Maximum		Minimum		Maximum				
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.		mm	in.
N00	10	.3937	19.0	3/4	5.31	.209	5.81	.229	15.4	.605	15.9	.625	W00	1.07	.042
N01	12	.4724	22.2	7/8	7.70	.303	8.20	.323	17.8	.699	18.3	.719	W01	1.07	.042
N02	15	.5906	25.4	1	7.70	.303	8.20	.323	20.1	.793	20.7	.813	W02	1.07	.042
N03	17	.6693	28.6	1 1/8	8.48	.334	8.99	.354	23.3	.918	23.8	.938	W03	1.07	.042
N04	20	.7874	34.9	1 3/8	9.27	.365	9.78	.385	28.1	1.105	28.6	1.125	W04	1.07	.042
N05	25	.9843	39.7	1 9/16	10.1	.396	10.6	.416	32.0	1.261	32.5	1.281	W05	1.27	.050
N06	30	1.1811	44.4	1 3/4	10.1	.396	10.6	.416	37.6	1.480	38.1	1.500	W06	1.27	.050
N07	35	1.3780	52.4	2 1/16	10.9	.428	11.4	.448	45.5	1.793	46.1	1.813	W07	1.27	.050
N08	40	1.5748	57.2	2 1/4	10.9	.428	11.4	.448	50.3	1.980	50.8	2.000	W08	1.47	.058
N09	45	1.7717	64.3	2 17/32	10.9	.428	11.4	.448	57.4	2.261	57.9	2.281	W09	1.47	.058
N10	50	1.9685	68.3	2 11/16	12.4	.490	13.0	.510	61.4	2.418	61.9	2.438	W10	1.47	.058
N11	55	2.1654	75.4	2 31/32	12.4	.490	13.0	.510	67.0	2.636	67.5	2.656	W11	1.60	.063
N12	60	2.3622	80.2	3 5/32	13.2	.521	13.7	.541	71.7	2.824	72.2	2.844	W12	1.60	.063
N13	65	2.5591	85.7	3 3/8	14.0	.553	14.6	.573	77.3	3.043	77.8	3.063	W13	1.60	.063
N14	70	2.7559	92.1	3 5/8	14.0	.553	14.6	.573	83.4	3.283	84.2	3.313	W14	1.60	.063
AN15	75	2.9528	98.4	3 7/8	14.8	.584	15.3	.604	89.7	3.533	90.5	3.563	W15	1.83	.072
AN16	80	3.1496	105.6	4 5/32	14.8	.584	15.3	.604	96.9	3.814	97.6	3.844	W16	1.83	.072
AN17	85	3.3465	111.9	4 13/32	15.6	.615	16.1	.635	101.6	4.001	102.4	4.031	W17	1.83	.072
AN18	90	3.5433	118.3	4 21/32	17.2	.678	17.7	.698	108.0	4.251	108.7	4.281	W18	2.39	.094
AN19	95	3.7402	125.4	4 15/16	18.0	.709	18.5	.729	115.1	4.533	115.9	4.563	W19	2.39	.094
AN20	100	3.9370	131.8	5 3/16	18.7	.735	19.3	.760	121.5	4.783	122.3	4.813	W20	2.39	.094
AN21	105	4.1339	138.1	5 7/16	18.7	.735	19.3	.760	126.2	4.970	127.0	5.000	W21	2.39	.094
AN22	110	4.3307	145.3	5 23/32	19.5	.766	20.1	.791	133.4	5.251	134.1	5.281	W22	3.18	.125
AN24	120	4.7244	155.6	6 1/8	20.3	.798	20.9	.823	143.7	5.658	144.5	5.688	W24	3.18	.125
AN26	130	5.1181	171.4	6 3/4	21.8	.860	22.5	.885	156.4	6.158	157.2	6.188	W26	3.18	.125
AN28	140	5.5118	180.2	7 3/32	23.4	.923	24.1	.948	165.1	6.501	165.9	6.531	W28	3.18	.125
AN30	150	5.9055	195.3	7 11/16	24.2	.954	24.9	.979	178.6	7.033	179.4	7.063	W30	3.96	.156
AN32	160	6.2992	204.8	8 1/16	25.8	1.016	26.4	1.041	187.9	7.398	188.9	7.438	W32	3.96	.156
AN34	170	6.6929	219.9	8 21/32	26.6	1.048	27.3	1.073	203.0	7.991	204.0	8.031	W34	3.96	.156
AN36	180	7.0866	230.2	9 1/16	27.4	1.079	28.0	1.104	211.7	8.335	212.7	8.375	W36	3.96	.156
AN38	190	7.4803	240.5	9 15/32	28.2	1.110	28.8	1.135	222.0	8.741	223.0	8.781	W38	3.96	.156
AN40	200	7.8740	250.0	9 27/32	29.8	1.173	30.4	1.198	231.5	9.116	232.6	9.156	W40	3.96	.156
N44	220	8.6614	279.4	11	31.2	1.230	32.0	1.260	249.0	9.803	250.0	9.843	W44	3.96	.156

Shaft dimensions for lock nuts



Threads—American (National) Standard Form, Fine Pitch Class 3 Fit

Lock nut number	Threads per inch	Dimensions of shaft threads								Keyway							
		Major diameter				Pitch diameter				Length P		Full length L		Full depth length M		Width N	
										+.40 -0	+1/64 -0	+.40 -0	+1/64 -0	+.40 -0	+1/64 -0	+.40 -0	+1/64 -0
		Maximum		Minimum		Maximum		Minimum									
		mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
N00	32	9.93	**.391**	9.794	**.3856**	9.416	**.3707**	9.350	**.3681**	7.1	**9/32**	1.6	**1/16**	2.4	**3/32**	3.2	**1/8**
N01	32	11.91	**.469**	11.775	**.4636**	11.397	**.4487**	11.331	**.4461**	9.5	**3/8**	1.6	**1/16**	2.4	**3/32**	3.2	**1/8**
N02	32	14.88	**.586**	14.747	**.5806**	14.369	**.5657**	14.293	**.5627**	9.5	**3/8**	2.0	**5/64**	2.4	**3/32**	3.2	**1/8**
N03	32	16.87	**.664**	16.728	**.6586**	16.350	**.6437**	16.274	**.6407**	10.3	**13/32**	2.0	**5/64**	2.4	**3/32**	3.2	**1/8**
N04	32	19.84	**.781**	19.700	**.7756**	19.322	**.7607**	19.235	**.7573**	11.1	**7/16**	2.0	**5/64**	2.4	**3/32**	4.8	**3/16**
N05	32	24.61	**.969**	24.475	**.9636**	24.097	**.9487**	24.011	**.9453**	11.9	**15/32**	2.4	**3/32**	3.2	**1/8**	4.8	**3/16**
N06	18	29.79	**1.173**	29.586	**1.1643**	28.877	**1.1369**	28.776	**1.1329**	11.9	**15/32**	2.4	**3/32**	3.2	**1/8**	4.8	**3/16**
N07	18	34.95	**1.376**	34.742	**1.3678**	34.034	**1.3399**	33.932	**1.3359**	12.7	**1/2**	2.4	**3/32**	3.2	**1/8**	4.8	**3/16**
N08	18	39.70	**1.563**	39.492	**1.5548**	38.783	**1.5269**	38.669	**1.5224**	13.5	**17/32**	2.4	**3/32**	3.2	**1/8**	7.9	**5/16**
N09	18	44.88	**1.767**	44.674	**1.7588**	43.965	**1.7309**	43.851	**1.7264**	13.5	**17/32**	2.4	**3/32**	4.0	**5/32**	7.9	**5/16**
N10	18	49.96	**1.967**	49.754	**1.9588**	49.045	**1.9309**	48.931	**1.9264**	15.1	**19/32**	2.4	**3/32**	4.0	**5/32**	7.9	**5/16**
N11	18	54.79	**2.157**	54.580	**2.1488**	53.871	**2.1209**	53.741	**2.1158**	15.1	**19/32**	3.2	**1/8**	4.0	**5/32**	7.9	**5/16**
N12	18	59.94	**2.360**	59.736	**2.3518**	59.027	**2.3239**	58.898	**2.3188**	15.9	**5/8**	3.2	**1/8**	4.0	**5/32**	7.9	**5/16**
N13	18	64.72	**2.548**	64.511	**2.5398**	63.802	**2.5119**	63.673	**2.5068**	16.7	**21/32**	3.2	**1/8**	4.0	**5/32**	7.9	**5/16**
N14	18	69.88	**2.751**	69.667	**2.7428**	68.959	**2.7149**	68.829	**2.7098**	16.7	**21/32**	3.2	**1/8**	6.4	**1/4**	7.9	**5/16**
AN15	12	74.50	**2.933**	74.214	**2.9218**	73.124	**2.8789**	72.987	**2.8735**	17.5	**11/16**	3.2	**1/8**	6.4	**1/4**	7.9	**5/16**
AN16	12	79.68	**3.137**	79.395	**3.1258**	78.306	**3.0829**	78.156	**3.0770**	17.5	**11/16**	3.2	**1/8**	6.4	**1/4**	9.5	**3/8**
AN17	12	84.84	**3.340**	84.552	**3.3288**	83.462	**3.2859**	83.274	**3.2785**	18.3	**23/32**	3.2	**1/8**	6.4	**1/4**	9.5	**3/8**
AN18	12	89.59	**3.527**	89.301	**3.5153**	88.212	**3.4729**	88.024	**3.4655**	20.6	**13/16**	4.0	**5/32**	6.4	**1/4**	9.5	**3/8**
AN19	12	94.74	**3.730**	94.458	**3.7188**	93.368	**3.6759**	93.180	**3.6685**	21.4	**27/32**	4.0	**5/32**	6.4	**1/4**	9.5	**3/8**
AN20	12	99.52	**3.918**	99.233	**3.9068**	98.143	**3.8639**	97.955	**3.8565**	22.2	**7/8**	4.0	**5/32**	7.9	**5/16**	9.5	**3/8**
AN21	12	104.70	**4.122**	104.415	**4.1108**	103.325	**4.0679**	103.114	**4.0596**	22.2	**7/8**	4.0	**5/32**	7.9	**5/16**	9.5	**3/8**
AN22	12	109.86	**4.325**	109.571	**4.3138**	108.481	**4.2709**	108.270	**4.2626**	23.0	**29/32**	4.8	**3/16**	7.9	**5/16**	9.5	**3/8**
AN24	12	119.79	**4.716**	119.502	**4.7048**	118.412	**4.6619**	118.202	**4.6536**	23.8	**15/16**	4.8	**3/16**	7.9	**5/16**	9.5	**3/8**
AN26	12	129.69	**5.106**	129.408	**5.0948**	128.319	**5.0519**	128.108	**5.0436**	25.4	**1**	4.8	**3/16**	7.9	**5/16**	12.7	**1/2**
AN28	12	139.62	**5.497**	139.340	**5.4858**	138.250	**5.4429**	138.039	**5.4346**	27.0	**1 1/16**	4.8	**3/16**	7.9	**5/16**	15.9	**5/8**
AN30	12	149.56	**5.888**	149.271	**5.8768**	148.181	**5.8339**	147.971	**5.8256**	28.6	**1 1/8**	5.6	**7/32**	9.5	**3/8**	15.9	**5/8**
AN32	8	159.61	**6.284**	159.228	**6.2638**	157.551	**6.2028**	157.320	**6.1937**	30.2	**1 3/16**	6.0	**15/64**	9.5	**3/8**	15.9	**5/8**
AN34	8	169.14	**6.659**	168.753	**6.6438**	167.076	**6.5778**	166.845	**6.5687**	31.0	**1 7/32**	6.0	**15/64**	9.5	**3/8**	19.1	**3/4**
AN36	8	179.48	**7.066**	179.091	**7.0508**	177.414	**6.9848**	177.183	**6.9757**	31.8	**1 1/4**	6.0	**15/64**	9.5	**3/8**	19.1	**3/4**
AN38	8	189.79	**7.472**	189.403	**7.4568**	187.727	**7.3908**	187.496	**7.3817**	32.5	**1 9/32**	6.0	**15/64**	9.5	**3/8**	19.1	**3/4**
AN40	8	199.31	**7.847**	198.928	**7.8318**	197.252	**7.7658**	196.962	**7.7544**	34.1	**1 11/32**	6.0	**15/64**	9.5	**3/8**	22.2	**7/8**
N44	8	219.15	**8.628**	218.766	**8.6128**	217.089	**8.5468**	216.782	**8.5347**	34.9	**1 3/8**	9.5	**3/8**	4.8	**3/16**	27.0	**1 1/16**

*Z = Minimum bearing width: .016 ± .010 in. (.406 ± .254 mm).

Lock nut torque and clamping force

Lock nut torques are standardized regardless of the type of lock nut used. Acceptable lock nut torques for dry thread engagement are shown in the following table. Bearing lock nuts shall be tightened using a torque wrench and a two-point lock nut wrench or other suitable torque wrench adapter.

Bearing bore (mm)	Lock nut torque (ft-lb)	Approximate clamping force (lb)
10	10-20	1 620-3 240
12	10-20	1 340-2 680
15	10-20	1 070-2 140
17	10-20	940-1 880
20	12-35	950-2 770
25	23-50	1 450-3 170
30	32-60	1 690-3 170
35	39-70	1 750-3 140
40	50-80	1 970-3 140
45	64-90	2 220-3 120
50	67-100	2 090-3 120
55	82-125	2 330-3 540
60	99-150	2 560-3 880
65	131-175	3 130-4 190
70	152-200	3 360-4 430
75	173-250	3 610-5 220
80	197-275	3 840-5 350
85	222-325	4 060-5 940
90	248-375	4 280-6 480
95	277-425	4 520-6 950
100	345-475	5 360-7 380
105	380-550	5 620-8 120
110	380-550	5 340-7 740
120	380-550	4 900-7 080
130	380-550	4 510-6 540
140	380-550	4 190-6 070
150	380-550	3 910-5 660
160	380-550	3 680-5 330

Installation procedures

For the precision ball and roller bearings supplied by MRC Bearings, skill and cleanliness while handling, mounting and dismounting are necessary to ensure satisfactory bearing performance. As precision components, rolling bearings must be handled with appropriate care during transportation, storage, mounting and dismounting. For example, it is well known that minute dents, and small amounts of contact surface corrosion and contaminants will seriously shorten bearing endurance. Such damages can be caused by improper handling.

Bearing storage and transportation

Before packaging, MRC precision bearings are treated with a high-grade preservative and they should be stored in the original, unbroken package. **The relative humidity in the storage room should not exceed 60%.** When transporting bearings into and out of the storage room, care must be exercised not to drop the bearings or apply heavy or even moderate impact loading of any kind to prevent damage to, or dislodging of, any of the bearing components. Also care must be exercised to assure the package remains unbroken to prevent contaminants from being introduced into the bearings.

Preparations for bearing mounting

Mounting should be carried out in a dry, dust free room away from metal-working or other machines producing swarf and dust and operating with contaminating agents. Before mounting the bearings, all the necessary parts, tools and equipment should be at hand. It is also important that any drawings or instructions be studied to determine the correct order in which the various components are to be mounted.

All components of the bearing arrangement (housings, shafts, etc.) must be carefully cleaned and any burrs removed; unmachined internal surfaces of cast housings must be free of core grit. The dimensional and form accuracy of all components in contact with the bearings must be checked. The bearings will only perform satisfactorily if the prescribed tolerances of the mounting structures are adhered to. The bearings should be left in their original packages until immediately before mounting.

There is usually no need to remove preservative protecting the bearings. If, however, the bearings are to be grease-lubricated and used at very high or very low temperatures, or when the grease has been determined to be incompatible with the preservative, it is necessary to wash the bearings in a suitable, non-contaminated fluid and carefully dry the bearings prior to mounting. This is to prevent any detrimental effect on the lubricating properties of the grease.

Bearings which have become contaminated because of improper handling (damaged package, etc.) must be carefully washed and dried before mounting.

Bearings which are supplied ready-greased and which have seals, shields or polymerized lubricant must never be washed before mounting.

Bearing mounting

The method (mechanical, hydraulic or thermal) used to mount a bearing depends on the type and size of the bearing and complexity of the application assembly.

In all cases, it is extremely important that neither the bearing, nor any of its components (rings, cage or rolling elements), receive any impact loading (hammer blows, etc.) as this would damage the bearing and could dislodge components. Also, under no circumstances must pressure be applied to one ring in order to mount the other ring.

With non-separable bearings, the ring which is to have the tighter fit is generally mounted first. The seating surface should be lightly oiled before mounting. Pressure may be uniformly applied against a sleeve abutting the bearing ring face; the use of a mounting dolly instead of a sleeve, as shown in Figure 1, permits a mounting force to be applied centrally.

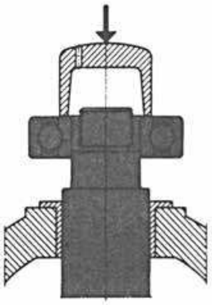


Figure 1

If a non-separable bearing is to be pressed onto the shaft and into the housing simultaneously, the tool set shown by Figure 2, in which a mounting ring is inserted between the dolly and the bearing to simultaneously abut the side faces of the inner and outer rings, may be used. For the mounting forces to be applied equally to both rings, the abutment surfaces of the mounting ring must lie in the same plane.

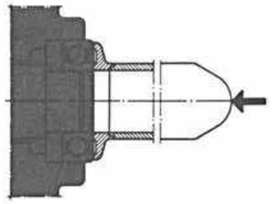


Figure 2

Bearing mounting

Most split inner ring ball bearings, cylindrical roller bearings and tapered roller bearings are designed as separable bearings. In the case of split inner ring ball bearings and cylindrical roller bearings, this means that the outer ring, cage and rolling elements comprise a non-separable unit when the inner ring is removed. Sometimes the inner ring, cage and rolling elements comprise the non-separable unit; this is usually the case for tapered roller bearings.

With separable bearings, the inner ring can be mounted independently of the outer ring. This simplifies mounting, particularly where each ring is to have an interference fit. When inserting the shaft, with the inner ring already mounted, into the housing containing the outer ring, care must be taken that the shaft is correctly aligned with the housing to prevent scoring the raceways and damaging the rolling elements.

For a cylindrical roller bearing, should either part of the bearing be mounted askew, damage may easily be caused to the rings or rollers especially if the rollers and raceways are not oiled or if the parts are rotated during fitting.

It is generally not possible to mount larger bearings in the cold state, as the force required to mount a bearing increases very considerably with bearing size. The bearings, the inner rings or the housings are heated prior to mounting. The required difference in temperature between the bearing ring and shaft or housing depends on the degree of interference and the diameter of the bearing seating. Guideline values for the temperature differences required for some of the most commonly employed fits of bearings may be found in the accompanying diagram (Figure 3). Bearings fabricated from AISI 52100 steel, or other steels suitable for normal operating temperatures (for example, 150° C (300° F) should not be heated to more than 125° C (250° F) since dimensional changes caused by alterations in the material structure may occur.

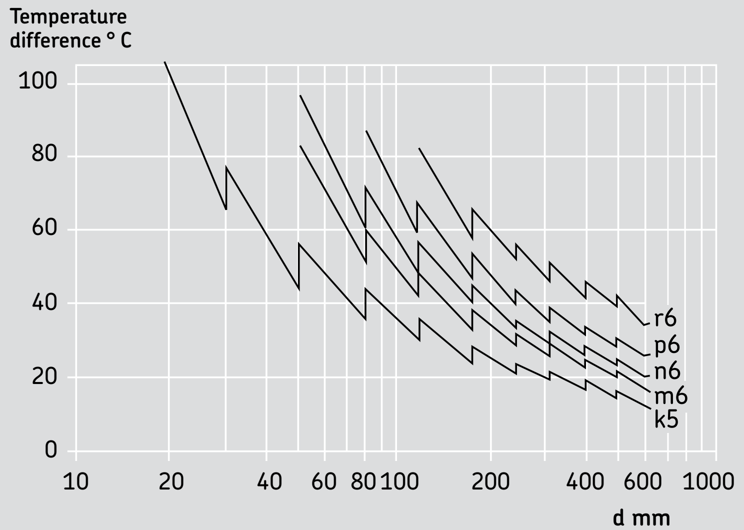


Figure 3

Bearings fabricated from steels capable of operation at higher temperatures may be heated to somewhat higher temperatures; e.g., 205° C [400° F] for mounting purposes. The indicated temperature is more dictated by the preserving lubricant temperature limit than by the steel. Ready-greased bearings fitted with seals and/or shields should not be heated.

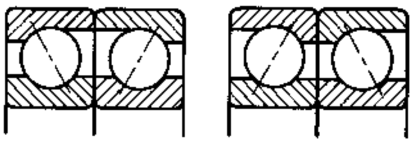
Local overheating must be avoided when heating bearings. Uniform, risk-free heating can be achieved using induction heaters, electric heaters, heating cabinets and oil baths. If hotplates are used, the bearing must be turned over a number of times. The inner rings of medium and large cylindrical roller bearings, which have no flange or an integral flange on one side only, may be heated using an induction heating tool or heating ring.

Bearing adjustment

The internal clearance of single row, angular contact ball bearings is only established, in contrast to other radial bearings, when one bearing is adjusted against a second bearing. Usually these bearings are arranged in face-to-face or back-to-back pairs, and one bearing ring is axially displaced until a given clearance or preload is attained (Figure 4).

The appropriate value for the clearance to be obtained when mounting is determined by the conditions when the bearing is under load and at the operating temperature. Depending on the size and arrangement of the bearings, the materials from which the shaft and housing are fabricated and the distance between the two bearings, the initial clearance obtained on mounting may be smaller or larger in actual operation. If, for example, differential thermal expansion will cause a reduction in clearance, the initial clearance must be sufficiently large so that distortion of the bearings and resultant detrimental effects are avoided.

Figure 4
Angular contact ball bearings pair mounting arrangements



Face-to-face	Back-to-back
Bearings are placed so that the unmarked (low shoulder side) of the outer rings are together. Contact angle lines of two bearings converge inwardly toward the bore of the bearing.	Bearings are placed so that the marked backs (full shoulder side) of the outer rings are together. Contact angle lines of the bearings converge outwardly, away from the bearing bores.

Installation procedures

Since there is a definite relationship between radial and axial internal clearance of angular contact ball bearings, it is sufficient to specify a single value, generally the axial internal clearance. This specified value is then obtained, starting from a condition of zero clearance, by loosening or tightening a nut on the shaft or a threaded ring in the housing bore, or by inserting calibrated shims between one of the bearing rings and its abutment. The actual methods used to adjust the clearance and measure the set clearance are determined by whether a few or many bearings are to be mounted.

Dismounting of bearings

If bearings are to be reused after removal from the application, the force used to dismount them must never be applied through the rolling elements. With separable bearings, the ring with the rolling element and cage assembly can be removed independently of the other ring. With non-separable bearings, the ring having the looser fit should be removed from its seating first. To dismount a bearing ring having an interference fit, the tools and accessories described in the following may be used depending on bearing type and size.

Bearing ring puller

Small bearings may be removed from their seatings by using a puller as illustrated in Figure 5.

