

## TAPERED ROLLER BEARINGS

### Metric Design Single-Row Tapered Roller Bearings

Bore Diameter 100 – 1 900mm ..... B102

### Inch Design Single-Row Tapered Roller Bearings

Bore Diameter 100.000 – 1 270.000mm ..... B114  
The index for inch design tapered roller bearings is in an appendix (Page C62~C61).

### Double-Cup Type Tapered Roller Bearings

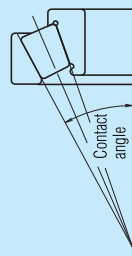
Bore Diameter 100 – 2 000mm ..... B182  
KBE (TDO)  
Bore Diameter 100 – 1 450mm ..... B246  
KDE (TDO)  
KF (TNA)  
Bore Diameter 101.600 – 406.400mm ..... B252

### Double-Cone Type Tapered Roller Bearings

Bore Diameter 100 – 1 290mm ..... B262  
KH (TDI)  
Bore Diameter 100 – 540mm ..... B282  
KDH (TDI)

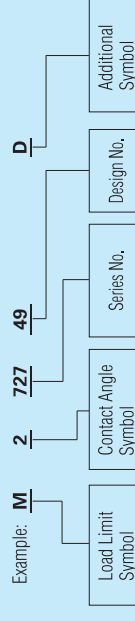
### Design, Types, and Features

Tapered roller bearings are designed so the apices of the cones formed by the raceways of the cone and cup and the conical rollers all coincide at one point on the axis of the bearing. When a radial load is imposed, an axial force component occurs; therefore, it is necessary to use two bearings in opposition or some other multiple arrangement.



Among the metric design tapered roller bearings with high load capacity (HR series), some bearings have the basic number suffixed by J to conform to the specifications of ISO for the cup back face raceway diameter, cup width, and contact angle. Therefore, the cone assembly and cup of bearings with the same basic number suffixed by J are internationally interchangeable.

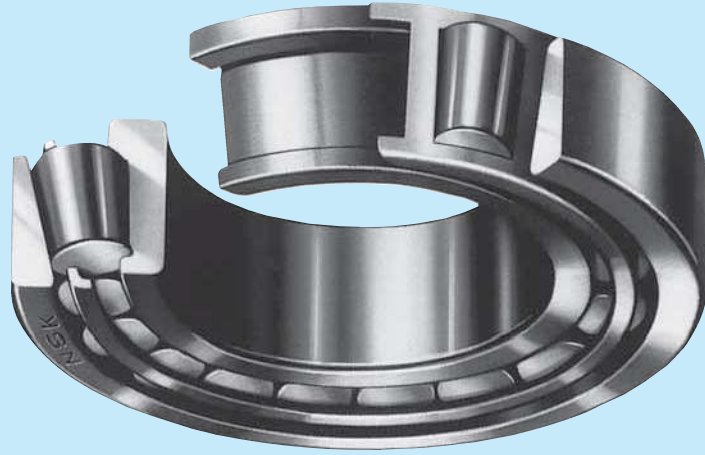
For the cone assemblies and cups of inch design tapered roller bearings, except four-row bearings, the bearing numbers are approximately formulated as follows:



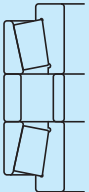
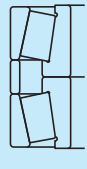
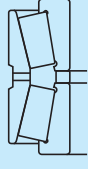
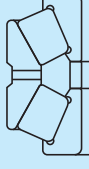
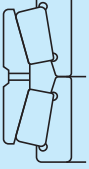
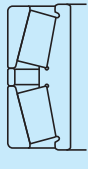
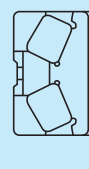
For tapered roller bearings, besides single-row bearings, there are also various combinations of bearings as listed in Table 1.

The cages of tapered roller bearings are either pressed steel or pin type.

Regarding four-row tapered roller bearings for roll necks, refer to page B344.



