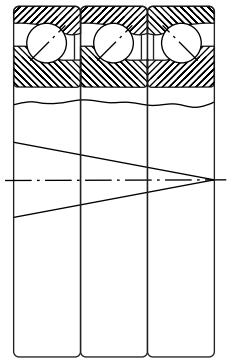
The MRC ball screw support bearing is a single row angular contact, non-separable ball bearing with one heavy shoulder and one low shoulder on each ring, on opposite sides. Construction and ring design permit a greater number of balls than standard angular contact types, and with a 60° contact angle, a very high thrust load-carrying capacity and maximum axial stiffness are attained. As heavy thrust loads must be taken in both directions, these ball screw support bearings are mounted in duplex pairs, back-to-back or face-to-face, or in triplex or quadruple sets if greater support is required.

The sets of bearings are matched during production so that when mounted immediately adjacent to each other, the predetermined value of the preload and/or an even distribution of the load will be obtained. The bore and outside diameters of the bearings of a set differ at the most by half the permissible tolerance range.

To facilitate proper mounting of sets, the bearing O.D. surface is etched with a "V" pointing in the direction of the thrust acting on the inner ring. When the thrust load acts in both directions the direction of the greater thrust should be considered. An example of marking is shown below for a triplex set.



Universal Mounting

Ball screw support bearings are manufactured so that they can be mounted in random order in back-to-back or face-to-face pairs, or triplex and quadruple sets. Regardless of the arrangement, the proper preload will be maintained. When ordering, the number of individual bearings must be specified.

Pairs of two bearings are also available with matched bore and outside diameters. Some of the sets listed in the bearing tables have this special matching.

Cages

MRC ball screw support bearings are fitted with a ball-centered cage of injection moulded polyamide 6.6. Generally, these cages may be used at temperatures up to + 110°C (230°F) although brief periods at higher temperatures will not have a detrimental effect provided they are interspersed with long periods at lower temperatures.

The lubricants normally employed with rolling bearings generally have no adverse effect on cage properties, with the exception of a few synthetic oils and greases based on such oils and some lubricants containing large proportions of EP additives, particularly at high temperatures.

Speed Ratings

The speed ratings given in the bearing tables are guideline values and apply to single bearings. Speed ratings for matched sets of 2, 3 or 4 bearings are obtained by multiplying the values given in the table by

0.80	for sets of 2 bearings
0.65	for sets of 3 bearings
0.50	for sets of 4 bearings

Tolerances

MRC ball screw support bearings are made to the tolerances shown in the table on page 50. These correspond to ABEC-7 and ISO Class 4 specifications (ISO 492) although the standards only apply to radial bearings. The values quoted refer to single bearings.

Maximum and minimum values quoted for a single diameter or height represent the permissible deviations from the nominal dimensions given in the bearing tables.

The axial runout (lateral eccentricity) of a single direction angular contact thrust ball bearing is an important parameter. For matched sets which are correctly mounted on accurately machined seatings, the axial runout will generally not exceed 0.0025 mm (.0001 inches).

Tolerances in Inches (Shaded) and Millimeters							
	Over	10	18	30	50	80	120
d,D (mm)	Incl	18	30	50	80	120	150
d_S	Max	.0000	.0000	.0000	.0000	.0000	—
		.000	.000	.000	.000	.000	
	Min	−.00015	−.00015	−.0002	−.0002	−.00025	—
		−.0038	−.0038	−.0050	−.005	−.0065	
D_S	Max	—	—	.0000	.0000	.0000	.0000
				.000	.000	.000	.000
	Min	—	—	−.0002	−.0002	−.0003	−.0004
				−.005	−.005	−.0075	−.010
B	Max	.0000	.0000	.0000	.0000	.0000	—
		.000	.000	.000	.000	.000	
	Min	−.0031	−.0047	−.0047	−.0059	−.0079	—
		−.080	−.120	−.120	−.150	−.200	
S_i, S_e	Max	.00008	.0001	.0001	.0001	.0001	.0001
		.002	.0025	.0025	.0025	.0025	.0025