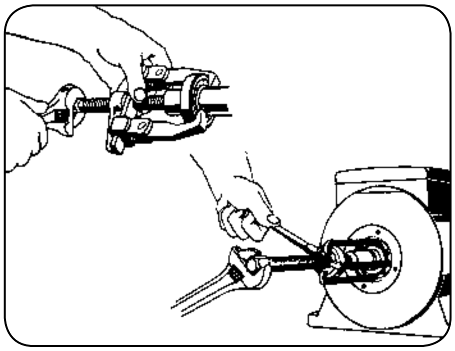


Figure 5

The claws of the puller should be placed against the side face of the ring to be removed or an adjacent component; e.g., a labyrinth ring, etc. Dismounting is made easier if, when designing the bearing arrangement, slots are provided in the shaft and housing shoulders to accommodate the claws of the puller. Outer rings can be removed more easily from their housings if tapped holes are provided in the shoulders to take withdrawal screws (Figure 6).

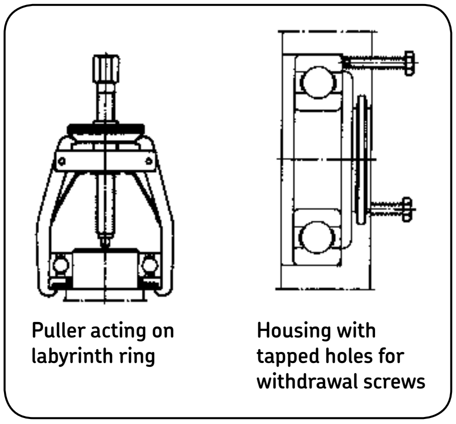
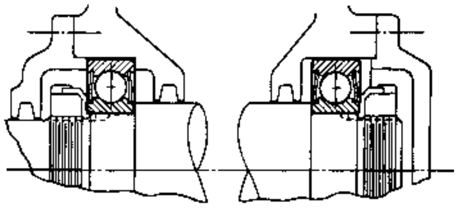


Figure 6

Installation procedures

Typical horizontal mountings for single-row radial and double-row bearings



Standard mounting

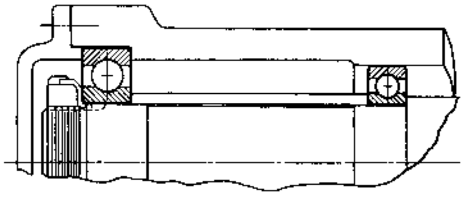
This is the ideal mounting for a shaft supported by two ball bearings, and has these advantages:

1 It permits one bearing to take thrust in either direction.

2 Axial shaft expansion is provided for by the "floating" of the unclamped bearing.

3 The bearings cannot be axially preloaded through improper adjustment of the lock nuts. The lock nuts serve to clamp the bearing inner rings against the shaft shoulder.

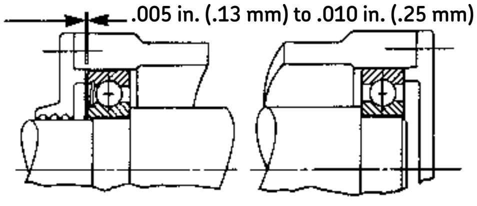
4 This mounting arrangement is suitable for a wide range of speed and temperature conditions.



Standard mounting (with spacer)

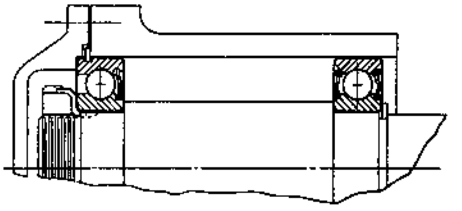
This is an alternate mounting with that shown above, and should be used where the bearings are assembled from one end of the shaft. Note that the inner rings of both bearings, together with the spacer which separates them, are clamped against the shaft shoulder by means of one lock nut at the end of the shaft. (Compare mounting above which requires two lock nuts.) This construction has the same advantages as those enumerated above.

The mounting shown below employs no lock nuts on the shaft and permits through bore in the housing. Due to tolerance build-up of the various components, it is difficult to control the axial play of the shaft unless shims are used. These shims are usually mounted between the face of the bearing outer ring and the end cover shoulder. Axial play of the shaft should be sufficiently large to eliminate any possibility of preloading due to thermal expansions, yet small enough to eliminate excessive chucking under reversing thrust load.



Mounting with no lock nut or snap-ring

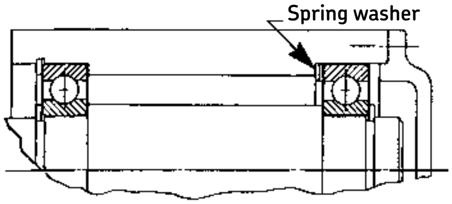
This means of mounting may be effectively employed where there is no rapid alternation in the direction of the thrust load. It is also adaptable for locations where shaft length is short.



Mounting with lock nut and snap-ring

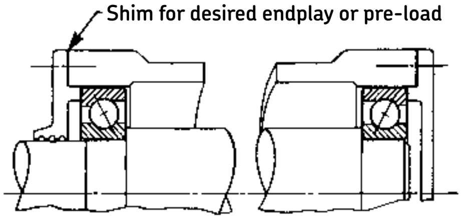
The type of mounting above differs from the standard mounting in that the bearing on the right end is held on the shaft by a snap-ring, which eliminates the lock nut and the necessity of threading the shaft. Use of a snap-ring bearing on the left above, makes use of a through bore housing possible, thereby allowing economies in manufacture.

Installation procedures



Mounting with snap-rings and spring washer

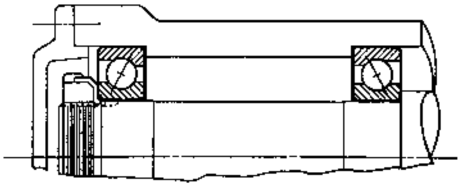
The above mounting can be used where both shaft and housing have shoulders, and where thrust is not excessive. The commercially available spring washer provides a small preload to the bearings. This eliminates shaft endplay and enhances quiet bearing operation.



Pair of angular-contact bearings mounted opposed to take thrust in either direction

This construction requires a shoulder on the shaft, and a clamping member of the outer ring, with shim adjustment.

Lock nuts on the shaft can in general be dispensed with, but should be used where the inner ring must be very firmly secured to resist shock or vibratory loads.



This construction requires housing shoulders, and a lock nut on the shaft. Adjustment is made by means of the lock nut. The left hand bearing should have a sliding fit on the shaft.

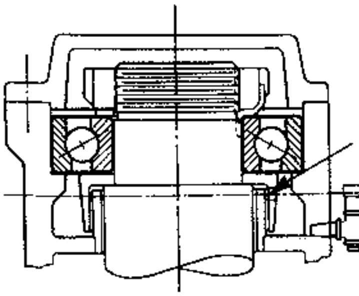
Owing to the difficulty of accurate adjustment and danger of excessive tightening, this mounting is not often recommended.

If the thrust in one direction is substantially less than in the opposite direction, the bearings can be of different sizes so as to give approximately equal safety factors. Also the reverse thrust can, if desired, be taken care of by a smaller angular-contact bearing, or by a radial bearing.

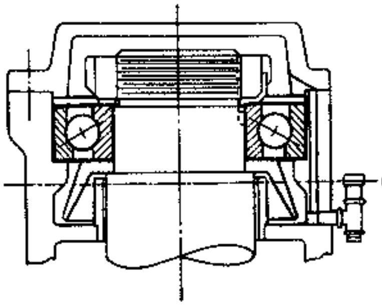
Installation procedures

Typical vertical mountings for angular-contact bearings

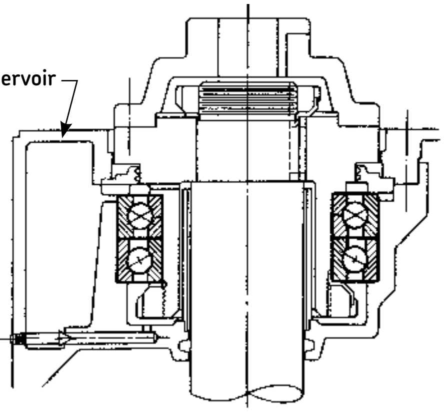
Vertical mountings are frequently used with oil lubrication. This requires a means for lifting the oil into contact with the bearings. The sketches on this page show three approved mounting arrangements.



The design above is suited for uni-directional thrust. If reversing thrust is present, it must be taken by an opposed bearing mounted at the bottom of the shaft. Note that the oil is lifted into the bearing by means of the inverted rotating cone. Attention is called to the drilled hole which prevents possible siphoning out of the oil when the shaft is stationary.



The sketch above shows the conventional method of circulating oil in a vertical application. Note that the dish-shaped oil thrower pumps the oil up through the drilled hole in the housing from which the oil flows downward through the bearing by gravity. Reverse thrust loads must be carried by an opposed bearing.



Application of MRC 97000 series

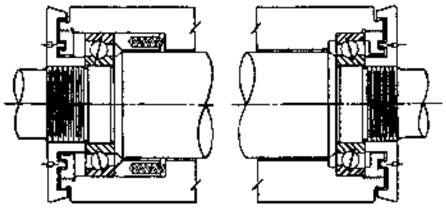
The bearing arrangement above is capable of supporting extremely heavy thrust in the downward direction as well as substantially heavy thrust loads in the upward direction. The radial support bearing at the bottom of the shaft need not be shimmed to carry the up-thrust. The 9000UD bearing may be mounted above (as shown) or below, the 7000D, but maintaining the same orientation of bearing faces. (See page 243)

In the lubricating arrangement shown, the bearings serve as a pump to elevate the oil from the chamber immediately below the bearings to a passageway at the top of the bearings. From this point the oil returns by gravity to the reservoir shown at the left. Oil flow into the chamber below the bearings is adjusted by means of a metering pin. This system has a unique advantage in that the bearings may be completely covered by the oil level during shut-down, thereby protecting them against damage through corrosion.

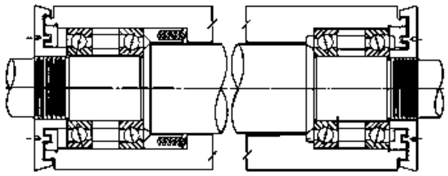
Installation procedures

Typical methods of mounting bearings for high speed operation

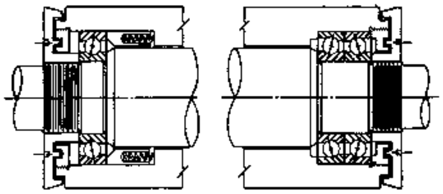
The drawings here illustrate proven designs for high speed service, primarily for machine tool spindles. Note the rugged sections for minimizing deflection and the labyrinth flinger seals for protecting the bearings against the entrance of foreign material. Additional sealing protection is often provided by introducing air-oil mist in the chamber between the two bearings. This not only lubricates the bearings, but also assures a positive outward flow of air through the labyrinth passage. The radial clearances in the labyrinth should be .005 in. (.13mm) to .010 in. (.25 mm) and the axial clearances should be approximately $^{1}/_{32}$ in. (.080 mm) to $^{1}/_{16}$ in. (1.59 mm).



This is the simplest high speed mounting arrangement and is used for a wide variety of applications involving extremely high speeds. The spring pack bears against the face of the outer ring on the bearing at the left in order to preload the two bearings. Bearing on left end of shaft must be free to float in housing for preload to be effective. For extremely high speeds, the floating bearing is sometimes mounted in a cartridge in order to improve the length-to-diameter ratio of the sliding member.

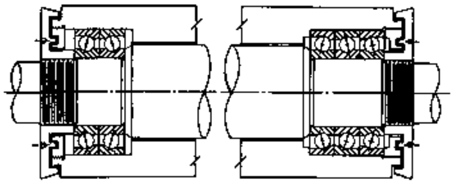


In the arrangement above, the duplex tandem pair on the left end of the shaft is spring preloaded against another duplex tandem pair on the right. The pairs at either end are separated by equal length spacers between bearing outer rings and inner rings. This arrangement produces good shaft rigidity due to the multiple shaft support.

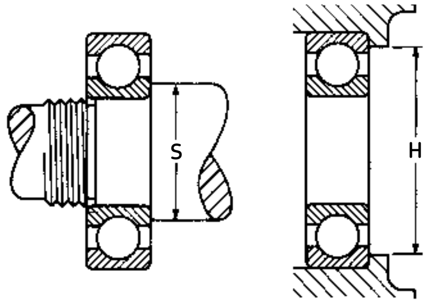


In this arrangement the shaft is supported at the right end by a duplex pair mounted in the back-to-back relationship. These bearings may be supplied as a preloaded set if operating conditions require that deflections be minimized. The bearing on the left end of the shaft is a single-row deep-groove bearing which floats axially in the housing and is lightly spring loaded to remove residual clearances.

The shaft below is located axially by the arrangement on the right end of the shaft, which consists of a pair of tandem bearings opposed back-to-back against a single bearing. The duplex back-to-back pair on the left end of the shaft is free to move axially in the housing. This mounting arrangement has great rigidity.



Shaft and housing shoulder diameters



Shoulder diameters for millimeter and inch-size MRC ball bearings

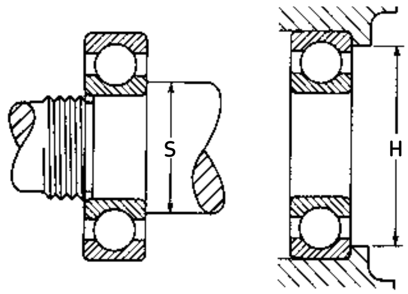
The tables on these pages show minimum shaft shoulder diameters and maximum housing shoulder diameters as established by MRC Engineering. However, the user may wish to modify these diameters to meet specific requirements such as assembly or disassembly problems or extremely heavy thrust loads. Please consult MRC Engineering for specific recommendations concerning your requirements.

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
34	5.51	**.22**	14.2	**.56**
35	6.61	**.26**	17.0	**.67**
36	7.61	**.30**	17.0	**.67**
37	8.61	**.34**	20.0	**.79**
38	9.71	**.38**	20.0	**.79**
39	11.4	**.45**	23.4	**.92**
R2	4.60	**.179**	8.3	**.33**
R2A	4.60	**.179**	11.8	**.47**
R3	6.20	**.24**	11.8	**.47**
R4	7.90	**.31**	14.4	**.57**
R4A	8.20	**.32**	17.2	**.68**
R6	11.50	**.45**	20.3	**.80**
R8	15.90	**.63**	26.0	**1.03**
R10	19.10	**.75**	31.8	**1.25**
R12	22.20	**.88**	38.1	**1.50**
R14	25.40	**1.00**	44.5	**1.75**
R16	28.60	**1.13**	47.6	**1.88**
R18	31.80	**1.25**	50.8	**2.00**
R20	34.90	**1.38**	54.0	**2.13**
R22	38.10	**1.50**	60.3	**2.38**
R24	41.30	**1.63**	63.5	**2.50**
102	17.00	**.67**	30.0	**1.18**
103	19.10	**.75**	35.1	**1.38**
104	22.60	**.89**	37.1	**1.46**
105	27.40	**1.08**	46.7	**1.84**
106	34.00	**1.34**	56.1	**2.21**
107	38.90	**1.53**	64.0	**2.52**
108	43.90	**1.73**	73.9	**2.91**
109	49.30	**1.94**	79.0	**3.11**
110	54.10	**2.13**	83.1	**3.27**
111	59.20	**2.33**	92.9	**3.66**
112	64.30	**2.53**	98.0	**3.86**
113	69.10	**2.72**	108.0	**4.25**
114	73.90	**2.91**	113.0	**4.45**
115	79.00	**3.11**	123.0	**4.84**
116	84.10	**3.31**	128.0	**5.05**
117	88.90	**3.50**	136.0	**5.35**
118	97.50	**3.84**	141.0	**5.55**
119	102.00	**4.05**	150.0	**5.91**
120	107.00	**4.23**	150.0	**5.91**
122	120.00	**4.72**	165.0	**6.49**
124	130.00	**5.12**	180.0	**7.09**
126	140.00	**5.51**	195.0	**7.68**
128	150.00	**5.91**	208.0	**8.19**
130	162.00	**6.38**	223.0	**8.78**

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
132	172.0	**6.77**	238.0	**9.37**
134	182.0	**7.17**	253.0	**9.96**
136	192.0	**7.56**	266.0	**10.55**
138	202.0	**7.95**	288.0	**11.34**
140	212.0	**8.35**	308.0	**12.13**
142	222.0	**8.74**	326.0	**12.84**
144	234.0	**9.21**	336.0	**13.23**
146	244.0	**9.61**	356.0	**14.02**
148	254.0	**10.00**	372.0	**14.65**
150	266.0	**10.47**	392.0	**15.43**
152	278.0	**10.95**	412.0	**16.22**
156	298.0	**11.73**	442.0	**17.40**
164	338.0	**13.31**	482.0	**18.98**
100K	11.9	**.47**	24.1	**.95**
101K	14.0	**.55**	25.9	**1.02**
102K	17.0	**.67**	30.0	**1.18**
103K	19.1	**.75**	33.0	**1.30**
104K	22.6	**.89**	37.1	**1.46**
105K	27.4	**1.08**	41.9	**1.65**
106K	34.0	**1.34**	49.0	**1.93**
107K	38.9	**1.53**	56.1	**2.21**
108K	43.9	**1.73**	62.0	**2.44**
109K	49.3	**1.94**	69.0	**2.72**
110K	54.1	**2.13**	73.9	**2.91**
111K	59.2	**2.33**	83.1	**3.27**
112K	64.3	**2.53**	88.1	**3.47**
113K	69.1	**2.72**	92.9	**3.66**
114K	73.9	**2.91**	103.0	**4.06**
115K	79.0	**3.11**	108.0	**4.25**
116K	84.1	**3.31**	118.0	**4.65**
117K	88.9	**3.50**	123.0	**4.84**
118K	97.5	**3.84**	131.0	**5.16**
119K	102.0	**4.05**	136.0	**5.35**
120K	107.0	**4.23**	141.0	**5.55**
121K	115.0	**4.53**	150.0	**5.91**
122K	120.0	**4.72**	160.0	**6.30**
124K	130.0	**5.12**	170.0	**6.69**
126K	140.0	**5.51**	190.0	**7.48**
128K	150.0	**5.91**	200.0	**7.87**
130K	162.0	**6.38**	213.0	**8.39**
132K	172.0	**6.77**	228.0	**8.98**
134K	182.0	**7.17**	248.0	**9.76**
136K	192.0	**7.56**	266.0	**10.55**
138K	202.0	**7.95**	278.0	**10.95**
140K	212.0	**8.35**	298.0	**11.73**

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
144K	234.0	**9.21**	326.0	**12.84**
148K	254.0	**10.00**	346.0	**13.62**
152K	278.0	**10.95**	382.0	**15.04**
156K	298.0	**11.73**	402.0	**15.83**
160K	318.0	**12.52**	442.0	**17.40**
164K	338.0	**13.31**	462.0	**18.19**
200	12.7	**.50**	24.9	**.98**
201	14.7	**.58**	26.9	**1.06**
202	17.5	**.69**	30.0	**1.18**
203	19.6	**.77**	34.0	**1.34**
204	23.9	**.94**	40.9	**1.61**
205	29.0	**1.14**	46.0	**1.81**
206	34.0	**1.34**	56.1	**2.21**
207	38.9	**1.53**	65.0	**2.56**
208	43.9	**1.73**	72.9	**2.87**
209	49.3	**1.94**	78.0	**3.07**
210	54.1	**2.13**	83.1	**3.27**
211	61.2	**2.41**	93.5	**3.68**
212	67.8	**2.67**	101.0	**3.98**
213	72.6	**2.86**	111.0	**4.37**
214	77.7	**3.06**	116.0	**4.57**
215	82.6	**3.25**	121.0	**4.76**
216	90.2	**3.55**	130.0	**5.12**
217	95.3	**3.75**	140.0	**5.51**
218	100.0	**3.94**	150.0	**5.91**
219	107.0	**4.21**	158.0	**6.22**
220	112.0	**4.41**	168.0	**6.61**
221	117.0	**4.61**	178.0	**7.01**
222	122.0	**4.80**	188.0	**7.40**
224	132.0	**5.20**	203.0	**7.99**
226	144.0	**5.67**	216.0	**8.50**
228	154.0	**6.05**	236.0	**9.29**
230	164.0	**6.46**	256.0	**10.08**
232	174.0	**6.85**	276.0	**10.87**
234	188.0	**7.40**	292.0	**11.50**
236	198.0	**7.80**	302.0	**11.89**
238	208.0	**8.19**	322.0	**12.68**
240	218.0	**8.58**	342.0	**13.47**
242	232.0	**9.13**	359.0	**14.13**
244	238.0	**9.37**	382.0	**15.04**
246	254.0	**10.00**	397.0	**15.63**
248	258.0	**10.16**	422.0	**16.61**
250	277.0	**10.92**	434.0	**17.07**
252	282.0	**11.10**	458.0	**18.03**
256	302.0	**11.89**	478.0	**18.82**
260	322.0	**12.68**	518.0	**20.39**
264	342.0	**13.47**	558.0	**21.97**

Shaft and housing shoulder diameters



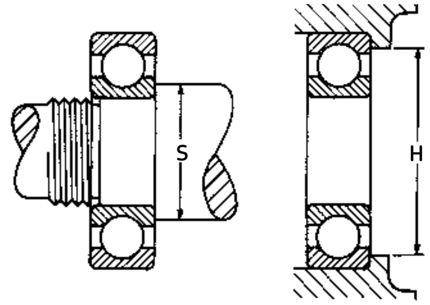
Shoulder diameters for millimeter and inch-size MRC ball bearings

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
300	12.7	**.50**	30.0	**1.18**
301	16.0	**.63**	31.0	**1.22**
302	19.1	**.75**	36.1	**1.42**
303	21.1	**.83**	40.9	**1.61**
304	23.9	**.94**	45.0	**1.77**
305	29.0	**1.14**	55.1	**2.17**
306	34.0	**1.34**	65.0	**2.56**
307	42.9	**1.69**	71.1	**2.80**
308	49.0	**1.93**	81.0	**3.19**
309	54.1	**2.13**	90.9	**3.58**
310	59.9	**2.36**	100.0	**3.94**
311	65.0	**2.56**	110.0	**4.33**
312	72.1	**2.84**	118.0	**4.65**
313	77.0	**3.03**	128.0	**5.04**
314	82.0	**3.23**	138.0	**5.43**
315	87.1	**3.43**	148.0	**5.83**
316	91.9	**3.62**	158.0	**6.22**
317	99.1	**3.90**	166.0	**6.54**
318	104.0	**4.09**	176.0	**6.93**
319	109.0	**4.29**	186.0	**7.32**
320	114.0	**4.49**	201.0	**7.91**
321	119.0	**4.69**	211.0	**8.31**
322	124.0	**4.88**	226.0	**8.90**
324	134.0	**5.28**	246.0	**9.69**
326	148.0	**5.83**	262.0	**10.32**
328	158.0	**6.22**	282.0	**11.10**
330	168.0	**6.61**	302.0	**11.89**
332	178.0	**7.01**	322.0	**12.68**
334	188.0	**7.40**	342.0	**13.47**
336	198.0	**7.80**	362.0	**14.25**
338	212.0	**8.35**	378.0	**14.88**
340	222.0	**8.74**	398.0	**15.67**
342	240.0	**9.43**	412.0	**16.21**
344	242.0	**9.53**	438.0	**17.24**
348	262.0	**10.32**	478.0	**18.82**
352	288.0	**11.34**	512.0	**20.16**
356	308.0	**12.13**	552.0	**21.73**
403	24.1	**.95**	55.1	**2.17**
404	26.9	**1.06**	65.0	**2.56**
405	34.0	**1.34**	71.1	**2.80**
406	39.1	**1.54**	81.0	**3.19**
407	43.9	**1.73**	90.9	**3.58**
408	50.0	**1.97**	100.0	**3.94**
409	55.1	**2.17**	110.0	**4.33**
410	62.0	**2.44**	118.0	**4.65**
411	67.1	**2.64**	128.0	**5.04**
412	72.1	**2.84**	138.0	**5.43**
413	77.0	**3.03**	148.0	**5.83**
414	84.1	**3.31**	166.0	**6.54**
415	88.9	**3.50**	176.0	**6.93**
416	94.0	**3.70**	186.0	**7.32**
417	103.0	**4.06**	192.0	**7.56**