**Table 1 Design and Features of Combinations of Tapered Roller Bearings**

Figure	Arrangement	Examples of Bearing No.	Features
	Back-to-back DB	HR32220JDB+KLR20	Two standard bearings are combined. The bearing internal clearances are adjusted by cone spacers or cup spacers. The cones and cups and spacers are marked with serial numbers and matching symbols. Components with the same serial number can be assembled referring to the matching symbols.
	Face-to-face DF	HR32220JDF+KR	
	KBE(TDO)	100KBE31+L	This type of bearing consists of a double cup and two cone assemblies and a cone spacer. The bearing internal clearance has already been set using the cone spacer, and parts must be combined according to the serial number and matching symbol. The double cup has an oil groove and holes. The KBE type can carry both radial and axial loads, so it can be used as a fixed-end bearing. This is also used frequently on the free end by relieving the shaft elongation/contraction between the cup and housing. This type is basically the same as the back-to-back combination (DB combination) with two single-row tapered roller bearings coupled using cone and cup spacers, but is easier to handle because of fewer parts. This type of bearing is recommended where rigidity is required and strong moments exist.
	KDE(TDO)	100KDE1801+L	This type of bearing is equivalent to the KBE type but with a steeper contact angle. This is used when the axial load is larger than the radial load. The bearing internal clearance has already been set using a cone spacer. The bearing must be assembled according to the serial number and matching symbols.
	KF(TNA)	100KF1701	This type of bearing has one double cup and two cone assemblies. The two cones are in contact face-to-face and there is no cone spacer. Since the bearing internal clearance has already been set, the various parts must be assembled by observing the serial number and matching symbols.
	KH(TDI)	110KH31+K	This type of bearing consists of a double cone assembly and two cups and a cup spacer. Since the bearing internal clearance has already been set using the cup spacer, the parts must be combined according to the serial number and matching symbols. The cup spacer has an oil groove and holes. Since the depth of the oil groove is limited, it is desirable to also provide an oil groove inside the housing.
	KDH(TDI)	100KDH2101+K	This type of bearing is a double-row tapered roller bearing with the rows facing inward but the contact angle is steeper than in the KH type. This consists of a double cone assembly, two cups, and a cup spacer. This is recommended when the axial load is larger than the radial load or an axial load only exists. In certain cases, a spring is provided between the housing shoulder and cup end face for preloading (without using a cup spacer).

**Tolerances and Running Accuracy**

Metric Design Tapered Roller Bearings..... Table 2.3 (Pages A20 to A23)  
 Inch Design Tapered Roller Bearings..... Table 2.4 (Pages A24 to A25)  
 Inch design tapered roller bearings of J-line (in the bearing tables, bearings preceded by ▲ ) conform to the following tables. Symbols in the tables are described on page A15. Please contact NSK for details.

**Table 2 Tolerances for Cones (Class K)**

Nominal Bore Diameter <i>d</i> (mm)	$\Delta d_{mp}$		$V_{dp}$	$V_{dmp}$	$K'_{ia}$
	high	low			
over	incl		max.	max.	max.
80	120	0	20	15	30
120	180	0	25	19	35
180	250	0	30	23	50
250	315	0	35	26	60
315	400	0	40	30	70

**Table 3 Tolerances for Cups (Class K)**

Nominal Outside Diameter <i>D</i> (mm)	$\Delta D_{mp}$		$V_{Dp}$	$V_{Dmp}$	$K'_{ea}$
	high	low			
over	incl		max.	max.	max.
80	120	0	18	14	35
120	150	0	20	15	40
150	180	0	25	19	45
180	250	0	30	23	50
250	315	0	35	26	60
315	400	0	40	30	70
400	500	0	45	34	80