Symbols

d	nominal bore diameter
d_s	single diameter of bore
D	nominal outside diameter
D_s	single diameter of outside cylindrical surface
S_i, S_e	width variation, measured from middle of raceway to back (seating face) of inner ring and outer ring, respectively (axial runout)
B	bearing width, single bearing

Preload

All bearing sets of two bearings arranged back-to-back or face-to-face are available with preload to class A and class B (Table 1). The values given in the table refer to unmounted bearing pairs, i.e. the bearing rings are free to expand. This means that after mounting the preload will increase; the greater the increase, the tighter the fit applied.

Matched sets of 3 and 4 bearings arranged back-to-back or face-to-face have a higher preload. The appropriate values can be obtained by multiplying the values given in the table by the factors in Table 2.

Axial Stiffness

Ball screw support bearings are designed for high stiffness. The actual values are given in Table 1 and apply to bearing sets of two bearings arranged back-to-back or face-to-face.

Matched sets of 3 and 4 bearings arranged back-to-back or face-to-face have a higher axial stiffness. The appropriate values can be obtained by multiplying the values given in the table by the factors in Table 2.

Friction Torque

MRC ball screw support bearings have low friction. The actual values for the torque are given in Table 1 and are valid for unmounted bearing sets of two bearings.

Matched sets of 3 and 4 bearings arranged back-to-back or face-to-face have a higher friction torque. The appropriate values can be obtained by multiplying the values given in the table by the factors in Table 2.

Table 1

MRC bearing number	Preload class A N	Preload class A lbf	Preload class B N	Preload class B lbf	Axial stiffness A N/μm	Axial stiffness A lbf/μm	Axial stiffness B N/μm	Axial stiffness B lbf/μm	Friction torque A Nm	Friction torque A lbf-ft	Friction torque B Nm	Friction torque B lbf-ft
J1232	650	146	1300	292	345	78	440	99	.016	.012	.029	.021
J1535	775	174	1550	348	408	92	522	117	.023	.017	.040	.030
J2047	1480	333	2960	665	587	132	750	169	.056	.041	.100	.074
J2552	1580	355	3160	710	632	142	807	181	.077	.057	.132	.097
J3062	2250	506	4500	1010	809	182	1036	233	.130	.096	.225	.166
J2047A	1480	333	2960	665	587	132	750	169	.056	.041	.100	.074
J2562	2400	540	4800	1080	785	176	1000	225	.120	.089	.215	.159
J3062A	2250	506	4500	1010	809	182	1036	233	.130	.096	.224	.165
J3572	2950	663	5900	1330	960	216	1228	276	.200	.148	.345	.254
J4072	2950	663	5900	1330	960	216	1228	276	.200	.148	.345	.254
J093	2400	540	4800	1080	785	176	1000	225	.120	.089	.215	.159
J175	2900	652	5800	1300	1065	239	1335	300	.255	.188	.415	.306

[1] All sizes stocked with class A except J2047 and J093 are class B. Non−stocked preloads furnished on special order.

Table 2

Set	Multiplication factors: Preload	Axial stiffness	Friction torque
3 Bearings 1 PR DT, 1/2 PR DB or DF	1.35	1.45	1.35
4 Bearings 1 1/2 PR DT, 1/2 PR DB or DF	1.60	1.80	1.55
4 Bearings 1 PR DT vs 1 PR DT Mounted DB or DF	2.00	2.00	2.00

The equivalent dynamic radial load for single bearings and any configuration of bearings in a set can be calculated from the following:

$P = Y F_A + X F_R$ when $F_A/F_R \leqq 2.17$

$P = F_A + 0.92 FR$ when $F_A/F_R > 2.17$

where,

P = equivalent dynamic radial load
F_A = thrust load (including preload)
F_R = radial load
X = radial load factor
Y = thrust load factor

The X and Y factors can be obtained from the table on the next page.