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
418	108.0	**4.25**	207.0	**8.15**
419	109.0	**4.30**	231.0	**9.10**
420	121.0	**4.75**	245.0	**9.64**
421	130.0	**5.10**	267.0	**10.52**
422	138.0	**5.42**	294.0	**11.57**
1800	12.0	**.47**	17.0	**.67**
1801	14.0	**.55**	19.0	**.75**
1802	17.0	**.67**	22.0	**.87**
1803	19.0	**.75**	24.0	**.95**
1804	22.0	**.87**	30.0	**1.18**
1805	27.0	**1.06**	35.0	**1.38**
1806	32.0	**1.26**	40.0	**1.58**
1807	37.0	**1.46**	45.0	**1.77**
1808	42.0	**1.65**	50.0	**1.97**
1809	47.0	**1.85**	56.0	**2.21**
1810	52.0	**2.05**	63.0	**2.48**
1811	57.0	**2.24**	70.0	**2.76**
1812	62.0	**2.44**	76.0	**2.99**
1813	69.0	**2.72**	81.0	**3.19**
1814	74.0	**2.91**	86.0	**3.39**
1815	79.0	**3.11**	91.0	**3.58**
1816	84.0	**3.31**	96.0	**3.78**
1817	90.0	**3.54**	105.0	**4.13**
1818	95.0	**3.74**	110.0	**4.33**
1819	100.0	**3.94**	115.0	**4.53**
1820	105.0	**4.13**	120.0	**4.72**
1821	110.0	**4.33**	125.0	**4.92**
1822	115.0	**4.53**	135.0	**5.32**
1824	125.0	**4.92**	145.0	**5.71**
1826	136.5	**5.37**	158.5	**6.24**
1828	146.5	**5.77**	168.5	**6.63**
1830	156.5	**6.16**	183.5	**7.22**
1832	166.5	**6.56**	193.5	**7.62**
1834	176.5	**6.95**	208.5	**8.21**
1836	186.5	**7.34**	218.5	**8.61**
1838	198.0	**7.80**	232.0	**9.13**
1840	208.0	**8.19**	242.0	**9.53**
1844	228.0	**8.98**	262.0	**10.32**
1848	249.0	**9.81**	291.0	**11.46**
1852	269.0	**10.59**	311.0	**12.24**
1856	289.0	**11.38**	341.0	**13.43**
1860	311.0	**12.24**	369.0	**14.53**
1864	331.0	**13.03**	389.0	**15.32**
1868	351.0	**13.82**	409.0	**16.10**
1872	371.0	**14.61**	429.0	**16.89**
1876	391.0	**15.39**	469.0	**18.47**
1880	411.0	**16.18**	489.0	**19.25**
1884	431.0	**16.97**	509.0	**20.04**
1888	451.0	**17.76**	529.0	**20.83**
1892	473.0	**18.62**	567.0	**22.32**
1896	493.0	**19.41**	587.0	**23.11**

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
1900	11.2	**.44**	20.8	**.82**
1901	13.2	**.52**	22.9	**.90**
1902	16.3	**.64**	26.9	**1.06**
1903	18.0	**.71**	29.0	**1.14**
1904	21.6	**.85**	35.3	**1.39**
1905	26.7	**1.05**	39.9	**1.57**
1906	31.8	**1.25**	45.5	**1.79**
1907	37.1	**1.46**	52.8	**2.08**
1908	42.7	**1.68**	59.4	**2.34**
1909	47.8	**1.88**	65.3	**2.57**
1910	52.3	**2.06**	69.6	**2.74**
1911	58.2	**2.29**	76.7	**3.0**
1912	63.2	**2.49**	81.8	**3.22**
1913	68.1	**2.68**	86.9	**3.42**
1914	73.9	**2.91**	96.0	**3.78**
1915	78.5	**3.09**	101.0	**3.99**
1916	83.8	**3.30**	106.0	**4.18**
1917	89.4	**3.52**	116.0	**4.56**
1918	94.2	**3.71**	121.0	**4.75**
1919	99.8	**3.93**	125.0	**4.93**
1920	105.0	**4.13**	135.0	**5.33**
1921	110.0	**4.33**	140.0	**5.51**
1922	115.0	**4.52**	145.0	**5.70**
1924	125.0	**4.93**	160.0	**6.28**
1926	136.0	**5.36**	174.0	**6.85**
1928	146.0	**5.76**	184.0	**7.24**
1930	158.0	**6.21**	202.0	**7.97**
1932	168.0	**6.62**	212.0	**8.33**
1934	178.0	**7.01**	222.0	**8.74**
1936	189.0	**7.44**	241.0	**9.50**
1938	199.0	**7.83**	251.0	**9.89**
1940	210.0	**8.27**	269.0	**10.61**
1944	231.0	**9.09**	289.0	**11.38**
1948	251.0	**9.88**	309.0	**12.17**
1952	271.0	**10.67**	349.0	**13.74**
1956	291.0	**11.46**	369.0	**14.53**
1960	313.0	**12.32**	407.0	**16.02**
1964	333.0	**13.11**	427.0	**16.81**
1968	353.0	**13.90**	447.0	**17.60**
1972	373.0	**14.69**	467.0	**18.39**
1976	396.0	**15.59**	504.0	**19.84**
1980	416.0	**16.38**	524.0	**20.63**
1984	436.0	**17.17**	544.0	**21.42**
1988	456.0	**17.95**	584.0	**22.99**
1992	476.0	**18.74**	604.0	**23.78**
XLS1$^{3}/_{8}$	39.7	**1.56**	60.3	**2.38**
XLS1$^{1}/_{2}$	49.2	**1.69**	63.5	**2.50**
XLS1$^{5}/_{8}$	46.0	**1.81**	68.3	**2.69**
XLS1$^{3}/_{4}$	49.2	**1.94**	71.4	**2.81**
XLS1$^{7}/_{8}$	52.4	**2.06**	76.2	**3.00**
XLS2	55.6	**2.19**	79.4	**3.13**
XLS2$^{1}/_{8}$	60.3	**2.38**	81.0	**3.19**

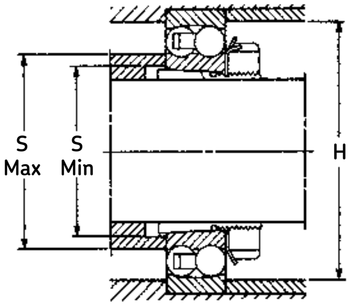
Shaft and housing shoulder diameters



Shoulder diameters for millimeter and inch-size MRC ball bearings

MRC bearing number	S Minimum		H Maximum	
	mm	in.	mm	in.
XLS2 1/4	63.5	2.50	84.1	3.31
XLS2 3/8	66.7	2.63	88.9	3.50
XLS2 1/2	69.9	2.75	92.1	3.63
XLS2 5/8	73.0	2.88	98.4	3.88
XLS2 3/4	76.2	3.00	98.4	3.88
XLS2 7/8	81.0	3.19	106.0	4.19
XLS3	84.1	3.31	106.0	4.19
XLS3 1/8	87.3	3.44	113.0	4.44
XLS3 1/4	90.5	3.56	113.0	4.44
XLS3 3/8	93.7	3.69	119.0	4.69
XLS3 1/2	96.8	3.81	119.0	4.69
XLS3 5/8	100.0	3.94	122.0	4.81
XLS3 3/4	103.0	4.06	122.0	4.81
XLS3 7/8	106.0	4.19	135.0	5.31
XLS4	110.0	4.31	135.0	5.31
XLS4 1/8	113.0	4.44	144.0	5.69
XLS4 1/4	116.0	4.56	144.0	5.69
XLS4 3/8	119.0	4.69	151.0	5.94
XLS4 1/2	122.0	4.81	151.0	5.94
XLS4 5/8	125.0	4.94	157.0	6.19
XLS4 3/4	129.0	5.06	157.0	6.19
XLS4 7/8	132.0	5.19	170.0	6.69
XLS5	135.0	5.31	170.0	6.69
XLS5 1/8	140.0	5.50	175.0	6.88
XLS5 1/4	143.0	5.63	175.0	6.88
XLS5 3/8	146.0	5.75	181.0	7.13
XLS5 1/2	149.0	5.88	181.0	7.13
XLS5 5/8	152.0	6.00	187.0	7.38
XLS5 3/4	156.0	6.13	187.0	7.38
XLS5 7/8	159.0	6.25	194.0	7.63
XLS6	162.0	6.38	194.0	7.63
XLS6 1/4	168.0	6.63	206.0	8.13
XLS6 1/2	175.0	6.88	213.0	8.38
XLS6 3/4	184.0	7.25	216.0	8.50
XLS7	191.0	7.50	229.0	9.00
XLS7 1/4	197.0	7.75	235.0	9.25
XLS7 1/2	203.0	8.00	241.0	9.50
XLS7 3/4	210.0	8.25	254.0	10.00
XLS8	216.0	8.50	260.0	10.25
XLS8 1/4	222.0	8.75	267.0	10.50
XLS8 1/2	229.0	9.00	279.0	11.00
XLS8 3/4	235.0	9.25	286.0	11.25
XLS9	241.0	9.50	292.0	11.50
XLS9 1/2	257.0	10.13	308.0	12.13
XLS10	270.0	10.63	321.0	12.63
XLS10 1/2	283.0	11.13	340.0	13.38
XLS11	295.0	11.63	352.0	13.88
XLS11 1/2	308.0	12.13	371.0	14.63
XLS12	321.0	12.63	391.0	15.38
135	7.0	.28	17.0	.67
126	8.0	.32	17.0	.67
127	9.0	.35	20.0	.79
108	10.0	.39	20.0	.79
129	13.0	.51	22.0	.87
1200E	14.0	.55	26.0	1.02
1201E	16.0	.63	28.0	1.10
1202E	19.0	.75	31.0	1.22
1203E	21.0	.83	36.0	1.42
1204E	25.0	.98	42.0	1.65
1205E	30.0	1.18	47.0	1.85
1206E	35.0	1.38	57.0	2.24
1207E	41.5	1.63	65.5	2.58
1208E	46.5	1.83	73.5	2.89
1209E	51.5	2.03	78.5	3.09
1210E	56.5	2.22	83.5	3.29
1211E	63.0	2.48	95.0	3.74
1212E	68.0	2.68	102.0	4.02
1213E	73.0	2.87	112.0	4.41
1214	78.0	3.07	117.0	4.61
1215	83.0	3.27	122.0	4.80
1216	89.0	3.51	131.0	5.16
1217	94.0	3.70	141.0	5.55
1218	99.0	3.90	151.0	5.95
1219	106.0	4.17	159.0	6.26
1220	111.0	4.37	169.0	6.65
1221	116.0	4.57	178.0	7.05
1222	121.0	4.76	189.0	7.44
1224	131.0	5.16	204.0	8.03
1226	143.0	5.63	217.0	8.54
1301E	17.0	.67	32.0	1.26
1302E	20.0	.79	37.0	1.46
1303E	22.0	.87	42.0	1.65
1304E	26.5	1.04	45.5	1.79
1305E	31.5	1.24	55.5	2.19
1306E	36.5	1.44	65.5	2.58
1307E	43.0	1.69	72.0	2.84
1308E	48.0	1.89	82.0	3.23
1309E	53.0	2.09	92.0	3.62
1310E	59.0	2.32	101.0	3.98
1311E	64.0	2.52	111.0	4.37
1312E	71.0	2.80	119.0	4.69
1313E	76.0	2.99	129.0	5.08
1314	81.0	3.19	139.0	5.47
1315	86.0	3.39	149.0	5.87
1316	91.0	3.58	159.0	6.26
1317	98.0	3.86	167.0	6.58
1318	103.0	4.06	177.0	6.97
1319	108.0	4.25	187.0	7.36
1320	113.0	4.45	202.0	7.95
1322	123.0	4.84	227.0	8.94
1406	38.0	1.50	82.0	3.23
1407	43.0	1.69	92.0	3.62
1408	49.0	1.93	101.0	3.98
1409	54.0	2.13	111.0	4.37
1410	61.0	2.40	119.0	4.69
1411	66.0	2.60	129.0	5.08
1412	71.0	2.80	139.0	5.47
2200E	14.0	.55	26.0	1.02
2201E	16.0	.63	28.0	1.10
2202E	19.0	.75	31.0	1.22
2203E	21.0	.83	36.0	1.41
2204E	25.0	.98	42.0	1.65
2205E	30.0	1.18	47.0	1.85
2206E	35.0	1.38	57.0	2.24
2207E	41.5	1.63	65.5	2.58
2208E	46.5	1.83	73.5	2.89
2209E	51.5	2.03	78.5	3.09
2210E	56.5	2.22	83.5	3.29
2211E	63.0	2.48	92.0	3.62
2212E	68.0	2.68	102.0	4.02
2213E	73.0	2.87	112.0	4.41
2214	78.0	3.07	117.0	4.61
2215	83.0	3.27	122.0	4.81
2216E	89.0	3.50	131.0	5.16
2217	94.0	3.70	141.0	5.55
2218	99.0	3.90	151.0	5.95
2219	106.0	4.17	159.0	6.26
2220	111.0	4.37	169.0	6.65
2221	116.0	4.57	179.0	7.05
2222	121.0	4.76	189.0	7.44
2301	17.0	.67	32.0	1.26
2302	20.0	.79	37.0	1.46
2303	22.0	.87	42.0	1.65
2304	26.5	1.04	45.5	1.79
2305	31.5	1.24	55.5	2.19
2306	36.5	1.44	65.5	2.58
2307E	43.0	1.69	72.0	2.84
2308E	48.0	1.89	82.0	3.23
2309E	53.0	2.09	92.0	3.62
2310	59.0	2.32	101.0	3.98
2311	64.0	2.52	111.0	4.37
2312	71.0	2.80	119.0	4.69
2313	76.0	2.99	129.0	5.08
2314	81.0	3.19	139.0	5.47
2315	86.0	3.39	149.0	5.87
2316	91.0	3.58	159.0	6.26
2317	98.0	3.86	167.0	6.58
2318	103.0	4.06	177.0	6.97
2319	108.0	4.25	187.0	7.36
2320	113.0	4.45	202.0	7.95
2322	123.0	4.84	227.0	8.94
11204E	—	—	42.0	1.65
11205E	—	—	47.0	1.85
11206E	—	—	57.0	2.24

Shaft and housing shoulder diameters



Shoulder diameters for millimeter and inch-size MRC ball bearings

MRC bearing number	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
11207E	—	—	65.5	2.58
11208E	—	—	73.5	2.89
11209E	—	—	78.5	3.09
11210E	—	—	83.5	3.29
11212E	—	—	102.5	4.02
11305E	—	—	55.5	2.19
11306E	—	—	65.5	2.58
11307E	—	—	72.0	2.84
11308E	—	—	82.0	3.23
11310E	—	—	101.0	3.98
Ball screw supports				
J078DF	27.3	1.07	41.7	1.64
J093DF	33.3	1.31	55.3	2.18
J098DF	36.3	1.43	55.3	2.18
J150DF	47.1	1.86	63.0	2.48
J175DF	52.0	2.05	67.9	2.67
J225DF	65.2	2.57	81.2	3.20
J300DF	85.6	3.37	102.0	4.00
J400DF	112.0	4.41	135.0	5.30

Self-aligning bearing with adapter sleeve

MRC bearing number	S Maximum mm	S Maximum in.	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
1204EK	28.5	1.12	23.0	.91	42.0	1.65
1205EK	33.0	1.30	28.0	1.10	47.0	1.85
1206EK	40.0	1.58	33.0	1.30	57.0	2.24
1207EK	47.0	1.85	38.0	1.50	65.5	2.58
1208EK	53.0	2.09	43.0	1.69	73.5	2.89
1209EK	57.0	2.24	48.0	1.89	78.5	3.09
1210EK	62.0	2.44	53.0	2.09	83.5	3.29
1211EK	70.0	2.76	60.0	2.36	95.0	3.74
1212EK	78.0	3.07	64.0	2.52	102.0	4.02
1213K	85.0	3.35	70.0	2.76	112.0	4.41
1215K	93.0	3.66	80.0	3.15	122.0	4.81
1216K	101.0	3.98	85.0	3.35	131.0	5.16
1217K	107.0	4.21	90.0	3.54	141.0	5.55
1218K	112.0	4.41	95.0	3.74	151.0	5.95
1219K	120.0	4.72	100.0	3.94	159.0	6.26
1220K	127.0	5.00	106.0	4.17	169.0	6.65
1221K	134.0	5.28	111.0	4.37	179.0	7.05
1222K	140.0	5.51	116.0	4.57	189.0	7.44
1224K	150.0	5.91	127.0	5.00	204.0	8.03
1304EK	33.0	1.30	23.0	.91	45.5	1.79
1305EK	37.0	1.46	28.0	1.10	55.5	2.19
1306EK	44.0	1.73	33.0	1.30	65.5	2.58
1307EK	51.0	2.01	39.0	1.54	72.0	2.84
1308EK	61.0	2.40	44.0	1.73	82.0	3.23
1309EK	67.0	2.64	50.0	1.97	92.0	3.62
1310EK	70.0	2.76	55.0	2.17	101.0	3.98
1311EK	77.0	3.03	60.0	2.36	111.0	4.37
1312EK	87.0	3.43	65.0	2.56	119.0	4.69
1313EK	89.0	3.50	70.0	2.76	129.0	5.08
1315K	104.0	4.09	80.0	3.15	149.0	5.87
1316K	109.0	4.29	85.0	3.35	159.0	6.26
1317K	117.0	4.61	91.0	3.58	167.0	6.58
1318K	122.0	4.80	96.0	3.78	177.0	6.97
1319K	127.0	5.00	102.0	4.02	187.0	7.36
1320K	136.0	5.35	108.0	4.25	202.0	7.95
1322K	154.0	6.06	118.0	4.65	227.0	8.94
2205EK	32.0	1.26	28.0	1.10	47.0	1.85
2206EK	38.0	1.50	33.0	1.30	57.0	2.24
2207EK	45.0	1.77	39.0	1.54	65.5	2.58
2208EK	52.0	2.05	44.0	1.73	73.5	2.89
2209EK	55.0	2.17	50.0	1.97	78.5	3.09
2210EK	61.0	2.40	55.0	2.17	83.5	3.29
2211EK	67.0	2.64	60.0	2.36	92.0	3.62
2212EK	74.0	2.91	65.0	2.56	102.0	4.02
2213EK	80.0	3.15	70.0	2.76	112.0	4.41
2215K	93.0	3.66	80.0	3.15	122.0	4.80
2216EK	99.0	3.90	85.0	3.35	131.0	5.16
2217K	105.0	4.13	91.0	3.58	141.0	5.55
2218K	112.0	4.41	96.0	3.78	151.0	5.95
2219K	118.0	4.65	102.0	4.02	159.0	6.26
2220K	124.0	4.88	108.0	4.25	169.0	6.65

Self-aligning bearing with adapter sleeve

MRC bearing number	S Maximum mm	S Maximum in.	S Minimum mm	S Minimum in.	H Maximum mm	H Maximum in.
2221K	131.0	5.16	113.0	4.45	179.0	7.05
2222K	137.0	5.39	118.0	4.65	189.0	7.44
2305K	35.0	1.38	30.0	1.18	55.0	2.19
2306K	41.0	1.61	35.0	1.38	65.5	2.58
2307EK	46.0	1.81	40.0	1.58	72.0	2.84
2308EK	53.0	2.09	45.0	1.77	82.0	3.23
2309EK	60.0	2.36	50.0	1.97	92.0	3.62
2310K	65.0	2.56	56.0	2.21	101.0	3.98
2311K	72.0	2.84	61.0	2.40	111.0	4.37
2312K	76.0	2.99	66.0	2.60	119.0	4.69
2313K	85.0	3.35	72.0	2.84	129.0	5.08
2315K	97.0	3.82	82.0	3.23	149.0	5.87
2316K	104.0	4.09	88.0	3.47	159.0	6.26
2317K	111.0	4.37	94.0	3.70	167.0	6.58
2318K	115.0	4.53	100.0	3.94	177.0	6.97
2319K	121.0	4.76	105.0	4.13	187.0	7.36
2320K	130.0	5.12	110.0	4.33	202.0	7.95
2322K	145.0	5.71	121.0	4.76	227.0	8.94

Millimeter-inch equivalents (one inch = 25.4 millimeters)

Note: The + or – sign indicates that the decimal equivalent is larger or smaller than the fractional equivalent.