**Table 4 Tolerances for Effective Width of Cone Assemblies and Cups and Bearing Width (Class K)**

Nominal Bore Diameter <i>d</i> (mm)	Cone Assembly Effective Width Deviation $\Delta I_{Ts}$		Cup Effective Width Deviation $\Delta I_{Tcs}$		Bearing Width Deviation $\Delta I_{Ts}$
	high	low	high	low	
over	incl		high	low	high
80	120	+100	+100	-100	+200
120	315	+150	+200	-100	+350
315	400	+200	+200	-200	+400

## Recommended Fits

**Metric Design Tapered Roller Bearings** .....Table 3.2 (Page A35)

Table 3.4 (Page A36)

**Inch Design Tapered Roller Bearings** .....Table 3.6 (Page A37)

Table 3.7 (Page A38)

**Internal Clearances** .....Table 3.13 (Page A43)

**Metric Design Tapered Roller Bearings  
(Matched and Double-Row)**

**Inch Design Tapered Roller Bearings  
(Matched and Double-Row)**

## Dimensions Related to Mounting

The abutment and fillet dimensions for tapered roller bearings and listed in the bearing tables. Since the cages protrude from the ring face of tapered roller bearings, please use care when designing shafts and housings.

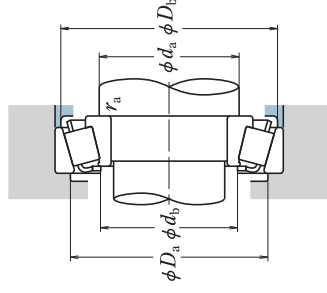
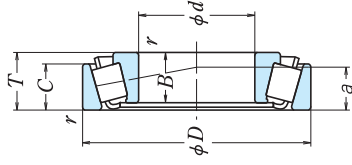
When heavy axial loads are imposed, the shaft shoulder dimensions and strength must be sufficient to support the cone rib.

## Permissible Misalignment

The permissible misalignment angle for single-row tapered roller bearings is approximately 0.0009 radian (3').

## Precautions for Use of Tapered Roller Bearings

1. If the load of tapered roller bearings becomes too small, or if the ratio of the axial and radial loads for matched bearings exceeds  $\epsilon'$  ( $\epsilon'$  is listed in the bearing tables) during operation, slippage between the rollers and raceways occurs, which may result in smearing. Especially with large bearings since the weight of the rollers and cage is high. If such load conditions are expected, please consult with **NSK** for selection of the bearings.
2. Confirm Abutment and Fillet Dimensions  $D_a$  and  $D_b$  at the time of the HR series adoption.



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

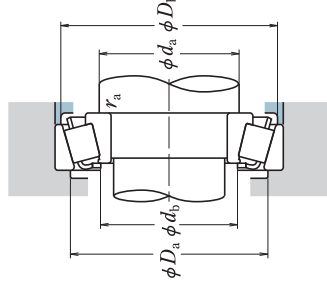
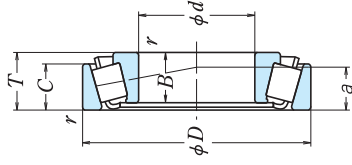
$F_r/F_r \leq e$		$F_r/F_r > e$	
X	Y	X	Y
1	0	0.4	$Y_1$

Static Equivalent Load

$P_0 = 0.5F_r + Y_0F_a$   
 When  $F_r > 0.5F_r + Y_0F_a$ , use  $P_0 = F_r$   
 The values of  $e$ ,  $Y_1$ , and  $Y_0$  are given in the table below.