Bearing arrangement	Load carrying capacity of bearing set[1] Dynamic	Static	Calculation factors $F_A/F_R \leq 2.17$ X	Y
2 Bearings DB or DF	C	C_0	1.9	0.55
2 Bearings in Tandem (DT)	1.62 C	2 C_0	—	—
3 Bearings in Tandem (DT)	2.16 C	3 Co	—	—
3 Bearings[2] 1 Pair DT, 1/2 Pair DB or DF	1.62 C	2 C_0	2.3	0.35
4 Bearings[2] 1 1/2 Pair DT, 1/2 Pair DB or DF	2.16 C	3 C_0	2.52	0.26
4 Bearings 1 Pair DT vs 1 Pair DT Mounted DB or DF	1.62 C	2 C_0	1.9	0.55
4 Bearings in Tandem (DT)	2.64 C	4 C_0	—	—

[1] C and C_0 are the basic dynamic and static load ratings of a single bearing (see Bearing Tables).
[2] Thrust on DT set.

Equivalent Static Radial Load

The equivalent static radial load may be calculated from:

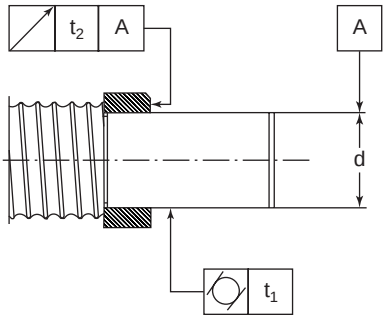
$P_0 = F_A + 4F_R$

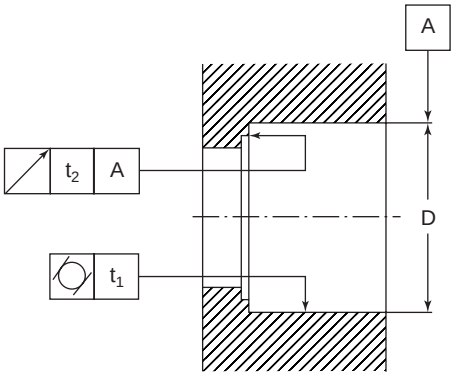
where,

P_0 = static equivalent radial load
F_A = thrust load (including preload)
F_R = radial load

The equation is also valid for single bearings and bearings arranged in tandem when the ratio F_R/F_A does not exceed 0.25, and gives satisfactory but less accurate values when F_R/F_A is more than 0.25 but less than 0.40.

Ball screw support bearings are manufactured to a high degree of accuracy and are primarily intended for the support of precision ball screws in numerically controlled machine tools and in robots. However, to achieve the desired running and positioning accuracy, the associated components must also have a corresponding precision. Deviations in dimensions from the geometrical form must be as small as possible. Recommended tolerances are shown on page 53.





Accuracy of Bearing Seatings on Spindles

Bore diameter d (mm)		Deviations				Tolerances			
		High		Low		Cylindricity runout			
						t_1		t_2	
Over	Incl	mm	in	mm	in	mm	in	mm	in
10	18	.000	.0000	−.005	−.0002	.002	.00008	.002	.00008
18	30	.000	.0000	−.006	−.00025	.0025	.0001	.0025	.0001
30	50	.000	.0000	−.007	−.00028	.0025	.0001	.0025	.0001
50	80	.000	.0000	−.008	−.0003	.003	.00012	.003	.00012
80	120	.000	.0000	−.010	−.0004	.004	.00015	.004	.00015