mm	in.			mm	in.			mm	in.			mm	in.		
1	0.0394	1/32	+	56	2.2047	2 7/32	–	111	4.3701	4 3/8	–	166	6.5354	6 17/32	+
2	0.0787	3/32	–	57	2.2441	2 1/4	–	112	4.4094	4 13/32	+	167	6.5748	6 9/16	+
3	0.1181	1/8	–	58	2.2835	2 9/32	+	113	4.4488	4 7/16	+	168	6.6142	6 5/8	–
4	0.1575	5/32	+	59	2.3228	2 5/16	+	114	4.4882	4 1/2	–	169	6.6535	6 21/32	–
5	0.1969	3/16	+	60	2.3622	2 3/8	–	115	4.5276	4 17/32	–	170	6.6929	6 11/16	+
6	0.2362	1/4	–	61	2.4016	2 13/32	–	116	4.5669	4 9/16	+	171	6.7323	6 23/32	+
7	0.2756	9/32	–	62	2.4409	2 7/16	+	117	4.6063	4 19/32	+	172	6.7717	6 25/32	–
8	0.3150	5/16	+	63	2.4803	2 15/32	+	118	4.6457	4 21/32	–	173	6.8110	6 13/16	–
9	0.3543	11/32	+	64	2.5197	2 17/32	–	119	4.6850	4 11/16	–	174	6.8504	6 27/32	+
10	0.3937	13/32	–	65	2.5591	2 9/16	–	120	4.7244	4 23/32	+	175	6.8898	6 7/8	+
11	0.4331	7/16	–	66	2.5984	2 19/32	+	121	4.7638	4 3/4	+	176	6.9291	6 15/16	–
12	0.4724	15/32	+	67	2.6378	2 5/8	+	122	4.8031	4 13/16	–	177	6.9685	6 31/32	–
13	0.5118	1/2	+	68	2.6772	2 11/16	–	123	4.8425	4 27/32	–	178	7.0079	7	+
14	0.5512	9/16	–	69	2.7165	2 23/32	–	124	4.8819	4 7/8	+	179	7.0472	7 1/16	–
15	0.5906	19/32	–	70	2.7559	2 3/4	+	125	4.9213	4 29/32	+	180	7.0866	7 3/32	–
16	0.6299	5/8	+	71	2.7953	2 25/32	+	126	4.9606	4 31/32	–	181	7.1260	7 1/8	+
17	0.6693	21/32	+	72	2.8346	2 27/32	–	127	5.0000	5		182	7.1654	7 5/32	+
18	0.7087	23/32	–	73	2.8740	2 7/8	–	128	5.0394	5 1/32	+	183	7.2047	7 7/32	–
19	0.7480	3/4	–	74	2.9134	2 29/32	+	129	5.0787	5 3/32	–	184	7.2441	7 1/4	–
20	0.7874	25/32	+	75	2.9528	2 15/16	+	130	5.1181	5 1/8	–	185	7.2835	7 9/32	+
21	0.8268	13/16	+	76	2.9921	3	–	131	5.1575	5 5/32	+	186	7.3228	7 5/16	+
22	0.8661	7/8	–	77	3.0315	3 1/32	+	132	5.1969	5 3/16	+	187	7.3622	7 3/8	–
23	0.9055	29/32	–	78	3.0709	3 1/16	+	133	5.2362	5 1/4	–	188	7.4016	7 13/32	–
24	0.9449	15/16	+	79	3.1102	3 1/8	–	134	5.2756	5 9/32	–	189	7.4409	7 7/16	+
25	0.9843	31/32	+	80	3.1496	3 5/32	–	135	5.3150	5 5/16	+	190	7.4803	7 15/32	+
26	1.0236	1 1/32	–	81	3.1890	3 3/16	+	136	5.3543	5 11/32	+	191	7.5197	7 17/32	–
27	1.0630	1 1/16	+	82	3.2283	3 7/32	+	137	5.3937	5 13/32	–	192	7.5591	7 9/16	–
28	1.1024	1 3/32	+	83	3.2677	3 9/32	–	138	5.4331	5 7/16	–	193	7.5984	7 19/32	+
29	1.1417	1 5/32	–	84	3.3071	3 5/16	–	139	5.4724	5 15/32	+	194	7.6378	7 5/8	+
30	1.1811	1 3/16	–	85	3.3465	3 11/32	+	140	5.5118	5 1/2	+	195	7.6772	7 11/16	–
31	1.2205	1 7/32	+	86	3.3858	3 3/8	+	141	5.5512	5 9/16	–	196	7.7165	7 23/32	–
32	1.2598	1 1/4	+	87	3.4252	3 7/16	–	142	5.5906	5 19/32	–	197	7.7559	7 3/4	+
33	1.2992	1 5/16	–	88	3.4646	3 15/32	–	143	5.6299	5 5/8	+	198	7.7953	7 25/32	+
34	1.3386	1 11/32	–	89	3.5039	3 1/2	+	144	5.6693	5 21/32	+	199	7.8346	7 27/32	–
35	1.3780	1 3/8	+	90	3.5433	3 17/32	+	145	5.7087	5 23/32	–	200	7.8740	7 7/8	–
36	1.4173	1 13/32	+	91	3.5827	3 19/32	–	146	5.7480	5 3/4	–	201	7.9134	7 29/32	+
37	1.4567	1 15/32	–	92	3.6220	3 5/8	–	147	5.7874	5 25/32	+	202	7.9528	7 15/16	+
38	1.4961	1 1/2	–	93	3.6614	3 21/32	+	148	5.8268	5 13/16	+	203	7.9921	8	–
39	1.5354	1 17/32	+	94	3.7008	3 11/16	+	149	5.8661	5 7/8	–	204	8.0315	8 1/32	+
40	1.5748	1 9/16	+	95	3.7402	3 3/4	–	150	5.9055	5 29/32	–	205	8.0709	8 1/16	+
41	1.6142	1 5/8	–	96	3.7795	3 25/32	–	151	5.9449	5 15/16	+	206	8.1102	8 1/8	–
42	1.6535	1 21/32	–	97	3.8189	3 13/16	+	152	5.9843	5 31/32	+	207	8.1496	8 5/32	–
43	1.6929	1 11/16	+	98	3.8583	3 27/32	+	153	6.0236	6 1/32	–	208	8.1890	8 3/16	+
44	1.7323	1 23/32	+	99	3.8976	3 29/32	–	154	6.0630	6 1/16	+	209	8.2283	8 7/32	+
45	1.7717	1 25/32	–	100	3.9370	3 15/16	–	155	6.1024	6 3/32	+	210	8.2677	8 9/32	–
46	1.8110	1 13/16	–	101	3.9764	3 31/32	+	156	6.1417	6 5/32	–	211	8.3071	8 5/16	–
47	1.8504	1 27/32	+	102	4.0157	4 1/32	–	157	6.1811	6 3/16	–	212	8.3465	8 11/32	+
48	1.8898	1 7/8	+	103	4.0551	4 1/16	–	158	6.2205	6 7/32	+	213	8.3858	8 3/8	+
49	1.9291	1 15/16	–	104	4.0945	4 3/32	+	159	6.2598	6 1/4	+	214	8.4252	8 7/16	–
50	1.9685	1 31/32	–	105	4.1339	4 1/8	+	160	6.2992	6 5/16	–	215	8.4646	8 15/32	–
51	2.0079	2	+	106	4.1732	4 3/16	–	161	6.3386	6 11/32	–	216	8.5039	8 1/2	+
52	2.0472	2 1/16	–	107	4.2126	4 7/32	–	162	6.3780	6 3/8	+	217	8.5433	8 17/32	+
53	2.0866	2 3/32	–	108	4.2520	4 1/4	+	163	6.4173	6 13/32	+	218	8.5827	8 19/32	–
54	2.1260	2 1/8	+	109	4.2913	4 9/32	+	164	6.4567	6 15/32	–	219	8.6220	8 5/8	–
55	2.1654	2 5/32	+	110	4.3307	4 11/32	–	165	6.4961	6 1/2	–	220	8.6614	8 21/32	+

Millimeter-inch equivalents (one inch = 25.4 millimeters)

Note: The + or – sign indicates that the decimal equivalent is larger or smaller than the fractional equivalent.

mm		in.		mm		in.		mm		in.		mm		in.	
221	8.7008	**8 11/16**	+	276	10.8661	**10 7/8**	–	331	13.0315	**13 1/32**	+	386	15.1969	**15 3/16**	+
222	8.7402	**8 3/4**	–	277	10.9055	**10 29/32**	–	332	13.0709	**13 1/16**	+	387	15.2362	**15 1/4**	–
223	8.7795	**8 25/32**	–	278	10.9449	**10 15/16**	+	333	13.1102	**13 1/8**	–	388	15.2756	**15 9/32**	–
224	8.8189	**8 13/16**	+	279	10.9843	**10 31/32**	+	334	13.1496	**13 5/32**	–	389	15.3150	**15 5/16**	+
225	8.8583	**8 27/32**	+	280	11.0236	**11 1/32**	–	335	13.1890	**13 3/16**	+	390	15.3543	**15 11/32**	+
226	8.8976	**8 29/32**	–	281	11.0630	**11 1/16**	+	336	13.2283	**13 7/32**	+	391	15.3937	**15 13/32**	–
227	8.9370	**8 15/16**	–	282	11.1024	**11 3/32**	+	337	13.2677	**13 9/32**	–	392	15.4331	**15 7/16**	–
228	8.9764	**8 31/32**	+	283	11.1417	**11 5/32**	–	338	13.3071	**13 5/16**	–	393	15.4724	**15 15/32**	+
229	9.0157	**9 1/32**	–	284	11.1811	**11 3/16**	–	339	13.3465	**13 11/32**	+	394	15.5118	**15 1/2**	+
230	9.0551	**9 1/16**	–	285	11.2205	**11 7/32**	+	340	13.3858	**13 3/8**	+	395	15.5512	**15 9/16**	–
231	9.0945	**9 3/32**	+	286	11.2598	**11 1/4**	+	341	13.4252	**13 7/16**	–	396	15.5906	**15 19/32**	–
232	9.1339	**9 1/8**	+	287	11.2992	**11 5/16**	–	342	13.4646	**13 15/32**	–	397	15.6299	**15 5/8**	+
233	9.1732	**9 3/16**	–	288	11.3386	**11 11/32**	–	343	13.5039	**13 1/2**	+	398	15.6693	**15 21/32**	+
234	9.2126	**9 7/32**	–	289	11.3780	**11 3/8**	+	344	13.5433	**13 17/32**	+	399	15.7087	**15 23/32**	–
235	9.2520	**9 1/4**	+	290	11.4173	**11 13/32**	+	345	13.5827	**13 19/32**	–	400	15.7480	**15 3/4**	–
236	9.2913	**9 9/32**	+	291	11.4567	**11 15/32**	–	346	13.6220	**13 5/8**	–	401	15.7874	**15 25/32**	+
237	9.3307	**9 11/32**	–	292	11.4961	**11 1/2**	–	347	13.6614	**13 21/32**	+	402	15.8268	**15 13/16**	+
238	9.3701	**9 3/8**	–	293	11.5354	**11 17/32**	+	348	13.7008	**13 11/16**	+	403	15.8661	**15 7/8**	–
239	9.4094	**9 13/32**	+	294	11.5748	**11 9/16**	+	349	13.7402	**13 3/4**	–	404	15.9055	**15 29/32**	–
240	9.4488	**9 7/16**	+	295	11.6142	**11 5/8**	–	350	13.7795	**13 25/32**	–	405	15.9449	**15 15/16**	+
241	9.4882	**9 1/2**	–	296	11.6535	**11 21/32**	–	351	13.8189	**13 13/16**	+	406	15.9843	**15 31/32**	+
242	9.5276	**9 17/32**	–	297	11.6929	**11 11/16**	+	352	13.8583	**13 27/32**	+	407	16.0236	**16 1/32**	–
243	9.5669	**9 9/16**	+	298	11.7323	**11 23/32**	+	353	13.8976	**13 29/32**	–	408	16.0630	**16 1/16**	+
244	9.6063	**9 19/32**	+	299	11.7717	**11 25/32**	–	354	13.9370	**13 15/16**	–	409	16.1024	**16 3/32**	+
245	9.6457	**9 21/32**	–	300	11.8110	**11 13/16**	–	355	13.9764	**13 31/32**	+	410	16.1417	**16 5/32**	–
246	9.6850	**9 11/16**	–	301	11.8504	**11 27/32**	+	356	14.0157	**14 1/32**	–	411	16.1811	**16 3/16**	–
247	9.7244	**9 23/32**	+	302	11.8898	**11 7/8**	+	357	14.0551	**14 1/16**	–	412	16.2205	**16 7/32**	+
248	9.7638	**9 3/4**	+	303	11.9291	**11 15/16**	–	358	14.0945	**14 3/32**	+	413	16.2598	**16 1/4**	+
249	9.8031	**9 13/16**	–	304	11.9685	**11 31/32**	–	359	14.1339	**14 1/8**	+	414	16.2992	**16 5/16**	–
250	9.8425	**9 27/32**	–	305	12.0079	**12**	+	360	14.1732	**14 3/16**	–	415	16.3386	**16 11/32**	–
251	9.8819	**9 7/8**	+	306	12.0472	**12 1/16**	–	361	14.2126	**14 7/32**	–	416	16.3780	**16 3/8**	+
252	9.9213	**9 29/32**	+	307	12.0866	**12 3/32**	–	362	14.2520	**14 1/4**	+	417	16.4173	**16 13/32**	+
253	9.9606	**9 31/32**	–	308	12.1260	**12 1/8**	+	363	14.2913	**14 9/32**	+	418	16.4567	**16 15/32**	–
254	10.0000	**10**		309	12.1654	**12 5/32**	+	364	14.3307	**14 11/32**	–	419	16.4961	**16 1/2**	–
255	10.0394	**10 1/32**	+	310	12.2047	**12 7/32**	–	365	14.3701	**14 3/8**	–	420	16.5354	**16 17/32**	+
256	10.0787	**10 3/32**	–	311	12.2441	**12 1/4**	–	366	14.4094	**14 13/32**	+	421	16.5748	**16 9/16**	+
257	10.1181	**10 1/8**	–	312	12.2835	**12 9/32**	+	367	14.4488	**14 7/16**	+	422	16.6142	**16 5/8**	–
258	10.1575	**10 5/32**	+	313	12.3228	**12 5/16**	+	368	14.4882	**14 1/2**	–	423	16.6535	**16 21/32**	–
259	10.1969	**10 3/16**	+	314	12.3622	**12 3/8**	–	369	14.5276	**14 17/32**	–	424	16.6929	**16 11/16**	+
260	10.2362	**10 1/4**	–	315	12.4016	**12 13/32**	–	370	14.5669	**14 9/16**	+	425	16.7323	**16 23/32**	+
261	10.2756	**10 9/32**	–	316	12.4409	**12 7/16**	+	371	14.6063	**14 19/32**	+	426	16.7717	**16 25/32**	–
262	10.3150	**10 5/16**	+	317	12.4803	**12 15/32**	+	372	14.6457	**14 21/32**	–	427	16.8110	**16 13/16**	–
263	10.3543	**10 11/32**	+	318	12.5197	**12 17/32**	–	373	14.6850	**14 11/16**	–	428	16.8504	**16 27/32**	+
264	10.3937	**10 13/32**	–	319	12.5591	**12 9/16**	–	374	14.7244	**14 23/32**	+	429	16.8898	**16 7/8**	+
265	10.4331	**10 7/16**	–	320	12.5984	**12 19/32**	+	375	14.7638	**14 3/4**	+	430	16.9291	**16 15/16**	–
266	10.4724	**10 15/32**	+	321	12.6378	**12 5/8**	+	376	14.8031	**14 13/16**	–	431	16.9685	**16 31/32**	–
267	10.5118	**10 1/2**	+	322	12.6772	**12 11/16**	–	377	14.8425	**14 27/32**	–	432	17.0079	**17**	+
268	10.5512	**10 9/16**	–	323	12.7165	**12 23/32**	–	378	14.8819	**14 7/8**	+	433	17.0472	**17 1/16**	–
269	10.5906	**10 19/32**	–	324	12.7559	**12 3/4**	+	379	14.9213	**14 29/32**	+	434	17.0866	**17 3/32**	–
270	10.6299	**10 5/8**	+	325	12.7953	**12 25/32**	+	380	14.9606	**14 31/32**	–	435	17.1260	**17 1/8**	+
271	10.6693	**10 21/32**	+	326	12.8346	**12 27/32**	–	381	15.0000	**15**		436	17.1654	**17 5/32**	+
272	10.7087	**10 23/32**	–	327	12.8740	**12 7/8**	–	382	15.0394	**15 1/32**	+	437	17.2047	**17 7/32**	–
273	10.7480	**10 3/4**	–	328	12.9134	**12 29/32**	+	384	15.0787	**15 3/32**	–	438	17.2441	**17 1/4**	–
274	10.7874	**10 25/32**	+	329	12.9528	**12 15/16**	+	384	15.1181	**15 1/8**	–	439	17.2835	**17 9/32**	+
275	10.8268	**10 13/16**	+	330	12.9921	**13**	–	385	15.1575	**15 5/32**	+	440	17.3228	**17 5/16**	+

Decimal equivalents of fractions of an inch

Fraction	Decimal	Fraction	Decimal
1/64	.0156	33/64	.5156
1/32	.0313	17/32	.5313
3/64	.0469	35/64	.5469
1/16	.0625	9/16	.5625
5/64	.0781	37/64	.5781
3/32	.0938	19/32	.5938
7/64	.1094	39/64	.6094
1/8	.1250	5/8	.6250
9/64	.1406	41/64	.6406
5/32	.1563	21/32	.6563
11/64	.1719	43/64	.6719
3/16	.1875	11/16	.6875
13/64	.2031	45/64	.7031
7/32	.2188	23/32	.7188
15/64	.2344	47/64	.7344
1/4	.2500	3/4	.7500
17/64	.2656	49/64	.7656
9/32	.2813	25/32	.7813
19/64	.2969	51/64	.7969
5/16	.3125	13/16	.8125
21/64	.3281	53/64	.8281
11/32	.3438	27/32	.8438
23/64	.3594	55/64	.8594
3/8	.3750	7/8	.8750
25/64	.3906	57/64	.8906
13/32	.4063	29/32	.9063
27/64	.4219	59/64	.9219
7/16	.4375	15/16	.9375
29/64	.4531	61/64	.9531
15/32	.4688	31/32	.9688
31/64	.4844	63/64	.9844
1/2	.5000	1	1.0000

Metric conversion factors

Multiply	by	to obtain
British thermal unit (BTU)	1055.056	Joule (J)
British thermal unit (BTU/hour)	0.2930711	Watt (W)
Celsius temperature (t_C)	$1.8t_C + 32 = t_F$	Fahrenheit temperature (t_F)
Celsius temperature (t_C)	$t_C+273.15 = t_K$	Kelvin temperature (t_K)
Centimeter (cm)	0.03280840	Foot (ft)
Centimeter (cm)	0.3937	Inch (in.)
Centimeter (cm)	0.01	Meter (m)
Centimeter (cm)	10	Millimeter (mm)
Centimeter per minute (cm/Min)	0.3937008	Inch per minute (ipm)
Centimeter per second (cm/s)	1.968504	Foot per minute (fpm)
Centimeter per second (cm/s)	0.03280840	Foot per second (fps)
Cubic centimeter (cm^3)	0.061023	Cubic Inch (in^3)
Cubic foot (ft^3)	0.02832	Cubic meter (m^3)
Cubic foot (ft^3)	28.31685	Liter (l)
Cubic foot per minute (ft^3/Min)	0.004719474	Cubic meter per second (m^3/s)
Cubic foot per minute (ft^3/Min)	28.31685	Liter per minute (l/min)
Cubic inch (in^3)	16.38706	Cubic centimeter (cm^3)
Cubic inch (in^3)	0.00001638706	Cubic meter (m^3)
Cubic inch (in^3)	16.387.06	Cubic millimeter (mm^3)
Cubic meter (m^3)	61,023.76	Cubic inch (in^3)
Cubic meter (m^3)	35.3147	Cubic foot (ft^3)
Cubic meter (m^3)	264.1720	Gallon, U.S. liquid (gal)
Cubic meter (m^3)	1000.0	Liter (l)
Cubic meter per minute (m^3/Min)	264.1720	Gallon per minute, U.S. liquid (gpm)
Cubic meter per second (m^3/s)	2118.880	Cubic foot per minute (ft^3/Min)
Cubic meter per second (m^3/s)	15,850.32	Gallon per minute U.S. liquid (gpm)
Cubic millimeter (mm^3)	0.00006102376	Cubic inch (in^3)
Dyne	0.00001	Newton (N)
Dyne-centimeter	0.0000001	Newton-meter (N-m)
Fahrenheit temperature (t_F)	$(T_F-32)/1.8 = t_C$	(t_C)
Fahrenheit temperature (t_F)	$(t_F+459.67)/1.8 = t_K$	Kelvin temperature (t_K)
Foot (ft)	30.48	Centimeter (cm)
Foot (ft)	0.3048	Meter (m)
Foot per hour (fph)	0.3048	Meter per hour (m/hr)
Foot per hour (fph)	0.00508	Meter per minute (m/min)
Foot per hour (fph)	0.00008466667	Meter per second (m/s)
Foot per minute (fpm)	0.508	Centimeter per second (cm/s)
Foot per minute (fpm)	18.288	Meter per hour (m/hr)
Foot per minute (fpm)	0.3048	Meter per minute (m/min)

Multiply	by	to obtain
Foot per minute (fpm)	0.00508	Meter per second (m/s)
Foot per second (fps)	30.48	Centimeter per second (cm/s)
Foot per second (fps)	18.288	Meter per minute (m/min)
Foot per second (fps)	0.3048	Meter per second (m/s)
Foot per second per second	0.3048	Meter per second per second (m/s^2)
Foot-pound-force (ft-lbf)	1.3558:8	Joule (J)
Foot-poundal	0.04214011	Joule (J)
Foot-pound per hour (ft-lb/hr)	0.0003766161	Watt (W)
Foot-pound per minute (ft-lb/min)	0.02259697	Watt (W)
Gallon, U.S. liquid (gal)	0.003785412	Cubic meter (m^3)
Gallon, U.S. liquid (gal)	3.785412	Liter (l)
Gallon per minute, U.S. liquid (gpm)	3.785412	Liter per minute (l/min)
Gallon per minute, U.S. liquid (gpm)	0.06309020	Liter per second (l/s)
Gallon per minute, U.S. liquid (gpm)	0.003785412	Cubic meter per minute (m^3/min)
Gallon per minute, U.S. liquid (gpm)	0.00006309020	Cubic meter per second (m^3/s)
Gram (g)	0.03527397	Ounce, (Av) (oz)
Gram (g)	0.03215074	Ounce, (troy) (oz)
Gram per cubic centimeter (g/cm^3)	0.3612730	Pound per cubic inch (lb/in^3)
Horsepower (hp)	0.7456999	Kilowatt (kW)
Horsepower (hp)	745.6999	Watt (W)
Horsepower, Metric (hp)	735.499	Watt (W)
Inch (in.)	2.540	Centimeter (cm)
Inch (in.)	0.0254	Meter (m)
Inch (in.)	25.4	Millimeter (mm)
Inch of mercury, 32° F	3386.39	Newton per square meter (N/m^2)
Inch per minute (ipm)	2.54	Centimeter per minute (cm/min)
Inch per minute (ipm)	0.0254	Meter per minute (m/min)
Inch per minute (ipm)	25.4	Millimeter per minute (mm/min)
Joule (J)	0.0009478170	British thermal unit (BTU)
Joule (J)	0.7375621	Foot-pound-force (ft-lbf)
Joule (J)	23.73036	Foot-poundal
Joule (J)	0.0002777778	Watt-hour (W-h)
Kelvin temperature (t_K)	$t_K - 273.15 = t_C$	Celsius temperature (t_C)
Kelvin temperature (t_K)	$1.8t_K - 459.67 = t_F$	Fahrenheit temperature (t_F)