d	Boundary Dimensions (mm)				Basic Load Ratings (kgf)				Bearing Numbers
	D	T	B	C	$C_r$	$C_{0r}$	$C_r$	$C_{0r}$	
100	140	25	25	20	117	205	12 000	20 900	HR32920J
	145	24	22.5	17.5	113	163	11 500	16 600	T4CB100
	150	32	32	24	176	294	17 900	30 000	HR32020XJ
	180	37	34	29	255	330	26 000	34 000	HR30220J
	180	40	46	39	325	450	33 000	46 000	HR32220J
	215	51.5	47	39	425	525	43 000	53 500	HR30320J
	215	77.5	73	60	565	755	57 500	77 000	HR32320J
	145	25	25	20	119	212	12 100	21 600	HR32921J
	160	35	35	26	204	340	20 800	34 500	HR32021XJ
	190	39	36	30	280	365	28 500	37 500	HR30221J
105	190	53	50	43	360	510	37 000	52 000	HR32221J
	225	53.5	49	41	455	565	46 500	57 500	HR30321J
	225	81.5	77	63	670	925	68 000	94 500	HR32321J
	150	25	25	20	123	224	12 500	22 800	HR32922J
	170	38	38	29	236	390	24 000	40 000	HR32022XJ
	200	41	38	32	315	420	32 000	43 000	HR30222J
	200	56	53	46	400	565	40 500	57 500	HR32222J
	240	54.5	50	42	485	595	49 500	60 500	HR30322J
	240	84.5	80	65	675	910	68 500	93 000	HR32322J
	120	165	29	29	23	161	291	16 400	29 700
170		27	25	19.5	153	243	15 600	24 800	T4CB120
180		38	38	29	242	405	24 600	41 000	HR32024XJ
215		43.5	40	34	335	450	34 000	46 000	HR30224J
215		61.5	58	50	440	635	44 500	65 000	HR32224J
260		59.5	55	46	535	655	54 500	67 000	HR30324J
260		90.5	86	69	770	1 060	78 500	108 000	HR32324J
180		32	32	25	200	365	20 400	37 500	HR32926J
200		45	45	34	320	535	32 500	54 500	HR32026XJ
230		43.75	40	34	375	505	38 000	51 500	HR30226J
130	230	67.75	64	54	530	790	54 000	80 500	HR32226J
	280	63.75	58	49	650	820	66 000	83 500	HR30326J
	280	98.75	93	78	830	1 150	84 500	117 000	32326

Abutment and Fillet Dimensions (mm)				Efr. Load Centers (mm)	Constant	Axial Load Factors		Mass (kg)
$d_a$	$d_b$	$D_a$	$D_b$			$Y_1$	$Y_0$	
112	106	131	136	24.2	0.33	1.8	1.0	1.18
114	106	133	141	30.1	0.47	1.3	0.70	1.18
115	106	138	146	32.5	0.46	1.3	0.72	1.95
121	110	163	172	36.1	0.42	1.4	0.79	3.78
122	110	161	174	41.5	0.42	1.4	0.79	5.05
129	119	193	202	41.4	0.35	1.7	0.96	8.41
130	114	190	206	53.2	0.35	1.7	0.96	12.7
117	111	136	141	25.3	0.34	1.8	0.96	1.23
122	112	146	155	34.3	0.44	1.4	0.74	2.48
127	116	172	182	38.1	0.42	1.4	0.79	4.52
128	115	170	183	44.8	0.42	1.4	0.79	6.26
136	124	202	212	43.2	0.35	1.7	0.96	9.52
136	122	199	213	55.2	0.35	1.7	0.96	14.9
122	116	141	146	26.5	0.36	1.7	0.93	1.29
128	117	156	165	35.9	0.43	1.4	0.77	3.09
134	121	181	192	40.1	0.42	1.4	0.79	5.28
135	121	179	193	47.2	0.42	1.4	0.79	7.35
143	129	216	228	45.1	0.35	1.7	0.96	11
144	127	213	229	58.5	0.35	1.7	0.96	17.1
133	126	155	161	29.2	0.35	1.7	0.95	1.8
136	126	157	166	35.0	0.47	1.3	0.70	1.78
138	127	165	175	39.7	0.46	1.3	0.72	3.27
145	132	195	206	44.4	0.44	1.4	0.76	6.28
146	131	192	208	52.0	0.44	1.4	0.76	9.0
150	139	234	247	50.0	0.35	1.7	0.96	13.9
155	137	230	248	62.4	0.35	1.7	0.96	21.8
145	138	168	174	31.4	0.34	1.8	0.97	2.46
151	139	184	195	43.9	0.43	1.4	0.76	5.06
157	146	210	220	45.8	0.44	1.4	0.76	7.25
158	143	205	221	56.9	0.44	1.4	0.76	11.3
167	149	252	265	52.7	0.35	1.7	0.96	16.6
172	150	248	269	69.2	0.36	1.7	0.92	26.6