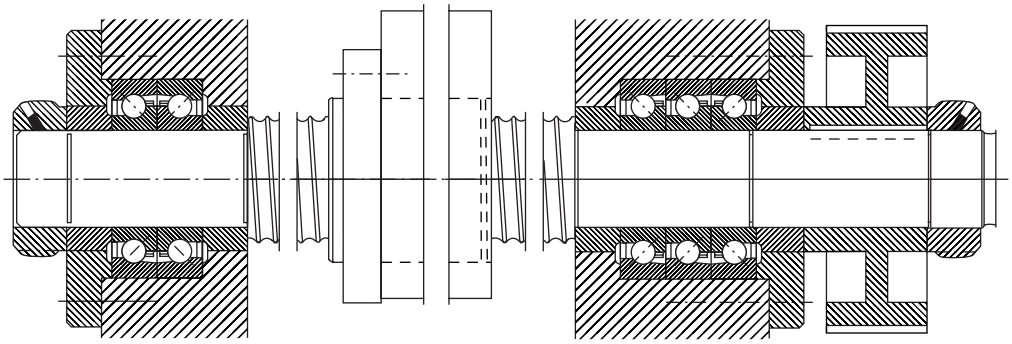
Accuracy of Bearing Seatings in Housing Bore

Outside diameter D (mm)		Deviations				Tolerances			
		Low		High		Cylindricity runout			
						t_1		t_2	
Over	Incl	mm	in	mm	in	mm	in	mm	in
—	50	.000	.0000	+.011	+.0004	.0025	.0001	.004	.00015
50	80	.000	.0000	+.013	+.0005	.003	.00012	.005	.0002
80	120	.000	.0000	+.015	+.0006	.004	.00015	.006	.00025
120	150	.000	.0000	+.018	+.0007	.005	.0002	.008	.0003

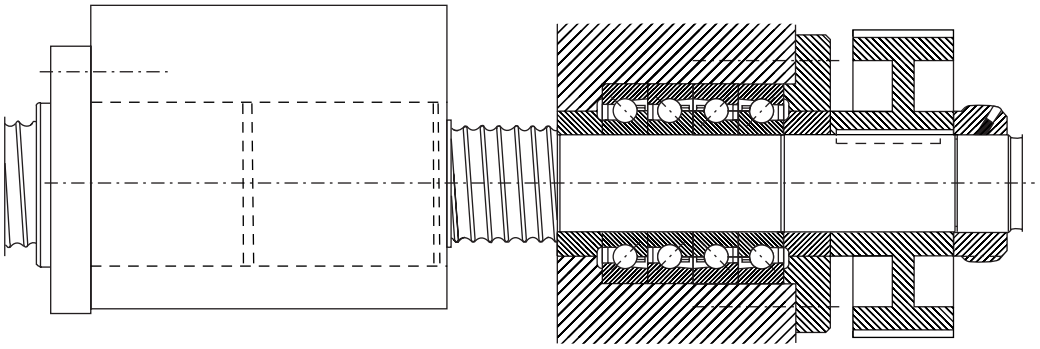
Design of Bearing Arrangement

The screws are generally supported at both ends in matched bearing sets where the bearings are arranged face-to-face or back-to-back, see drawing on next page. A one-sided support is also commonly used for short screws as illustrated in the lower drawing. Particularly stiff bearing arrangements can be achieved if the screws are mounted in tension between sets of bearings arranged in tandem and adjusted against each other.

If errors of alignment can occur it is recommended that a face-to-face arrangement of the bearings be used, as shown in the bearing arrangement examples. Because the distance between pressure center is shorter for bearings arranged face-to-face than for those arranged back-to-back, errors of alignment can be more easily accommodated.



Screw supported at both ends using a set of three bearings arranged in tandem and face-to-face and a set of two bearings arranged face-to-face



Screw supported at one end using a set of four bearings in a face-to-face arrangement

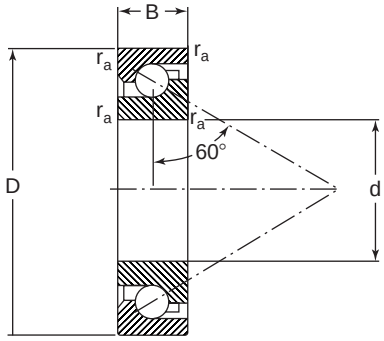
Lubrication

Ball screw support bearings can be lubricated with either grease or oil. Generally, grease lubrication is preferred as bearing arrangement design can be simple, sealing arrangements uncomplicated and maintenance requirements minimized. Good quality, rust inhibiting lithium base greases of consistency 2 to the NLGI scale with an operating temperature range of −30 to +110°C (−22 to +230°F) are suitable. As a rule, a "normal" filling grade (25 to 35% of the free space in the bearing) is recommended; the actual quantities are given in the table on the right.