Metric conversion factors

Multiply	by	to obtain
Kilogram (kg)	0.0009842064	Ton (long)
Kilogram (kg)	0.001	Ton (metric)
Kilogram (kg)	0.001102311	Ton (short)
Kilogram (kg)	35.27397	Ounce, (Av) (oz)
Kilogram (kg)	32.15074	Ounce, (Troy) (oz)
Kilogram (kg)	2.20462	Pound, (Av) (lb)
Kilogram-force (kgf) or kilopound	9.80665	Newton (N)
Kilogram force per square millimeter (kgf/mm^2)	9.806650	Megapascal (MPa) or (MN/m^2)
Kilogram-force-meter (kgf-m)	9.806650	Newton-meter (N-m)
Kilogram-meter per second (kg-m/s) second	7.233011	Pound-foot per second (lb-ft/s)
Kilogram-meter per second (kg-m/s)	86.79614	Pound-inch per second (lb-in./s)
Kilogram per cubic meter (kg/m^3)	0.06242797	Pound per cubic foot (lb/ft^3)
Kilometer (km)	0.6213712	Mile, (U.S. statute)
Kilometer per hour (kph)	0.6213712	Mile per hour, (U.S. statute) (mph)
Kilogram-force per square centimeter (kgf/cm^2)	14.22334	Pound per square inch (psi)
Kilogram-force per square meter (kgf/m^2)	9.806650	Newton per square meter (N/m^2)
Kilogram-force per square meter (kgf/m^2)	9.806650	Pascal (Pa)
Kilogram-force per square meter (kgf/m^2)	0.2048161	Pound per square foot (lb/ft^2)
Kilogram-force per square meter (kgf/m^2)	0.001422	Pound per square inch (psi)
Kilowatt (kW)	1.341022	Horsepower (hp)
Kilowatt-hour (kwh)	3,600,000	Joule (J)
Kilonewton per square meter kN/m^2)	0.1450377	Pound per square inch (psi)
Liter (l)	0.03531466	Cubic foot (ft^3)
Liter (l)	0.001	Cubic meter (m^3)
Liter (l)	0.2641720	Gallon, U.S. liquid (gal)
Liter per minute (lpm)	0.03531466	Cubic foot per minute (ft^3/min)
Liter per minute (lpm)	0.2641720	Gallon per minute, U.S. liquid (gpm)
Liter per second (lps)	15.85032	Gallon per minute, U.S. liquid (gpm)
Megapascal (MPa)	145.0377	Pound per square inch (psi)
Meter (m)	39.37008	Inch (in.)
Meter (m)	3.280840	Foot (ft)
Meter (m)	1.0936	Yard (yd)

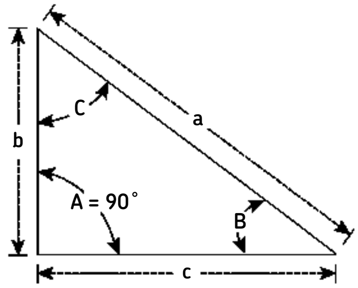
Multiply	by	to obtain
Meter per hour (m/hr)	3.280840	Foot per hour (fph)
Meter per hour (m/hr)	0.5468067	Foot per minute (fpm)
Meter per minute (m/min)	3.280840	Foot per minute (fpm)
Meter per minute (m/min)	0.05468067	Foot per second (fps)
Meter per minute (m/min)	39.37008	Inch per minute (ipm)
Meter per second (m/s)	11,811.02	Foot per hour (fph)
Meter per second (m/s)	196.8504	Foot per minute (fpm)
Meter per second (m/s)	3.280840	Foot per second (fps)
Microinch	0.0254	Micrometer or micron
Micron	0.00000132	Atmosphere
Micron	0.0000394	Inch of mercury
Micron	0.001	Millimeter of mercury (Torr)
Micron	0.0000195	Pound per square inch (psi)
Micrometer or micron	39.37008	Microinch
Mile (U.S. statute)	1.609344	Kilometer (km)
Mile per hour (mph) (kph)	1.609344	Kilometer per hour
Millimeter (mm)	0.03937008	Inch (in.)
Millimeter (mm)	0.003280840	Foot (ft)
Millimeter of mercury (Torr)	0.00132	Atmosphere
Millimeter of mercury (Torr)	0.0394	Inch of mercury
Millimeter of mercury (Torr)	1000	Micron
Millimeter of mercury (Torr)	0.0195	Pound per square inch (psi)
Millimeter per minute (mm/Min)	0.3937008	Inch per minute (ipm)
Newton (N)	100,000	Dyne
Newton (N)	0.1019716	Kilogram-force or kilo pound (kgf)
Newton (N)	3.596942	Ounce-force (ozf)
Newton (N)	7.23301	Poundal
Newton (N)	0.2248089	Pound-force (lbf)
Newton-meter (N-m)	10,000,000	Dyne-centimeter
Newton-meter (N-m)	0.1019716	Kilogram-force-meter (kgf-m)
Newton-meter (N-m)	141.6119	Ounce-force-inch (ozf-in.)
Newton-meter (N-m)	0.73756	Pound-force-foot (lbf-ft)
Newton-millimeter (N-mm)	0.1416119	Ounce-force-inch (ozf-in.)
Newton per meter (N/m)	0.06852178	Pound-force per foot (lbf/ft)
Newton per meter (N/m)	0.005710148	Pound-force per inch (lbf/in.)
Newton per square centimeter (N/cm^2)	1.450377	Pound per square inch (psi)

Metric conversion factors

Multiply	by	to obtain
Newton per square meter (N/m^2)	0.0002953	Inch of mercury
Newton per square meter (N/m^2)	0.1019716	Kilogram per square meter (kg/m^2)
Newton per square meter (N/m^2)	1.0	Pascal (Pa)
Newton per square meter (N/m^2)	0.0001450	Pound per square inch (psi)
Newton per square millimeter (N/mm^2)	145.0377	Pound per square inch (psi)
Ounce, (Av) (oz)	28.3495	Gram (g)
Ounce, (troy) (oz)	31.10348	Gram (g)
Ounce, (Av) (oz)	0.02834952	Kilogram (kg)
Ounce, (Troy) (oz)	0.03110348	Kilogram (kg)
Ounce-force (ozf)	0.2780139	Newton (N)
Ounce-force-inch (ozf-in.)	0.007061552	Newton-meter (N-m)
Ounce-force-inch (ozf-in.)	7.061552	Newton-millimeter (N-mm)
Pascal (Pa)	0.1019716	Kilogram per square meter (kg/m^2)
Pascal (Pa)	1.0	Newton per square meter (N/m^2)
Pascal (Pa)	0.02088543	Pound per square foot (lb/ft^2)
Pascal (Pa)	0.0001450377	Pound per square inch (psi)
Pound, (Av) (lb)	0.453592	Kilogram (kg)
Poundal	0.1382550	Newton (N)
Pound-foot-(lb-ft)	1.355818	Newton-meter (N-m)
Pound-foot per second (lb-ft/s)	0.1382550	Kilogram-meter per second (kg-m/s)
Pound-force (lbf)	4.448222	Newton (N)
Pound-inch per second (lb-in./s)	0.01152125	Kilogram-meter per second (kg-m/s)
Pound per cubic inch ($lb/in.^2$)	27.67990	Gram per cubic centimeter (g/cm^3)
Pound per cubic foot (lb/ft^3)	16.01846	Kilogram per cubic meter (kg/m^3)
Pound per foot (lb/ft)	14.59390	Newton per meter (N/m)
Pound per inch (lb/in.)	175.1268	Newton per meter (N/m)
Pound per square foot (lb/ft^2)	4.882429	Kilogram per square meter (kg/m^2)
Pound per square foot (lb/ft^2)	47.88026	Newton per square meter (N/m^2)
Pound per square foot (lb/ft^2)	47.88026	Pascal (Pa)
Pound per square inch (psi)	0.063	Atmosphere
Pound per square inch (psi)	2.036	Inch of Mercury
Pound per square inch (psi)	0.70730697	Kilogram per square centimeter (kg/cm^2)
Pound per square inch (psi)	703.1	Kilogram per square meter (kg/m^2)
Pound per square inch (psi)	6.8948	Kilonewton per square meter (kN/m^2)
Pound per square inch (psi)	51,500	Micron
Pound per square inch (psi)	51.5	Millimeter of mercury (Torr)
Pound per square inch (psi)	0.6894757	Newton per square centimeter (N/cm^2)
Pound per square inch (psi)	6894.76	Newton per square meter (N/m^2)
Pound per square inch (psi)	0.006895	Newton per square millimeter (N/mm^2)
Pound per square inch (psi)	6894.757	Pascal (Pa)
Square centimeter (cm^2)	0.001076391	Square foot (ft^2)
Square centimeter (cm^2)	0.1550003	Square inch ($in.^2$)
Square foot (ft^2)	929.0304	Square centimeter (cm^2)
Square foot (ft^2)	0.09290304	Square meter (m^2)
Square foot (ft^2)	92,903.04	Square millimeter (mm2)
Square foot per second (ft^2/s)	0.092900304	Square meter per second (m^2/s)
Square inch ($in.^2$)	6.4516	Square centimeter (cm2)
Square inch ($in.^2$)	0.00064516	Square meter (m^2)
Square inch ($in.^2$)	645.16	Square millimeter (mm^2)
Square meter (m^2)	10.763910	Square foot (ft^2)
Square meter (m^2)	1550.003	Square inch ($in.^2$)
Square millimeter (mm^2)	0.0001076387	Square foot (ft^2)
Square millimeter (mm^2)	0.001550003	Square inch ($in.^2$)
Ton (metric)	1000	Kilogram (kg)
Ton (long)	1016.047	Kilogram (kg)
Ton (short)	907.1847	Kilogram (kg)
Torr (mm Hg)	133.322	Pascal (Pa)
Watt (W)	3.412141	British thermal unit (BTU/hour)
Watt (W)	2655.224	Foot-pound per hour (ft-lb/hour)
Watt (W)	44.25372	Foot-pound per minute (ft-lb/min)
Watt (W)	0.001341022	Horsepower (hp)
Watt (W)	0.001359621	Horsepower (metric) (hp)
Watt-hour (W-h)	3600	Joule (J)
Yard (yd)	0.9144	Meter (m)

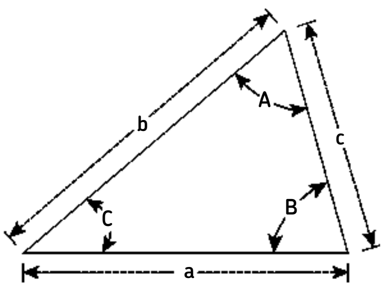
Trigonometric solutions

Solutions of triangles



Right-angled triangles

Sides and angles known	Formulas for sides and angles to be found		
Sides a and b	$c = \sqrt{a^2 - b^2}$	$\sin B = \frac{b}{a}$	C= 90°- B
Sides a and c	$b = \sqrt{a^2 - c^2}$	$\sin C = \frac{c}{a}$	B= 90°– C
Sides b and c	$a = \sqrt{b^2 + c^2}$	$\tan B = \frac{b}{c}$	C= 90°– B
Side a; angle B	$b = a \times \sin B$	$c = a \times \cos B$	C= 90°– B
Side b; angle B	$a = \frac{b}{\sin B}$	$c = a \times \cot B$	C= 90°– B
Side c; angle B	$a = \frac{c}{\cos B}$	$b = c \times \tan B$	C= 90°– B

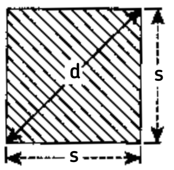


Oblique–angled triangles

Sides and angles known	Formulas for sides and angles to be found		
Side a; angles A, B	C = 180°– (A + B)	$b = \frac{a \times \sin B}{\sin A}$	$c = \frac{a + \sin C}{\sin A}$
Sides a, b; angle C	$\tan A = \frac{a + \sin C}{b - a \times \cos C}$	$c = \frac{a \times \sin C}{\sin A}$	B = 180°– (A + C)
Sides a, b; angle A	$\sin B = \frac{b + \sin A}{a}$	C = 180°– (A + B)	$c = \frac{a \times \sin C}{\sin A}$
Sides a, b, c	$\cos A = \frac{b^2 + c^2 - a^2}{2\,bc}$	$\sin B = \frac{b \times \sin A}{a}$	C = 180°– (A + B)

Trigonometric solutions

Areas of plane figures
A = area



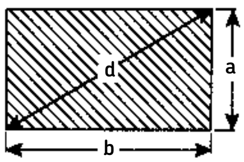
Square

$A = s^2$

$A = \frac{1}{2} d^2$

$s = 0.707d = \sqrt{A}$

$d = 1.414s = 1.414\sqrt{A}$



Rectangle

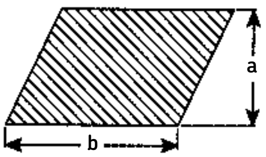
$A = ab$

$A = a\sqrt{d^2 - a^2} = b\sqrt{d^2 - b^2}$

$d = \sqrt{a^2 + b^2}$

$a = \sqrt{d^2 - b^2} = A \div b$

$b = \sqrt{d^2 - a^2} = A \div a$

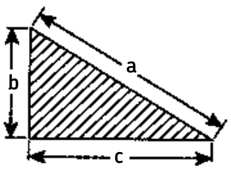


Parallelogram

$A = ab$

$a = A \div b$

$b = A \div a$



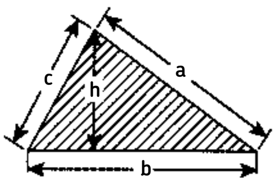
Right-angled triangle

$A = \frac{bc}{2}$

$a = \sqrt{b^2 + c^2}$

$b = \sqrt{a^2 - c^2}$

$c = \sqrt{a^2 - b^2}$

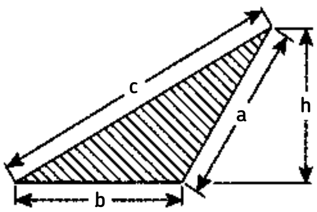


Acute-angled triangle

$A = \frac{bh}{2} = \frac{b}{2}\sqrt{c^2 - \left(\frac{a^2 + b^2 - c^2}{2b}\right)^2}$

If $S = \frac{1}{2}(a + b + c)$, then

$A = \sqrt{S(S-a)(S-b)(S-c)}$



Obtuse-angled triangle

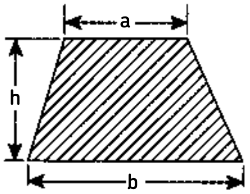
$A = \frac{bh}{2} = \frac{b}{2}\sqrt{a^2 - \left(\frac{c^2 - a^2 - b^2}{2b}\right)^2}$

If $S = \frac{1}{2}(a + b + c)$, then

$A = \sqrt{S(S-a)(S-b)(S-c)}$

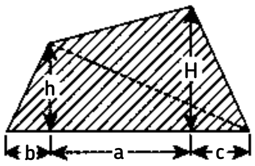
Trigonometric solutions

Areas of plane figures
A = area



Trapezoid

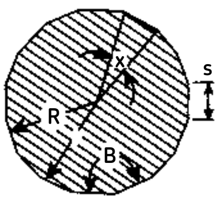
$$A = \frac{(a + b)\,h}{2}$$



Trapezium

$$A = \frac{(H + h)\,a + bh + cH}{2}$$

A trapezium can also be divided into two triangles as indicated by the dotted line. The area of each of the triangles is computed, and the results added to find the area of the trapezium.



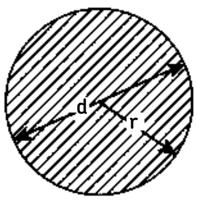
Regular polygon

n = number of sides

$\alpha = 360° \div n$; $ß = 180° - \alpha$

$$A = \frac{nsr}{2} = \frac{ns}{2}\sqrt{R^2 - \frac{s^2}{4}}$$

$$R = \sqrt{r^2 + \frac{s^2}{4}}\,,\quad r = \sqrt{R^2 + \frac{s^2}{4}}\,,\quad s = 2\sqrt{R^2 - r^2}$$



Circle

C = circumference

$A = \pi r^2 = 3.1416r^2 = 0.7854\,d^2$

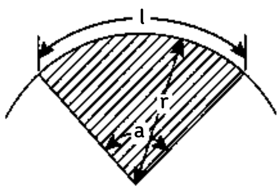
$C = 2\pi r = 6.2832\,r = 3.1416\,d$

$r = C \div 6.2832 = \sqrt{A \div 3.1416} = 0.564\ \sqrt{A}$

$d = C \div 3.1416 = \sqrt{A \div 0.7854} = 1.128\ \sqrt{A}$

Length of arc for center-angle of 1° = 0.008727 d

Length of arc for center-angle of n° = 0.008727 nd



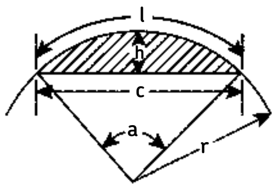
Circular sector

l = length of arc; α = angle in degrees

$$l = \frac{r \times \alpha \times 3.1416}{180} = 0.01745\,r\alpha = \frac{2A}{r}$$

$$A = \frac{1}{2}rl = 008727\alpha r^2$$

$$\alpha = \frac{57.296\,l}{r} \qquad r = \frac{2A}{l} = \frac{57.296\,l}{\alpha}$$



Circular segment

l= length of arc; α = angle in degrees

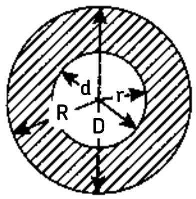
$$C = 2\sqrt{h\,(2r - h)} \qquad A = \frac{1}{2}\,[\,rl - c\,(rh)\,]$$

$$r = \frac{c^2 + 4h^2}{8h} \qquad l = 0.01745\,r\alpha$$

$$h = r - \frac{1}{2}\sqrt{4\,r^2 - c^2} \qquad \alpha = \frac{57.296\,l}{r}$$

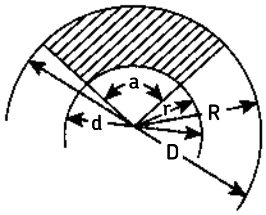
Trigonometric solutions

Areas of plane figures
A = area



Circular ring

$$A = \pi (R^2 - r^2) = 3.1416 (R^2 - r^2)$$
$$= 3.1416 (R + r)(R - r)$$
$$= 0.7854 (D^2 - d^2) = 0.7854 (D + d)(D - d)$$

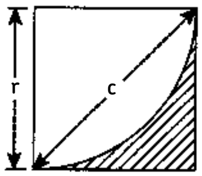


Circular ring sector

α = angle in degrees

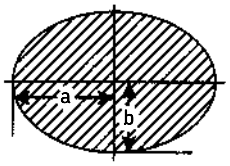
$$A = \frac{\alpha\pi}{360}(R^2 - r^2) = 0.00873\,\alpha\,(R^2 - r^2)$$

$$= \frac{\alpha\pi}{4 \times 360}(D^2 - d^2) = 0.00218\,\alpha\,(D^2 - d^2)$$



Spandrel or fillet

$$A = r^2 - \frac{\pi r^2}{4} = 0.215\, r^2$$
$$= 0.1075\, c^2$$



Ellipse

P= perimeter or circumference

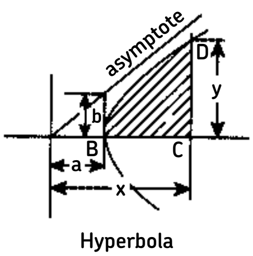
A= πab = 3.1416 ab

An approximate formula for the perimeter is:

$$P = 3.1416\sqrt{2(a^2 + b^2)}$$

A closer approximation is:

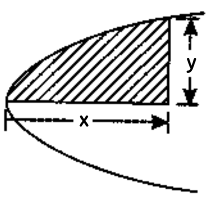
$$P = 3.1416\sqrt{2(a^2 + b^2) - \frac{(a - b)^2}{2.2}}$$



Hyperbola

A = area BCD

$$A = \frac{xy}{2} - \frac{ab}{2}\text{ hyp. log}\left(\frac{x}{a} + \frac{y}{b}\right)$$



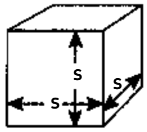
Parabola

$$A = \frac{2}{3}xy$$

The area is equal to two-thirds of the rectangle which has x for its base and y for its height.

Trigonometric solutions

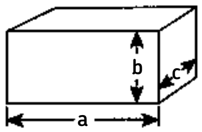
Volumes of solids
V = volume



Cube

$V = s^3$

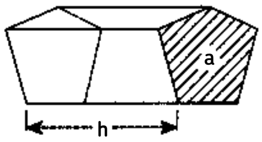
$s = \sqrt[3]{V}$



Square prism

$V = abc$

$a = \dfrac{V}{bc} \quad b = \dfrac{V}{ac} \quad c = \dfrac{V}{ab}$

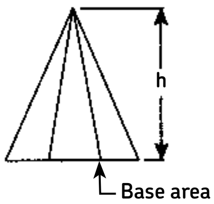


Prism

A = area of end surface

$V = h \times A$

The area A of the end surface is found by the formulas for areas of plane figures on the preceding pages.

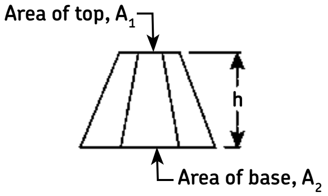


Pyramid

$V = \dfrac{1}{3} h \times \text{area of base}$

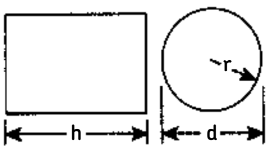
If the base is a regular polygon with n sides, and s= length of side, r= radius of inscribed circle, and R= radius of circumscribed circle, then:

$V = \dfrac{nsrh}{6} = \dfrac{nsh}{6} \sqrt{R^2 - \dfrac{s^2}{4}}$



Frustrum of prism

$V = \dfrac{h}{3} \left(A_1 + A_2 + \sqrt{A_1 \times A_2}\right)$



Cylinder

S = area of cylindrical surface

$V = 3.1416\, r^2 h = 0.7854\, d^2 h$

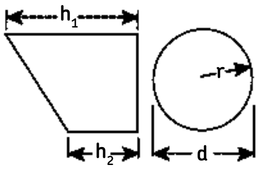
$S = 6.2832\, rh = 3.1416\, dh$

Total area A of cylindrical surface and end surfaces:

$A = 6.2832\, r\,(r + h) = 3.1416\, d\,(\dfrac{1}{2} d + h)\ 2$

Trigonometric solutions

Volumes of solids
V = volume

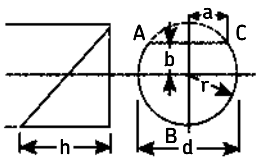


Portion of a cylinder

S = area of cylindrical surface

$V = 1.5708\ r^2 (h_1 + h_2) = 0.3927\ d^2 (h_1 + h_2)$

$S = 3.1416\ r (h_1 + h_2) = 1.5708\ d (h_1 + h_2)$



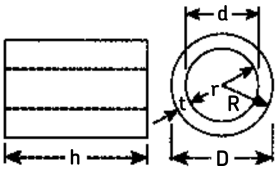
Portion of a cylinder

S = area of cylindrical surface

$$V = \left(\frac{2}{3} a^3 \pm b \times \text{area ABC}\right) \frac{h}{r \pm b}$$

$$S = (ad \pm b \times \text{length of arc ABC}) \frac{h}{r \pm b}$$

Use + when base area is larger, and – when base area is less than one-half the base circle.