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$F_r/F_a \leq e$		$F_r/F_a > e$	
X	Y	X	Y
1	0	0.4	$Y_1$

Static Equivalent Load

$$P_0 = 0.5F_r + Y_0F_a$$

When  $F_r > 0.5F_r + Y_0F_a$ , use  $P_0 = F_r$ .  
The values of  $e$ ,  $Y_1$ , and  $Y_0$  are given in the table below.

d	Boundary Dimensions (mm)					Basic Load Ratings (kgf)				Bearing Numbers
	D	T	B	C	min.	C <sub>r</sub>	C <sub>0r</sub>	C <sub>r</sub>	C <sub>0r</sub>	
140	190	32	32	25	2	21 000	39 500	HR32928J		
	210	45	45	34	2.5	33 000	57 000	HR32028KJ		
	250	45.75	42	36	4	40 000	52 500	HR30228J		
	250	71.75	68	58	4	61 000	93 500	HR32228J		
	300	67.75	62	53	5	75 500	96 500	HR30328J		
150	300	107.75	102	85	5	140 000	147 000	32328		
	210	38	30	2.5	2	28 000	53 000	HR32930J		
	225	48	48	36	3	37 500	66 500	HR32030KJ		
	270	49	45	38	4	46 500	67 500	HR30330J		
	270	77	73	60	4	71 500	110 000	HR32330J		
160	320	72	65	55	5	84 500	108 000	HR30330J		
	320	114	108	90	5	114 000	174 000	32330		
	220	38	30	2.5	2	30 000	58 000	HR32932J		
	240	51	51	38	3	43 500	76 500	HR32032KJ		
	290	52	48	40	4	47 500	62 000	30232		
170	290	84	80	67	4	81 000	125 000	HR32332J		
	340	75	68	58	5	118 000	170 000	HR30332J		
	340	121	114	95	5	170 000	230 000	32332		
	230	38	30	2.5	2	30 000	57 000	HR32934J		
	260	57	57	43	3	50 500	90 500	HR32034KJ		
180	310	57	52	43	5	69 000	70 500	30234		
	310	91	86	71	5	94 500	148 000	HR32334J		
	360	80	72	62	5	103 000	134 000	HR32334J		
	360	127	120	100	5	140 000	209 000	32334		
	250	45	45	34	2.5	36 000	69 500	HR32936J		
190	280	64	64	48	3	64 000	115 000	HR32036KJ		
	320	57	52	43	5	53 000	70 500	30236		
	320	91	86	71	5	98 000	157 000	HR32336J		
	380	83	75	64	5	123 000	176 000	HR32336J		
	380	134	126	106	5	155 000	234 000	32336		
190	360	45	45	34	2.5	37 000	73 000	HR32938J		
	290	64	64	48	3	66 000	119 000	HR32038KJ		
	340	60	55	46	5	79 000	80 500	30238		
	340	97	92	75	5	113 000	181 000	HR32338J		
	400	86	78	65	6	134 000	196 000	HR30338		
400	140	132	109	5	169 000	263 000	32338			