MRC bearing number	Grease quantity corresponding to percentage of free space (Grams)			
	10–15%	25–35%	45–60%	70–100%
J1232	0.1–0.2	0.3–0.4	0.5–0.7	0.8–1.2
J1535	0.15–0.2	0.35–0.5	0.6–0.9	1.0–1.4
J2047	0.35–0.5	0.9–1.2	1.6–2.1	2.4–3.5
J2552	0.45–0.7	1.1–1.5	2.0–2.6	3.0–4.4
J3062	0.6–0.9	1.4–2.0	2.6–3.5	4.0–5.8
J2047A	0.4–0.6	1.0–1.3	1.7–2.3	2.7–3.8
J2562	0.5–0.8	1.3–1.9	2.4–3.2	3.7–5.3
J3062A	0.5–0.8	1.3–1.9	2.4–3.2	3.7–5.3
J3572	0.6–0.9	1.5–2.1	2.7–3.7	4.3–6.1
J4072	0.6–0.9	1.5–2.1	2.7–3.7	4.3–6.1
J093	0.6–0.9	1.4–2.0	2.6–3.4	4.0–5.7
J175	0.7–1.1	1.8–2.5	3.2–4.3	5.0–7.1

MRC

Single Direction Angular Contact Ball Screw Support Bearings



MRC Bearing Number	Bore d		Outside Diameter D		Width B		Fillet[1] Radius r_a		Basic Radial Load Rating Dynamic $C^{2)}$		Basic Radial Load Rating Static C_0		Maximum Thrust Load		Speed Rating Grease	Speed Rating Oil
	mm	in	mm	in	mm	in	mm	in	N	lbf	N	bf	N	lbf	RPM	RPM
J1232	12	.4724	32	1.2598	10	.3937	0.6	.024	11200	2520	15600	3510	7250	1630	12000	16000
J1535	15	.5906	35	1.3780	11	.4331	0.6	.024	12100	2720	18600	4180	8500	1910	11000	15000
J2047	20	.7874	47	1.8504	14	.5512	1.0	.039	21200	4770	35500	7980	19500	4380	8200	11000
J2047A	20	.7874	47	1.8504	15	.5906	1.0	.039	21200	4770	5500	7980	19500	4380	8200	11000
J093	23.838	.9385	61.999	2.4409	15.875	.6250	1.0	.039	32500	7310	58500	13200	36000	8090	6900	9300
J2552	25	.9843	52	2.0472	15	.5906	1.0	.039	21600	4860	38000	8540	20800	4680	7500	10000
J2562	25	.9843	62	2.4409	15	5906	1.0	.039	32500	7310	58500	13200	36000	8090	7200	9600
J3062	30	1.1811	62	2.4409	16	.6299	1.0	.039	28100	6320	54000	12100	31500	7080	6900	9300
J3062A	30	1.1811	62	2.4409	15	.5906	1.0	.039	28100	6320	54000	12100	31500	7080	7200	9600
J3572	35	1.3780	72	2.8346	15	.5906	1.0	.039	35100	7890	71000	16000	42750	9610	6600	8900
J4072	40	1.5748	72	2.8346	15	.5906	1.0	.039	35100	7890	71000	16000	42750	4270	6600	8900
J175	44.475	1.7510	76.2	3.0000	15.875	.6250	1.0	.039	31200	7010	69500	15600	40200	9040	6300	8400

[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 (Rating for single bearing).