Hollow cylinder

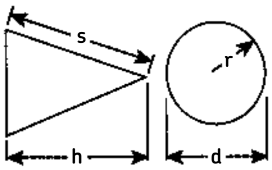
V = volume of cylinder

$V = 3.1416\ h (R^2 - r^2) = 0.7854\ h (D^2 - d^2)$

$= 3.1416\ ht (2R - t) = 3.1416\ ht (D - t)$

$= 3.1416\ ht (2r + t) = 3.1416\ ht (d + t)$

$= 3.1416\ ht (R + r) = 1.5708\ ht (D + d)$



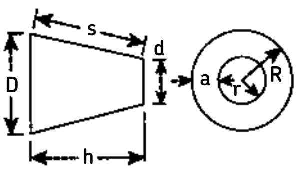
Cone

A = area of conical surface

$$V = \frac{3.1416\ r^2 h}{3} = 1.0472\ r^2 h = 0.2618\ d^2 h$$

$$A = 3.1416\ r \sqrt{r^2 + h^2} = 3.1416\ rs = 1.5708\ ds$$

$$s = \sqrt{r^2 + h^2} = \sqrt{\frac{d^2}{4} + h^2}$$



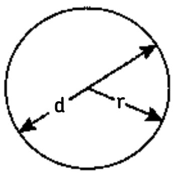
Frustrum cone

A = area of conical surface

$V = 1.0472\ h (R^2 + Rr + r^2) = 0.2618\ h (D^2 + Dd + d^2)$

$A = 3.1416\ s (R + r) = 1.5708\ s (D + d)$

$a = R - r \qquad s = \sqrt{a^2 + h^2} = \sqrt{(R - r)^2 + h^2}$



Sphere

A = area of surface

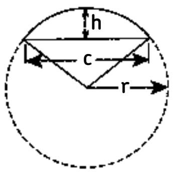
$$V = \frac{4\pi r^3}{3} = \frac{\pi d^3}{6} = 4.1888\ r^3 = 0.5236\ d^3$$

$$A = 4\ \pi r^2 = \pi d^2 = 12.5664 r^2 = 3.1416\ d^2$$

$$r = \sqrt[3]{\frac{3V}{4\pi}} = 0.6204 \sqrt[3]{V}$$

Trigonometric solutions

Volumes of solids
V = volume



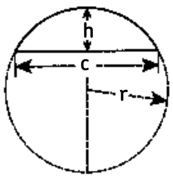
Spherical sector

A = total area of conical and spherical surface

$$V = \frac{2\pi r^2 h}{3} = 2.0944\, r^2 h$$

$$A = 3.1416\, r\left(2h + \frac{1}{2}c\right)$$

$$c = 2\sqrt{h(2r - h)}$$



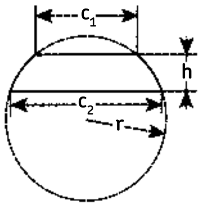
Spherical segment

A = area of spherical surface

$$V = 3.1416\, h^2\left(r - \frac{h}{3}\right) = 3.1416\, h\left(\frac{c^2}{8} + \frac{h^2}{6}\right)$$

$$A = 2\pi rh = 6.2832\, rh = 3.1416\left(\frac{c^2}{4} + h^2\right)$$

$$c = 2\sqrt{h(2r - h)}; \quad r = \frac{c^2 + 4h^2}{8h}$$



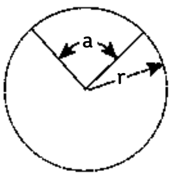
Spherical zone

A = area of spherical surface

$$V = 0.5236\, h\left(\frac{3c_1^2}{4} + \frac{3c_2^2}{4} + h^2\right)$$

$$A = 2\pi rh = 6.2832\, rh$$

$$r = \sqrt{\frac{c_2^2}{4} + \left(\frac{c_2^2 - c_1^2 - 4h^2}{8h}\right)^2}$$



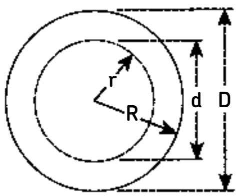
Spherical wedge

A = area of spherical surface

α = center angle in degrees

$$V = \frac{\alpha}{360} \times \frac{4\pi r^3}{3} = 0.0116\, \alpha r^3$$

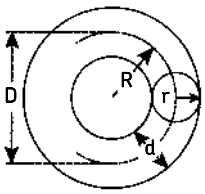
$$A = \frac{\alpha}{360} \times 4\pi r^2 = 0.0349\, \alpha r^2$$



Hollow sphere

$$V = \frac{4\pi}{3}(R^3 - r^3) = 4.1888\,(R^3 - r^3)$$

$$= \frac{\pi}{6}(D^3 - d^3) = 0.5236\,(D^3 - d^3)$$



Torus

A = area of surface

$$V = 2\pi^2 Rr^2 = 19.739\, Rr^2$$

$$= \frac{\pi^2}{4} Dd^2 = 2.4674\, Dd^2$$

$$A = 4\pi^2 Rr = 39.478\, Rr$$

$$= \pi^2 Dd = 9.8696\, Dd$$

Load computations

Horsepower and torque

Shaft torque, or twisting movement of the shaft, can be determined from the applied horsepower and speed in the following relationship:

$$Q = \frac{H \times 63000}{R} \quad \text{where,}$$

Q = Torque in in.-lbs

H = Horsepower

R = Speed in rpm

The torque used in computations is usually that of the main driving shaft or that of the engine or motor. The power is generally transmitted to another shaft by means of gears, pulleys, chains or other drives. The torque of the driving and driven shafts is inversely proportional to the rpm, so that if the torque of the driving shaft and rpm of both shafts are known, the torque of the driven shaft can be determined.

If the rpm of the shafts is known, the torque is figured directly from the horsepower. For instance the torque of shaft (2) is:

$$\frac{35 \times 63000}{400} = 5520 \text{ in.-lbs}$$

In some cases, such as on auxiliary drives, a shaft absorbs a certain amount of power from the drive shaft. The torque of the auxiliary shaft is easily computed by substituting values of "H" and "R" in the formula.

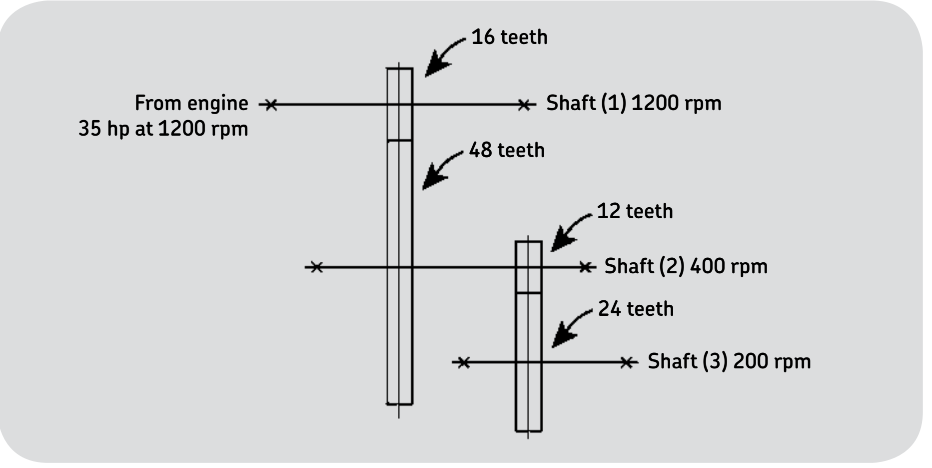


Figure 1

Example:
Figure 1 shows a gear train, shaft (1) coupled with engine developing 35 horsepower at 1200 rpm. The torque of shaft (1) is therefore:

$$\frac{63000 \times 35}{12000} = 1840 \text{ in.-lbs}$$

Torque of shaft (2) = 1840 × 48/16 = 5520 in.-lbs

Torque of shaft (3) = 5520 × 24/12 = 11040 in.-lbs

Load computations

Bearing loads

Radial and thrust loads

Radial loads

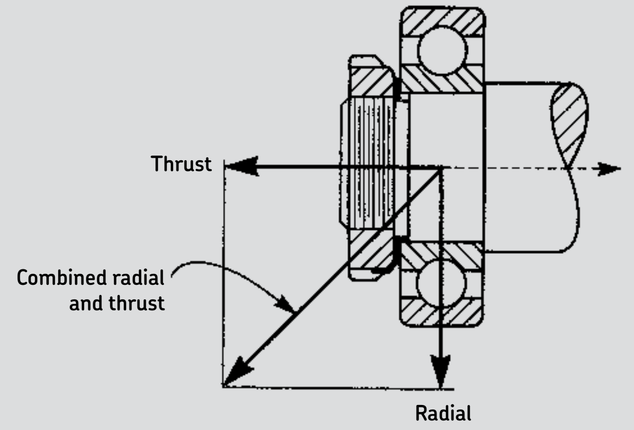
A radial load is one applied at right angles to the axis of the shaft. This load passes from the shaft to the inner ring through the balls to the outer ring and thence to the housing. In some cases this condition may be reversed, i.e., the radial load passing from a revolving housing through the bearing to a stationary shaft. A radial load is sustained by not more than one-half of the balls in the bearing.

A radial load may be due to a single force, such as weights of shaft and other revolving parts. More often, however, the radial load is due to two or more components such as tangential forces, separating forces, overturning moments, etc. which are combined into one load acting in a single direction at right angles to the axis of the shaft and the axis of the bearing.

Radial loads are supported by a pair of bearings which are mounted in one of two different manners: (1) straddle; (2) overhung. (See following page.)

In the straddle mounting, the radial load is divided in inverse proportion to the distance from the point of application of the load to the center of the bearing. The reactions at the bearings act in a direction opposite to the direction of the load. (See Figure 2) The straddle mounting is the most commonly used in supporting shafts.

The overhung mounting produces an entirely dissimilar result. In this, the load is applied at a point outside of the two bearings. The effect of this is to produce on the nearest bearing a load greater than the original radial load. The load on the opposite end bearing is generally relatively small. The load on the bearing nearest to the point of application acts in the same direction as that of the applied load. The load at the other bearing acts in the opposite direction to that of the applied load. (See Figure 3.)



Thrust loads

A thrust or end thrust load is one that acts in the same direction as the axis of the shaft. Its effect is to push the entire circle of balls against the race shoulder. The thrust may act from left to right or from right to left, or it may alternate. In the majority of cases, however, the thrust acts in one direction only. Horizontal mountings always require provision for thrust in both directions, although generally the thrust in one direction may be only a "locating" or nominal thrust. The ideal mounting for a ball bearing is where one bearing takes thrust in both directions. The "opposed" method of mounting allows one bearing to take thrust in one direction, and the other bearing to take thrust in the opposite direction.

Combined radial and thrust loads

One bearing of the pair sustains both radial and thrust loads. The resultant load is indicated by the diagonal line, which also shows the direction in which the shaft would move if not restrained by the bearing.

Load computations

Bearing loads

Straddle mounting

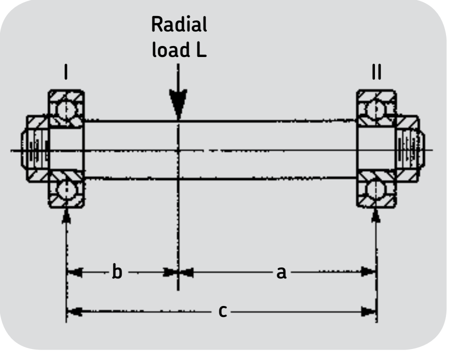


Figure 2
Straddle mounting

Radial load on bearing I = $\frac{L \times a}{c}$

Radial load on bearing II = $\frac{L \times b}{c}$

Overhung mounting

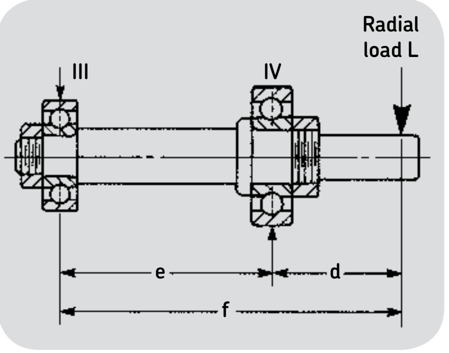
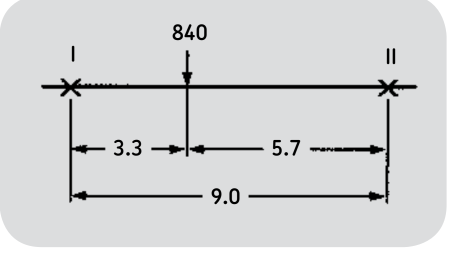


Figure 3
Overhung mounting

Radial load on bearing III = $\frac{L \times d}{e}$

Radial load on bearing IV = $\frac{L \times f}{e}$

Example: straddle mounting

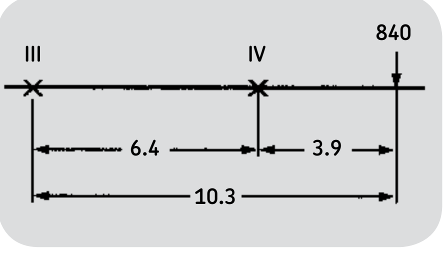


Radial load on I = $\frac{840 \times 5.7}{9.0}$ = 530 lbs

Radial load on II = $\frac{840 \times 3.3}{9.0}$ = 310 lbs

(530 + 310 = 840 check)

Example: overhung mounting



Radial load on III = $\frac{840 \times 3.9}{6.4}$ = 510 lbs

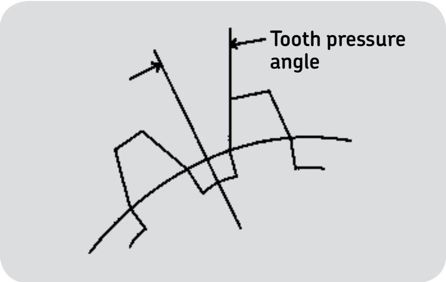
Radial load on IV = $\frac{840 \times 10.3}{6.4}$ = 1350 lbs

(1350 – 510 = 840 check)

Load computations

Radial loads due to spur gears

To compute radial loads on the bearings, obtain following data:
Horsepower (H) or torque (Q)
rpm of driving gear
Speed (R)
Number of teeth (t) in driving gear
Diametral pitch (p) of gears
Pitch diameter (D) of driving gear in inches
Tooth pressure angle
Gear ratio
Follow the example step by step in solving similar problems.

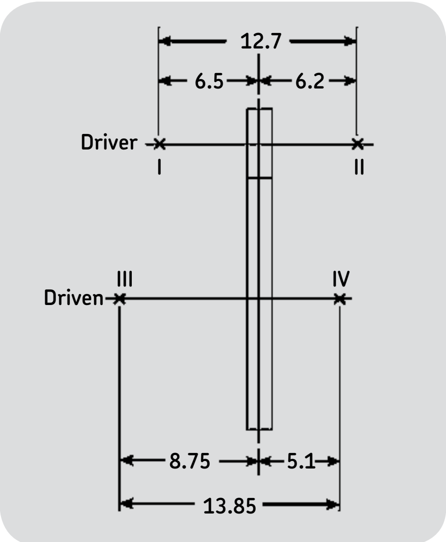


Example:
Horsepower (H) = 35 rpm
Speed (R) = 1200
Number of teeth (t) in driving gear = 18
Diametral pitch (p) of gears = 6
Pitch diameter (D) of driving gear = 18/6 = 3
Tooth pressure angle = A = $17^1/_2°$ cos $17^1/_2$ = .954
Gear ratio = 4

Torque (Q) = $\frac{63000\ H}{R} = \frac{63000 \times 35}{1200}$ = 1840 in.-lbs

Tooth load = $\frac{2\ Q}{D \cos A} = \frac{2 \times 1840}{3 \times .954}$ = 1290 lbs

Example: straddle mounting



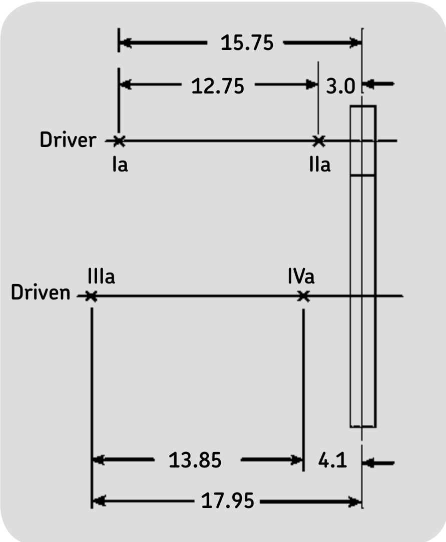
Radial load on I
1290 × 6.2/12.7 = 630 lbs at 1200 rpm

Radial load on II
1290 × 6.5/12.7 = 660 lbs at 1200 rpm

Radial load on III
1290 × 5.1/13.85 = 480 lbs at 300 rpm

Radial load on IV
1290 × 8.75/13.85 = 810 lbs at 300 rpm

Example: overhung mounting



Radial load on Ia
1290 × 3.0/12.75 = 300 lbs at 1200 rpm

Radial load on IIa
1290 ×15.75/12.75 =1590 lbs at 1200 rpm

Radial load on IIIa
1290 × 4.1/13.85 = 380 lbs at 300 rpm

Radial load on IVa
1290 ×17.95/13.85 =1670 lbs at 300 rpm

Load computations

Radial loads due to spur gears

Idler and intermediate shafts graphic method

Where loads are due both to driver and driven gears, plot end view and determine resultant load graphically as shown below.
Proceed as follows:

1 Draw gears in correct position, preferably to full or half scale.
2 Indicate direction of rotation with arrows.
3 Draw tangent (same direction as arrows).
4 Complete triangle making hypotenuse (tooth load) intersect driven gear.
5 Combine two forces as indicated in Figure 5.
6 Compute reactions on the bearings. (See page 353)

Example:
Horsepower (H) = 35
rpm (R) of driver =1200
Number of teeth in gears 18, 36, 72
Diametral pitch (p) of gears = 6
Tooth pressure angle =$17^1/_2°$

$$\text{Torque (Q)} = \frac{63000 \times 35}{1200} = 1840 \text{ in.-lbs}$$

$$\text{Pitch diameter of driver} = \frac{18}{6} = 3 \text{ in.}$$

Tooth pressure angle = A = $17^1/_2°$ cos $17^1/_2$ = .954

$$\text{Tooth load} = \frac{2\,Q}{D \cos A} = \frac{2 \times 1840}{3 \times .954} = 1290 \text{ lbs}$$

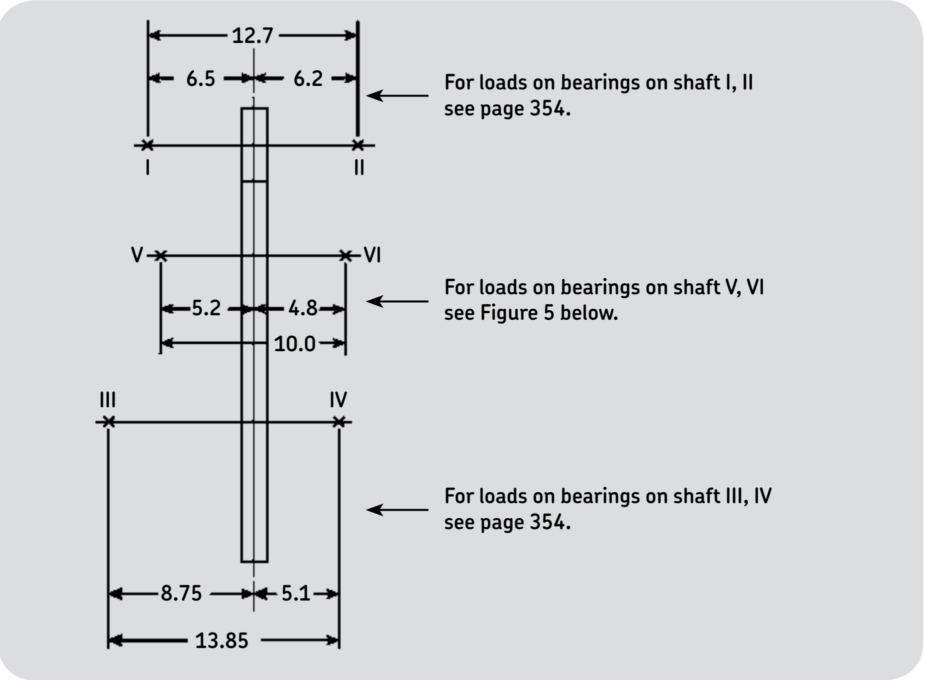


Figure 4

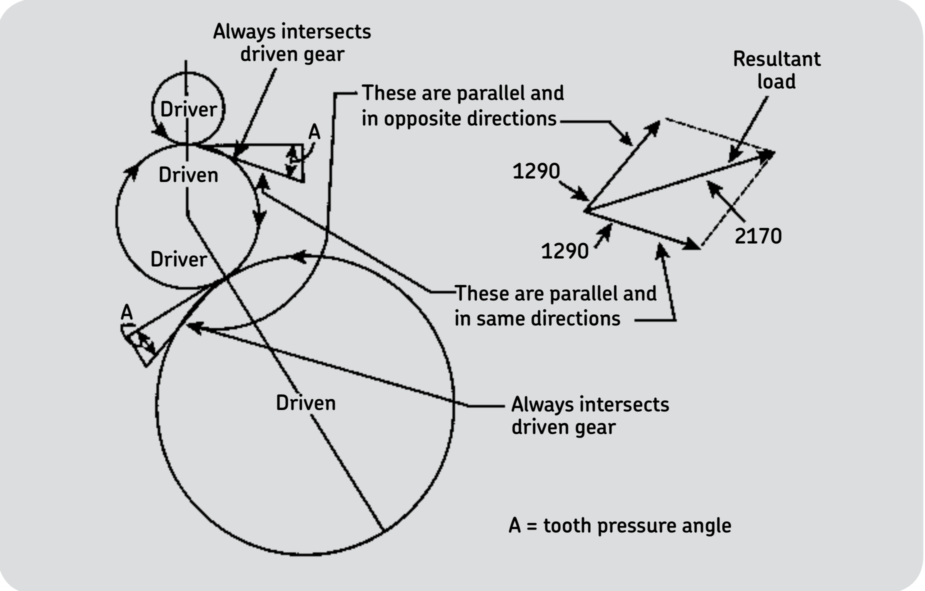


Figure 5

Load on V 2170 × 4.8/10 = 1040 lbs at 600 rpm
Load on VI 2170 – 1040 = 1130 lbs at 600 rpm

Load computations

Radial loads due to spur gears

Idler and intermediate shafts solution by formulas

Case 1: Where centers of driver, idler and driven shafts lie on one line. (See Figure 6)

Direction of rotation of gears is immaterial.