d <sub>a</sub>	Abutment and Fillet Dimensions (mm)					Efr. Load Centers (mm)	Constant	Axial Load Factors		Mass (kg)
	d <sub>b</sub>	D <sub>a</sub>	D <sub>b</sub>	CONE r <sub>a</sub> max.	CUP r <sub>a</sub> max.			Y <sub>1</sub>	Y <sub>0</sub>	
155	148	178	184	2	1.5	33.6	0.36	1.7	0.92	2.64
161	148	193	205	2	2	46.6	0.46	1.3	0.72	5.32
169	154	228	240	3	2.5	48.9	0.44	1.4	0.76	8.74
178	150	224	242	3	2.5	60.5	0.44	1.4	0.76	14.3
185	150	269	284	4	3	55.7	0.35	1.7	0.96	21.1
185	161	265	288	4	3	76.4	0.37	1.6	0.88	33.9
168	160	196	203	2	2	36.5	0.33	1.8	1.0	4.05
173	159	206	219	2.5	2	49.8	0.46	1.3	0.72	6.6
180	164	245	258	3	2.5	51.3	0.44	1.4	0.76	11.2
183	166	241	259	3	2.5	64.7	0.44	1.4	0.76	17.8
192	178	288	301	4	3	60.0	0.35	1.7	0.96	25
198	173	282	306	4	3	81.5	0.37	1.6	0.88	41.4
170	170	206	213	2	2	38.7	0.35	1.7	0.95	4.32
184	169	221	234	2.5	2	53.0	0.46	1.3	0.72	7.93
195	178	266	279	3	2.5	55.0	0.43	1.4	0.77	13.1
195	177	259	278	3	2.5	70.5	0.44	1.4	0.76	22.7
203	182	307	323	4	3	62.9	0.35	1.7	0.96	29.2
210	183	301	327	4	3	87.1	0.37	1.6	0.88	48.3
187	179	215	223	2	2	41.7	0.38	1.6	0.86	4.44
196	180	239	253	2.5	2	56.6	0.44	1.4	0.74	10.6
207	189	282	297	4	3	59.8	0.43	1.4	0.77	16.1
209	185	276	300	4	3	76.4	0.44	1.4	0.76	28
214	194	325	342	4	3	67.3	0.35	1.7	0.96	36.4
222	194	319	346	4	3	91.3	0.37	1.6	0.88	57
201	189	231	242	2	2	53.9	0.48	1.3	0.69	6.56
208	192	257	272	2.5	2	60.4	0.42	1.4	0.78	14.3
215	199	291	306	4	3	62.1	0.44	1.4	0.74	16.6
219	199	285	307	4	3	78.8	0.45	1.3	0.73	29.8
230	209	343	360	4	3	72.4	0.36	1.7	0.92	39.3
232	205	336	364	4	3	96.6	0.37	1.6	0.88	66.8
210	199	241	252	2	2	55.3	0.48	1.3	0.69	6.83
219	202	267	283	2.5	2	63.3	0.44	1.4	0.75	14.9
230	212	311	326	4	3	62.7	0.40	1.5	0.82	20.1
231	209	305	327	4	3	80.5	0.44	1.4	0.76	35.2
243	222	362	380	5	4	76.1	0.36	1.7	0.92	46
249	220	355	385	5	4	102.7	0.37	1.6	0.88	78.9

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[593033](#) [593058](#) [593072](#) [593564100](#) [593575](#) [593591](#) [593593](#) [LTI506SBLAMNBL](#) [CRCW08052740FRT1](#) [LUC-012S070DSM](#) [LUC-](#)  
[018S070DSP](#) [599-2021-3-NME](#) [599-JJ-2021-03](#) [00-5080-YWPP](#) [5E4750/01-20R0-T/R](#) [LW1A-L1-GD](#) [LW1A-L1-GL](#) [LW1A-P1-GD](#) [LW1L-](#)  
[A1C10V-GL](#) [LW1L-M1C70-A](#) [0202-0173](#) [00-9089-RDPP](#) [CRCW2010331JR02](#) [01-1003W-8/32-10](#) [601-GP-08-KT39](#) [601-JJ-06](#) [601-SPB](#)  
[601YSY](#) [602-JJ-03](#) [602SPB](#) [602Z](#) [603-JJ-07-FP](#) [603-JJY-04](#) [604J](#)