H = Horsepower
Q = Torque
R = rpm of driver
D = Pitch diameter of driver

Resultant tooth load on bearings V and VI

$$= \frac{4Q}{D} \text{ or } \frac{252000\ H}{RD}$$

Example: H = 35, R =1200, D = 3 in.
Gear reduction = 2

$$\text{Resultant tooth load} = \frac{252000 \times 35}{1200 \times 3}$$
= 2450 lbs

Radial load on V = 2450 × 4.8/10
= 1180 lbs at 600 rpm

Radial load on VI = 2450 – 1180
= 1270 lbs at 600 rpm

Radial loads on I, II, III and IV—see page 354.

Case 2: Where end view of gears is as shown in Figure 7.

Note direction of rotation (compare Figure 8).

A = Tooth pressure angle
Z = Angle (Figure 7)

$$K = \frac{2A + Z}{2}$$

Other symbols as in Case 1.

Resultant tooth load on bearings V and VI

$$= \frac{4\ Q \cos K}{D \cos A} \text{ or } \frac{252000\ H \cos K}{RD \cos A}$$

Example: H = 35 R = 1200 D = 3 in.
Gear reduction = 2
Tooth pressure angle =17$^1/_2$° cos 17$^1/_2$° = .954
Z = 30°

$$K = \frac{35 + 30}{2} = 32^1/_2°$$

cos 32$^1/_2$° = .843

$$\text{Resultant tooth load} = \frac{252000 \times 35 \times .843}{1200 \times 3 \times .954}$$

= 2170 lbs

Radial load on V = 2170 × 4.8/10
= 1040 lbs at 600 rpm

Radial loads on VI = 2170 – 1040
= 1130 lbs at 600 rpm

Radial loads on I, II, III and IV—see page 354.

Case 3: Where end view of gears is as shown in Figure 8.

Note direction of rotation (compare Figure 7).

A = Tooth pressure angle
Z = Angle (Figure 7)

$$J = \frac{2A - Z}{2}$$

Other symbols as in Case 1.

Resultant tooth load on bearings. V and VI

$$= \frac{4\ Q \cos J}{D \cos A} \text{ or } \frac{252000\ H \cos J}{RD \cos A}$$

Example: H = 35 R =1200 D = 3 in.
Gear reduction = 2
Tooth pressure angle =17$^1/_2$° cos 17$^1/_2$° = .954
Z = 30°

$$J = \frac{35 + 30}{2} = 2^1/_2°$$

cos 2$^1/_2$° = .999

$$\text{Resultant tooth load} = \frac{252000 \times 35 \times .999}{1200 \times 3 \times .954}$$

= 2570 lbs

Radial load on V = 2570 × 4.8/10
= 1230 lbs at 600 rpm

Radial load on VI = 2570 – 1230
= 1340 lbs at 600 rpm

Radial loads on I, II, III and IV—see page 354.

Load computations

Radial loads due to spur gears

Idler and intermediate shafts solution by formulas

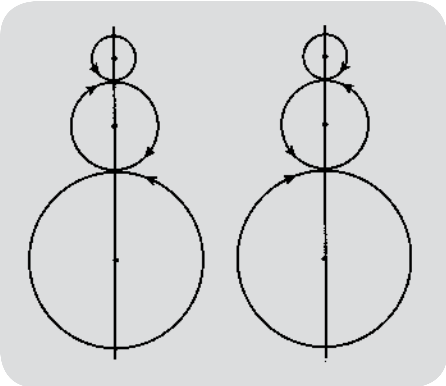


Figure 6

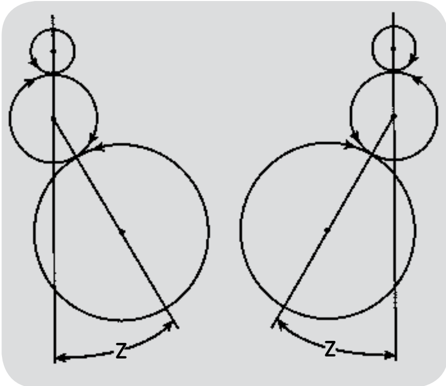


Figure 7

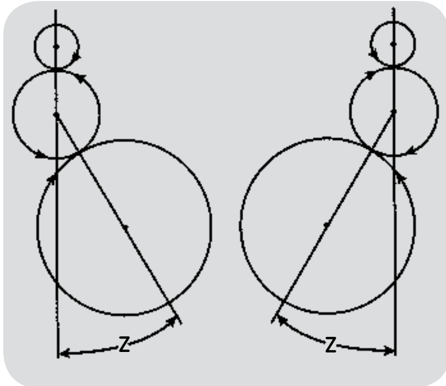


Figure 8

Case 1: Where centers of driver, idler and driven shafts lie on one line. (See Figure 6)

Direction of rotation of gears is immaterial.

Case 2: Where end view of gears is as shown in Figure 7.

Note direction of rotation (compare Figure 8).

Case 3: Where end view of gears is as shown in Figure 8.

Note direction of rotation (compare Figure 7).

Load computations

Loads due to planetary gears

The methods shown consider simple planetary spur gear arrangements only

To compute radial loads on the bearings:

1 Refer to page 353 for distribution of load (L) on bearings.

2 Obtain following data:
Horsepower (H) or Torque (Q)

Torque in in.-lbs (Q) = $\dfrac{63000\ H}{\text{rpm of driver}}$

Pitch diameter (s) of sun gear
Pitch diameter (p) of planet gear
Pitch diameter (g) of internal gear
Tooth pressure angle (necessary for single planet drive only)

3 See table on opposite page which gives resultant radial loads on bearings, and also the rpm's of the members. Note that the portion of the table devoted to loads is divided into two parts. The first is for the resultant radial load "L" on bearings III and IV for single planet, two planets or three planets. The second is for the resultant radial load "P" on bearings I and II and V and VI for single planet.

4 Consider first bearings III and IV. Select the proper expression for "L" according to whether your particular problem involves single planet, two planets or three planets.

5 Resultant radial load "L" is imposed on bearings III and IV. Compute individual loads on III and IV by method shown on page 353, unless planet is supported by a single centrally located bearing in which case "L" is the resultant bearing load.

6 Bearings III and IV are also subjected to centrifugal forces (except in combinations 3 and 4, see opposite page) which, if the speeds are very high, should be computed and combined with "L" as obtained in **5** above.

These centrifugal forces can be computed from the formula shown below, noting that: "W" equals the weight of the planet gear and shaft; rpm is that of the cage; "r" is as shown in Figure 11 on the opposite page.

Centrifugal force (CF) and "L" are combined as follows: $\sqrt{(CF)^2 + L^2}$. Use this instead of "L" when considering centrifugal force. The loads on the individual bearings must be computed as described on page 353.

Note: the centrifugal force to weight ratio $\dfrac{CF}{W}$ is of prime importance in the proper selection of the cage used in the bearing, or bearings, on the planet shaft.

7 When the planetary drive has a single planet there are also loads on the bearings supporting the driving and driven members. These values are given in the table on the opposite page as load "P" and are imposed on bearings I, II, V and VI. (Note: the expression for "P" is given in terms of "L" as obtained for bearings III and IV due to a single planet.)

Compute the loads on the individual bearings as described on page 353. For two or more planets, there is no theoretical load on bearings I, II, V and VI.

Actually there is some load due to mechanical unbalance and machining inaccuracies, but generally it can be neglected.

Centrifugal Force

Centrifugal force = $\dfrac{W \times r \times R^2}{35200}$

where, W = weight in pounds
r = radius in inches
R = rpm

Load computations

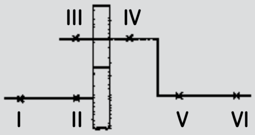


Figure 9
Combination 1 and 2

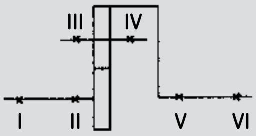


Figure 10
Combination 3 and 4

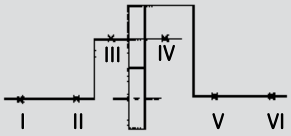


Figure 11
Combination 5 and 6

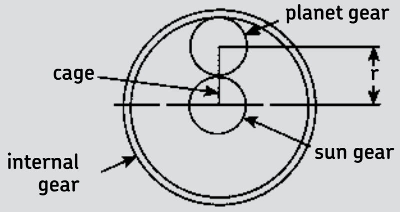


Figure 12

Element		Combination					
		1	2	3	4	5	6
Sun gear cage internal gear		Driving Driven Stationary	Driven Driving Stationary	Driving Stationary Driven	Driven Stationary Driving	Stationary Driving Driven	Stationary Driven Driving
Resultant radial load (L) on III and IV	Single planet	$\frac{4Q}{s}$	$\frac{2Q}{(s+p)}$	$\frac{2Q}{s}$	$\frac{4Q}{g}$	$\frac{2Q}{(s+p)}$	$\frac{4Q}{g}$
	Two planets	$\frac{2Q}{s}$	$\frac{Q}{(s+p)}$	$\frac{2Q}{s}$	$\frac{2Q}{g}$	$\frac{Q}{(s+p)}$	$\frac{2Q}{g}$
	Three planets	$\frac{4Q}{3s}$	$\frac{2Q}{3(s+p)}$	$\frac{4Q}{3s}$	$\frac{4Q}{3g}$	$\frac{2Q}{3(s+p)}$	$\frac{4Q}{3g}$
Resultant radial load (P) due to single planet	See sketch	Figure 9		Figure 10		Figure 11	
	On I and II	$\frac{L}{2\cos A}$		$\frac{L}{2\cos A}$		L	
	On V and VI	L		$\frac{L}{2\cos A}$		$\frac{L}{2\cos A}$	
rpm*	Sun gear	R	$R \times \frac{(g+s)}{s}$	R	$R \times \frac{g}{s}$	0	0
	Planet about own center	$R \times \frac{s}{(g+s)} \times \frac{g}{p}$	$R \times \frac{g}{p}$	$R \times \frac{s}{p}$	$R \times \frac{g}{p}$	$R \times \frac{s}{p}$	$R \times \frac{g}{(g+s)} \times \frac{s}{p}$
	Cage	$R \times \frac{s}{(g+s)}$	R	0	0	R	$R \times \frac{g}{(g+s)}$
	Internal gear	0	0	$R \times \frac{s}{g}$	R	$R \times \frac{(g+s)}{g}$	R

*In computing rpm it may be more convenient to use number of teeth of gears, that is: s = number of teeth of sun gear; p = number of teeth of planet gear; g = number of teeth of internal gear.

Load computations

Loads due to belt, rope and chain drives and cutting or working tools

General formula

$L = \frac{K \times 126000 \times H}{DR}$ where,

L = radial load (lbf)

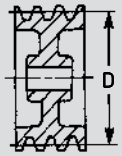
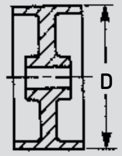
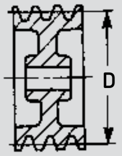
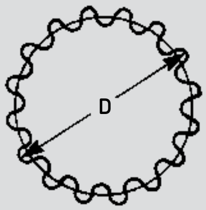
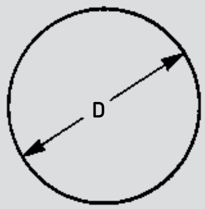
H = horsepower (hp)

D = pitch diameter of pulley sprocket or cutting tool (inches)

R = rpm

K = service factor

For distribution of load (L) on bearings, refer to page 353.

	Drive	K
	V-Belt	1.5
	Flat belt	
	Single ply	2.0
	Double ply	2.5
	Triple ply, small pulley diameter	3.0
	Rope	
	Pulley groove included angle 45°	2.0
	Pulley groove included angle 45°—60°	2.5
	Chain	1.25
	Cutting or working tool	5.0

Load computations

Loads on electric motor bearings

Horizontal belted motors

H = Horsepower
R = rpm
W = Weight of rotor in pounds*
D = Diameter of pulley (or pitch diameter of driving gear) in inches

Belt pull = $\frac{252000\ H}{RD}$ = B

Radial load on I = (B × f/e) + W/2
Radial load on II = (B × d/e) + W/2

Example:

H = 30	d = 8
R = 1200	e = 24
W = 240	f = 32
D = 10	

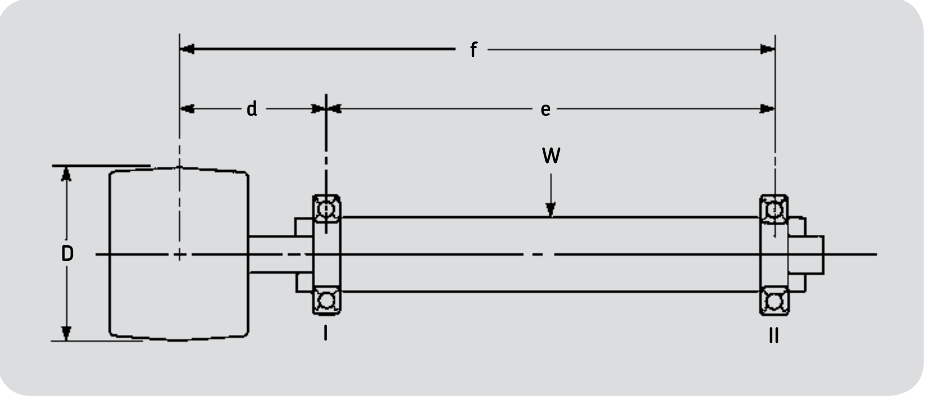
Belt pull = $\frac{252000 \times 30}{1200 \times 10}$ = 630 pounds

Radial load on I = 630 × 32/24 + 240/2
= 960 lbs at 1200 rpm

Radial load on II = 630 × 8/24 + 240/2
= 330 lbs at 1200 rpm

Vertical belted motors

Radial load on I = B × f/e
Radial load on II = B × d/e
Thrust load on I (or II) = W
(See formula above for "B")



Horizontal geared motors

Tooth Load = $\frac{132000\ H}{RD}$ = C

Radial load on I = (C × f/e) + W/2
Radial load on II = (C × d/e) + W/2

Direct coupled motors

Horizontal motors	Radial load = W/2 on each bearing
Vertical motors	Thrust load = W on I (or II)

In addition to the above loads there is often a shock load due to the coupling which should be considered in the selection of bearing sizes.

*If unbalanced, "W" equals two or three times the weight of the rotor in the formulas for radial loads.

Load computations

Thrust loads

Aircraft, motor boats, twist drills
Thrust due to propellers
H = Brake horsepower of engine
E = Propeller efficiency
R = rpm of engine at rated horsepower
r = rpm of propeller
M = Land miles per hour of motor boat
N = Level flight air speed of aircraft in miles per hour
n = Air speed of aircraft in climb in miles per hour
F = Pitch of propeller in feet

Wanted	Data given	Formula
Aircraft propeller thrust in level flight	1 Brake horsepower of engine "H" 2 Level flight air speed of aircraft in miles per hour "N" 3 Propeller efficiency assumed 85%	$\frac{320\ H}{N}$
Aircraft propeller thrust in level flight	1 Brake horsepower of engine "H" 2 Level flight air speed of aircraft in miles per hour "N" 3 Propeller efficiency "E"	$\frac{375\ H\ E}{N}$
Aircraft propeller thrust in climb	1 Brake horsepower of engine "H" 2 Air speed of aircraft in climb in miles per hour "n" 3 rpm of engine "R" (This formula does not apply to variable pitch propellers, where full power and rpm are maintained in climb.)	$\frac{250\ H}{n}$ at approx. .9 "R" rpm
Motor boat propeller thrust	1 Brake horsepower of engine "H" 2 Propeller efficiency (.60 to .70) "E" 3 Miles per hour of boat "M"	$\frac{375\ H\ E}{M}$
	1 Brake horsepower of engine "H" 2 Propeller efficiency (.60 to .70) "E" 3 rpm of propeller 4 Pitch of propeller in feet "F"	$\frac{33000\ H\ E}{r\ F}$

Thrust due to twist drills

Drill size diameter (in.)	Drill feed* inches per one revolution	Thrust load	
		Mild steel	Soft cast iron
1/16	.003	160	65
1/8	.004	300	130
3/16	.005	460	200
1/4	.006	620	290
5/16	.007	800	380
3/8	.008	990	480
7/16	.009	1180	580
1/2	.010	1380	690
5/8	.011	1710	870
3/4	.012	2040	1050
7/8	.013	2390	1240
1	.014	2740	1440

*recommended maximum

Load computations

Formulas for automobile bearing loads

H = Horsepower of engine
D = Diameter of tire in inches
Q = Torque in inch-pounds
G = Rear axle reduction
R = rpm of crankshaft
M = Miles per hour
C = Radius to brake pin in inches
—transmission or propeller shaft brake

J = Proportion of weight carried on front axle (generally .45 for passenger cars)
K = Proportion of weight carried on rear axle (generally .55 for passenger cars)
W = Total weight, including passengers or payload in pounds

Wanted	Data given	Formula
Torque (in inch-pounds)	1 Torque in foot-pounds	Q = (Torque in foot-pounds) × 12
Torque (Q)	1 Horsepower 2 rpm	$Q = \frac{63000\ H}{R}$
Horsepower of engine	1 Torque in inch-pounds 2 rpm	$H = \frac{QR}{63000}$
Braking torque at rear wheels	1 Weight on rear axle 2 Diameter of tire	$.3\ K\ W\ D$
Braking torque at pinion	1 Weight on rear axle 2 Diameter of tire 3 Axle reduction	$\frac{.3\ K\ W\ D}{G}$
Transmission or propeller shaft brake load (pivoted brakes)	1 Weight on rear axle 2 Diameter of tire 3 Axle reduction 4 Radius to brake pin	$\frac{.3\ K\ W\ D}{G\ C}$
Radial load on front wheel bearings	1 Weight on front axle	$\frac{J\ W}{2}$
Thrust load on front wheel bearings due to side skid	1 Weight on front axle	$.3\ J\ W$
Radial load on rear wheel bearings	1 Weight on rear axle	$.64\ K\ W$
Thrust load on rear wheel bearings due to side skid	1 Weight on rear axle	$.3\ K\ W$
Miles per hour of automobile	1 rpm of engine 2 Diameter of tire 3 Axle reduction	$\frac{D\ R}{336\ G}$
rpm of engine	1 Miles per hour 2 Diameter of tire 3 Axle reduction	$\frac{336\ M\ G}{D}$
rpm of axle	1 Miles per hour 2 Diameter of tire	$\frac{336\ M}{D}$
Axle reduction	1 Miles per hour 2 Diameter of tire 3 rpm of engine	$\frac{R\ D}{336\ M}$

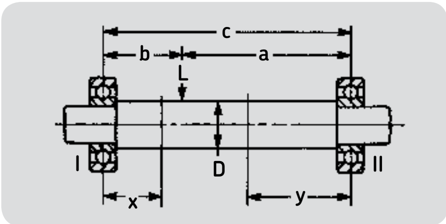
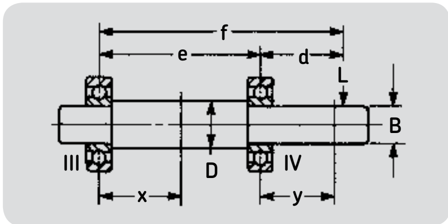
Load computations

Shaft stresses and deflections

L = Radial load in pounds
D = Shaft diameter in inches
H = Horsepower transmitted
R = Revolutions per minute of shaft
B = Bore of bearing in inches
Q = Torque in inch-pounds
E = Young's modulus (30,000,000 for steel)
S_B = Bending stresses in pounds per square inch

S_M = Maximum bending stress in pounds per square inch
S_Q = Maximum torsional stress in pounds per square inch
M = Deflection of shaft in inches
M_M = Maximum deflection of shaft in inches
A = Angularity of shaft at bearing support (subscript indicates support)

For hollow shafts, substitute $\left(\frac{D^4 - D_1^4}{D}\right)$ for D^3 and $(D^4 - D_1^4)$ for D^4 (where, D_1 = inside diameter of hollow shaft or tube).

Mounting	Straddle mounting	Overhung mounting
		
Bending stress		
S_B at x	$S_B = \frac{10.2\,L\,a\,x}{D^3\,c}$	$S_B = \frac{10.2\,L\,d\,x}{D^3\,e}$
S_B at y	$S_B = \frac{10.2\,L\,b\,y}{D^3\,c}$	$S_B = \frac{10.2\,L\,(d - y)}{B^3}$
Maximum stress S_M	$S_M = \frac{10.2\,L\,a\,b}{D^3\,c}$ (at L)	$S_M = \frac{10.2\,L\,a\,b}{D^3\,c}$ (at IV)
Torsional stress S_Q	$S_Q = \frac{321{,}000\,H}{R\,D^3}$ or $\frac{5.1\,Q}{D^3}$	
Shaft deflection		
M at x	$M = \frac{3.40\,L\,a\,x\,(c^2 - x^2 - a^2)}{c\,E\,D^4}$	$M = \frac{3.40\,L\,d\,x\,(e^2 - x^2)}{e\,E\,D^4}$
M at y	$M = \frac{3.40\,L\,b\,y\,(c^2 - y^2 - b^2)}{c\,E\,D^4}$ Let a be greater than b	$M = \frac{3.40\,L\,y\,(3\,d\,y - y^2 + 2\,d\,e)}{E\,B^4}$
Maximum deflection between supports M_M	Calculate $Y_1 = a + \sqrt{\frac{1}{3} + \frac{2\,B}{3\,a}}$ $M_M = \frac{6.80\,L\,b\,Y_1^3}{c\,E\,D^4}$	$M_M = \frac{1.312\,L\,d\,e^2}{E\,D^4}$
Deflection at load M at L	$M = \frac{6.80\,L\,a^2\,b^2}{c\,E\,D^4}$	$M = \frac{6.80\,L\,d^2\,f}{E\,B^4}$
Angularity of shaft at bearing supports	$\tan A_I = \frac{3.40\,L\,a\,(c^2 - a^2)}{c\,E\,D^4}$ $\tan A_{II} = \frac{3.40\,L\,b\,(c^2 - b^2)}{c\,E\,D^4}$	$\tan A_{III} = \frac{3.40\,L\,d\,e}{E\,D^4}$ $\tan A_{IV} = \frac{6.80\,L\,d\,e}{E\,B^4}$

Load computations

Loads due to plain bevel gears

General procedure

To compute loads on plain bevel gear, proceed as follows:

1) Compute torque of driving gear shaft

$$\text{Torque (Q)} = \frac{\text{Horsepower} \times 63000}{\text{rpm of drive shaft}}$$

or $\dfrac{H \times 63000}{R}$

2) Determine tangential pressure (P)

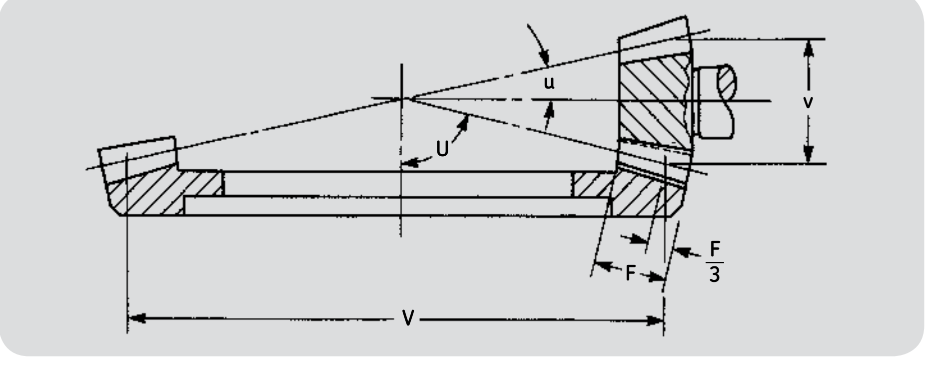
$$P = \frac{\text{Torque} \times 2}{\text{Mean pitch diameter of driving gear}}$$

or $\dfrac{Q \times 2}{v}$

3) Obtain gear thrust by solving for "X" (See below).

4) Compute radial load on bearings (See example on page 366).

Thrust loads



Direction of rotation (clockwise or counterclockwise) viewed from this side.

Note: Mean pitch diameter taken on pitch line 1/3 face length from pitch diameter, is approximately at the center of the contact area of the gears.

$$\text{Thrust} = \frac{2\,Q\,X}{v}$$

X = See below

Q = Engine torque in inch-pounds

G = Gear ratio

v = Mean pitch diameter of bevel driving gear in inches (taken on pitch line 1/3 face length from pitch diameter)

V = Mean pitch diameter of bevel drive gear in inches (taken on pitch line 1/3 face length from pitch diameter)

A = Tooth pressure angle

u = Pitch angle of driving gear

$$\tan u = \frac{\text{No. of teeth in driving gear}}{\text{No. of teeth in driven gear}}$$

Value of X

Driving gear: X = tan A sin u

Driven gear: X = tan A cos u

Load computations

Loads due to plain bevel gears

Obtain following data:
Horsepower (H) or torque (Q)
rpm (R) of driving gear shaft
Mean pitch diameter (v) of driving gear
Tooth pressure angle
Number of teeth in driving gear
Number of teeth in driven gear
Bearing and gear locations
(see Figures 13 and 14)

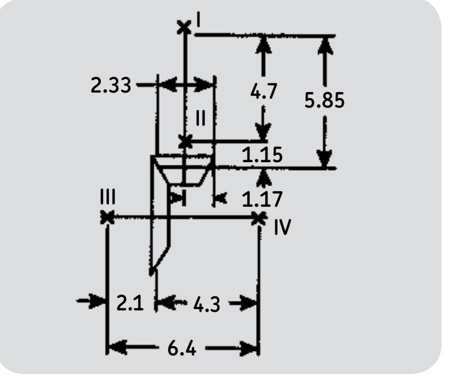


Figure 13
Overhung driving gear

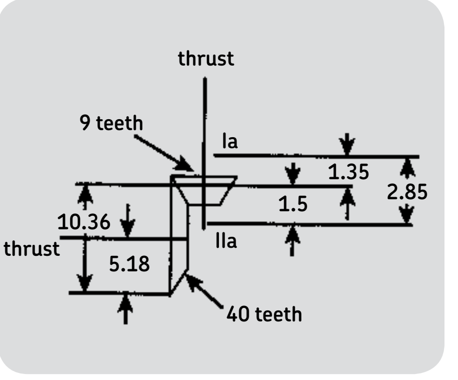


Figure 14
Straddle driving gear

Example:
Horsepower (H) = 35
rpm (R) =1200
Tooth pressure angle =$17^1/_2$°
Mean pitch diameter (v) of driving gear = 2.33
Gear ratio = 40/9 = 4.44
Mean pitch diameter (V) of driven gear
= 2.33 × 4.44 =10.36
Pitch angle of driving gear = u
= $\tan^{-1}$ 9/40 =12.68°

Torque (Q) = $\dfrac{63000\ H}{R} = \dfrac{63000 \times 35}{1200}$
= 1840 in.-lbs

Tangential pressure (P) = $\dfrac{2\ Q}{v} = \dfrac{2 \times 1840}{2.33}$
= 1580 lbs

Value of "X" (See page 365)
Driver X = tan a sin u = tan 17.5 sin 12.68
= .07

Driven X = tan a cos u = tan 17.5 cos 12.68
= .31

Thrust on driving gear (Tp) = P × X
= 1580 × .07 =110 lbs
Thrust on driven gear (Tg) = P × X
= 1580 × .31 = 490 lbs
Overturning moment on driving gear =
$\dfrac{Tp \times v/2}{4.7} = \dfrac{110 \times 1.17}{4.7}$ = 30*
Overturning moment on driven gear =
$\dfrac{Tg \times V/2}{6.4} = \dfrac{490 \times 5.18}{6.4}$ = 400**

P	Tp	Tg	v/2	V/2
1580	110	490	1.17	5.18

Driving gear thrust = Tp = 110 pounds thrust on bearing I or Ia
Driven gear thrust = Tg = 490 pounds thrust on bearing III

Bearing I	1580 × 1.15/4.7 = 390	490 × 1.15/4.7 = 120	30*
	$\sqrt{390^2 + (120 - 30)^2}$ = 400 pounds radial load at 1200 rpm		
Bearing II	1580 + 390 = 1970	490 + 120 = 610	30*
	$\sqrt{1970^2 + (610 - 30)^2}$ = 2050 pounds radial load at 1200 rpm		
Bearing III	1580 × 4.3/6.4 = 1060	110 × 4.3/6.4 = 70	400**
	$\sqrt{1060^2 + (400 + 70)^2}$ = 1160 pounds radial load at 270 rpm		
Bearing IV	1580 – 1060 = 520	110 – 70 = 40	400**
	$\sqrt{520^2 + (400 - 40)^2}$ = 630 pounds radial load at 270 rpm		
Bearing Ia	1580 × 1.5/2.85 = 830	490 × 1.5/2.85 = 260	110 × 1.17/2.85 = 50
	$\sqrt{830^2 + (260 + 50)^2}$ = 890 pounds radial load at 1200 rpm		
Bearing IIa	1580 – 830 = 750 490 – 260 = 230	110 × 1.17/2.85 = 50	
	$\sqrt{750^2 + (230 - 50)^2}$ = 770 pounds radial load at 1200 rpm		

Product index numerical order

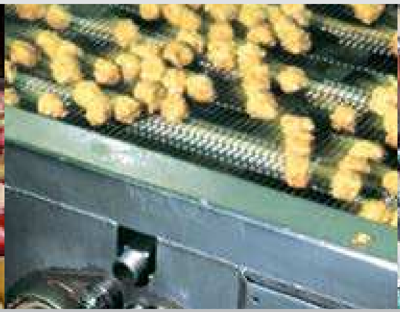
Product index numerical order

Product index numerical order

Product index numerical order

Product index numerical order

Product index alphabetical order



Marathon® series corrosion resistant mounted products and bearing units

Order publication #M660-710

Marathon series corrosion-resistant mounted products and bearing units

Few industries challenge bearings with a harsher operating environment than the food and beverage industries. Perhaps no industry works as hard to meet regulations governing contamination. When MRC® introduced the Marathon® series composite mounted bearing units, it was possibly the best solution to the problems associated with bearing failures.

Since then, in addition to the composite units, our HDi—heavy-duty cast iron—and XDs—extreme-duty cast stainless steel—have been introduced to more thoroughly meet the needs of the industry.

The HDi series combines corrosion resistance together with the strength of cast iron—without the problem of flaking nickel plating—and are priced competitively with nickel-plated versions. (See page 3 for details.)

For extremely challenging applications, the XDs series provides top-of-the-line corrosion resistance and the greatest housing strength available within the Marathon line. (See page 4 for details.)

At the heart of the Marathon units are high-quality, corrosion-resistant insert bearings, available with MRC's ZMaRC® coating or with stainless steel construction. The units' multifunction rubber seals are bonded to AISI 304 stainless steel for superior corrosion resistance, and sealed-for-life lubricants are USDA compliant.

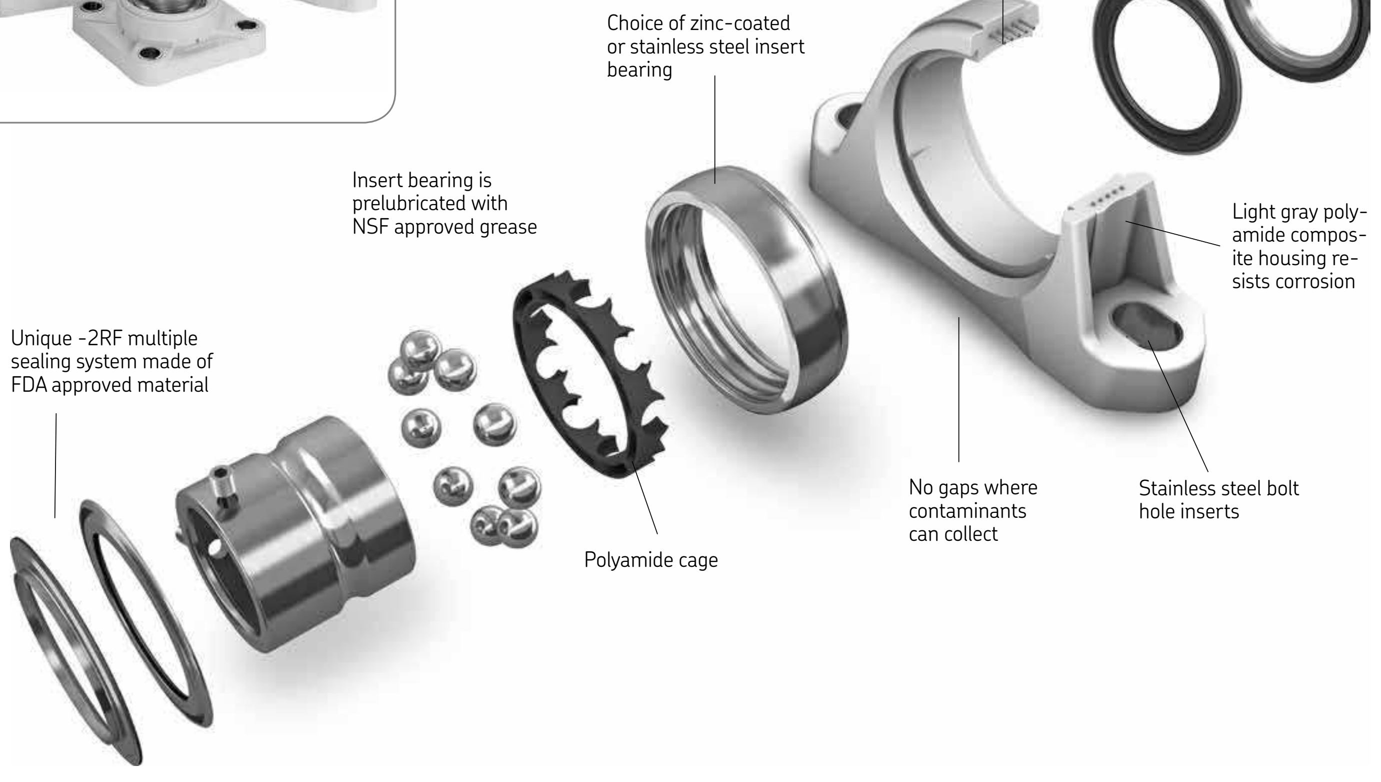
A composite housing with integrated performance features

The Marathon series' composite housing resists citric acids, cooking fats and most chemicals used in food and beverage processing. It is constructed of a thermoplastic composite material that can be up to 61% lighter than cast iron housings. Its spherical bore accommodates the insert bearing's spherical outer surface, enabling the unit to fully compensate for initial bearing seating misalignment.

Plus, the housing is loaded with design and performance advantages:

- Steel coils embedded in the housing contribute to the housing's fracture strength. Radial breaking load is far greater than the static load rating of the bearing. Marathon series housings have possibly the highest fracture strength of any composite unit available.
- A nylon-filled housing base enables the unit to meet flush with its mounting surface. Flush surface-to-surface mounting
eliminates gaps—potential areas for contaminants to collect.
- 300 series stainless steel bolt hole inserts provide added strength to each housing foot and prevent corrosion.
- Marathon series units are available in the following housing designs to meet the needs of most food and beverage processing applications:
  – pillow block
  – two- or four-bolt flange
  – tapped base
  – three-bolt bracket flange
  – narrow and wide slot take-up
  – low backing height pillow block
  – low profile two- and three-bolt flange
  – four-bolt piloted flange
  – hanger

Steel coils embedded in SKF composite housings provide additional fracture strength



Marathon XD_S unit—
MRC's top-of-the-line units

Extremely challenging applications require an extremely durable unit—the XD_S units. These housings are AISI 300 series cast stainless steel with MRC's proven stainless steel insert bearings.

The extra strength and toughness of the cast stainless housings are beneficial where loads are very heavy or where shock loads are possible. Also, the safety factor inherent in the cast steel housing is desirable in applications where housing failure could result in injury.

While composite and plated housings are resistant to most of the chemicals in use today, these stainless units are not affected by the strong concentrations of chlorine, hydrogen peroxide and other chemicals sometimes used in washdown procedures

The XD_S cast stainless housings were designed especially for use in food and beverage applications. The bases have no recesses to trap debris and bacteria; the exposed surfaces of the housings have no unnecessary crevices or pockets; and the smooth finish minimizes material trapped on the surface allowing a more thorough cleaning.

Like the other members of the Marathon family, the XD_S series incorporates the proven insert bearing design and patented sealing arrangement (see page 5), and are also greased for life and maintenance free.

Housing styles available include:
– pillow block
– two- and four-bolt flange
– tapped base

MRC XD_S extreme duty machined stainless steel mounted units

MRC can also offer additional housing styles in machined stainless steel. Made of AISI 300 series stainless steel, these units are machined from solid stainless steel plate rather than cast. These are especially suited for applications where surface roughness is critical, such as instances where chronic bacterial problems have existed. As with the cast housings, there are no unnecessary recesses or cavities to trap debris.

And like the cast stainless units, MRC's excellent stainless steel insert bearings are used.

Insert bearings

The Marathon units' high quality insert bearings are available with MRC's proprietary ZMaRC coating on the inner and outer rings. ZMaRC resists frequent washdowns with water and with acidic and caustic solutions far better than conventional insert bearings and conventional coatings, such as black oxide. That means greater protection against rust, greater protection against contaminant-related bearing failure and greater assurance that your equipment will pass USDA inspections.

If you prefer stainless steel, MRC will supply the Marathon series with AISI 420C stainless inner and outer rings and balls. The insert bearing's stainless steel set-screws, positioned 120 degrees apart, minimize inner ring distortion while maintaining good gripping strength.

ZMaRC-coated insert bearing

Stainless steel insert bearing

Marathon composite units with ZMaRC-coated bearing inserts are also available from stock with eccentric locking collar mounting.

Eccentric locking collars provide a nearly 360-degree shaft contact for reduced slippage and improved mounting integrity. The eccentric locking collar mounting is primarily intended for use in applications where the direction of rotation is constant. This alternative to setscrew mounting also makes bearing removal easier by providing access to the setscrew dimple created on the shaft surface during the initial mounting procedure. The mechanic is then able to file down the raised edges around the dimple in order to easily slide the bearing off the shaft.

Other Marathon style units with ZMaRC inserts can be ordered with the eccentric locking collar through our Made-to-Order program.

ZMaRC-coated insert bearing
with eccentric locking collar

Stainless steel sealing arrangement

A double-protection seal keeps the Marathon units running contaminant free. The sealing arrangement consists of a double-lip, AISI 304 stainless steel integral seal, an AISI 304 stainless steel flinger and a rubber-backed seal gasket. The flinger and seal's low-friction rubber lips, with optimized axial contact, form a double barrier against pollutants and washdowns. The seal gasket prevents contaminants from migrating around the seal insert's O.D., and the flinger adds mechanical and centrifugal protection against contaminant entry. The space between the insert seal and flinger is filled with USDA food-grade grease for even greater sealing efficiency.

USDA-compliant grease

Marathon units are prelubricated-for-life with USDA H1-approved grease. The high quality synthetic grease is odorless and tasteless, and is approved for use in all food processing industries.

Other Marathon mounted bearing unit grease benefits:

- Excellent internal and external bearing corrosion protection.
- High aging resistance for extended lubricant life.
- High load carrying capacity, which helps prevent premature bearing wear.

End covers

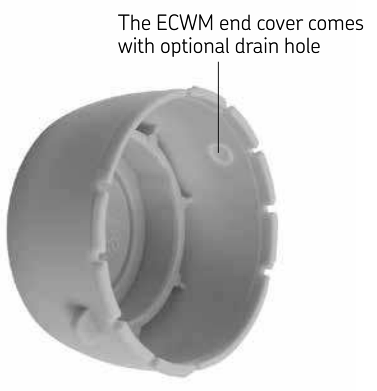
Secure fit, operator safety

If needed to comply with health and safety regulations, composite, stainless steel and cast iron zinc coated MRC Marathon units can be supplied with effective end covers.

ECWM (→ **fig. 1**) is for composite and stainless steel MRC Marathon units. It has an optional drainage hole that can be easily opened by the user as required.

ECWM end covers are tested to withstand 100 bar pressure wash and will not dislocate during washing.

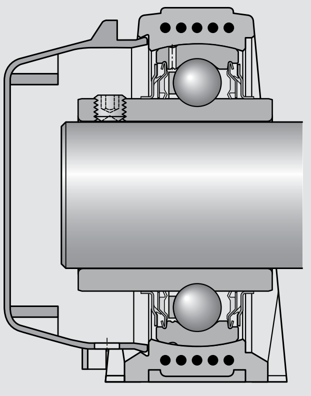
End covers are not included with the bearing units and must be ordered separately.



NOTE: drain hole faces down when in use

Fig. 1

ECWM cover



MRC

Made-To-Order
Solutions from MRC

Order publication #M200-111

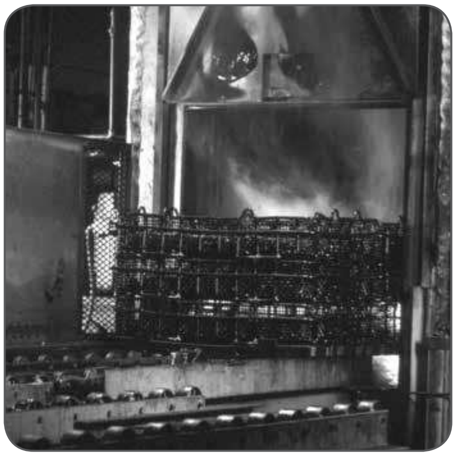
Made-To-Order (MTO) solutions from MRC

- **Hard to find or discontinued product?**
- **Cannot identify product or source?**
- **Difficult application, insufficient bearing service life or poor performance?**
- **Special lubrication, material or design requirements?**

MRC's MTO group has the technical expertise and wide bearing industry experience to help identify and source the hard-to-find, discontinued or special products you need. With manufacturing and rework/modification capabilities covering virtually all ball bearing designs and size ranges, MTO can satisfy your special or custom needs often in lot sizes as small as one. In addition, our flexible rework capabilities allow MTO to meet your tight time frame restrictions.

MRC Engineering

- Applications engineering reviews all MTO requests for application suitability and assignment of proper engineering specifications.
- Application engineering has extensive experience in bearing lubrication (low and high temperature, food grade, solid oil), materials (standard bearing steel, stainless steels, M50 steel, and ceramics), and all ball bearing designs in order to specify the most appropriate bearing solution to meet your needs.



Heat treatment

Design flexibility

MRC Customer Service

- MRC's customer service representatives, engineers, planners, and field sales personnel are committed to providing fast responses to your special bearing inquiries.
- 70% of inquiries for routine modifications of stocked product and repeat inquiries for custom product are responded to within one workday.
- Response time for special bearing designs and custom manufacture will depend upon the complexity of the request as well as the availability of components and raw materials.

MRC Commitment

All MTO reworked and modified products are done according to MRC's rigid standards and practices and are therefore sold with the same original manufacturer's warranty as our standard product.

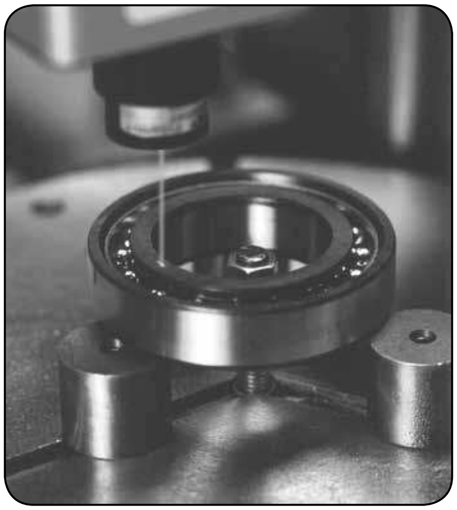
Lubrication

Capabilities

Bearing designs

MTO Product offers a broad range of single and double row ball bearing designs, including:

- Inch dimension – R, XLS, LS, MS series
- Thin section – 1800 and 1900 series
- Single row deep groove – S type
- Single row max type – M type
- Single row 15° angular contact – R type
- Single row angular contact – 7000, 7000P and 7000PJ series
- Single row angular contact split ring 9000 and 9000P Series
- PumPac 8000 Series
- Double row angular contact – 5000 series
- Self-aligning ball bearings
- Hybrid (ceramic) ball bearings
- Precision grades to ABEC 7+
- Custom designed product



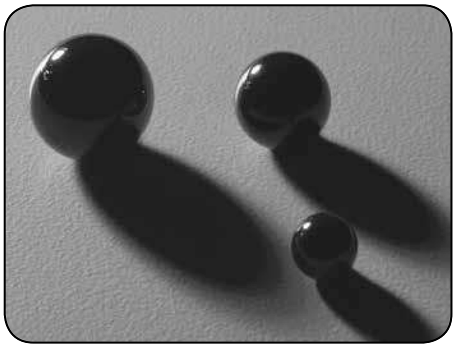
Non-contact measurement

Manufacturing, rework and modification

The MTO group offers wide ranging manufacturing, rework and modification capabilities, including:

- Bore modification – increase bore size, rework cylindrical bore to taper bore, slotting
- OD modification – reduce OD, add spherical crown, anti-rotation slots, snap ring grooves or lubrication holes
- Face modification – add anti-rotation slots or lubrication grooves
- Duplex grinding – matching bearing sets produce axial preload or clearance
- Width modification – reduce width, flush grinding, etc.
- Snap rings – grind snap ring groove in OD and add snap ring
- Lubrication – relubricate sealed or shielded product with special grease and custom fill or add solid oil
- Closures – change, add or remove closures. Shields are available in steel or stainless steel. Seals are available in nitrile rubber, Viton and Teflon.
- Cages – change existing cages to other materials: brass, phenolic (Bakelite), polyamide.
- Material – offering bearing components in standard 52100 steel, 440C stainless, M50 tool steel, HNCR "super stainless", silicon nitride (ceramic)
- Coatings – applying thin dense chrome, silver, cadmium, black oxide, NoWear® ("diamond like") or INSOCOAT® to bearing surfaces
- Heat treatment – dimensional stabilization of bearing components for extreme temperature environments
- Identification – special or custom marking of bearings and packaging
- Packaging – re-wrap, re-box or custom package bearing product

Cage designs



Ceramics

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