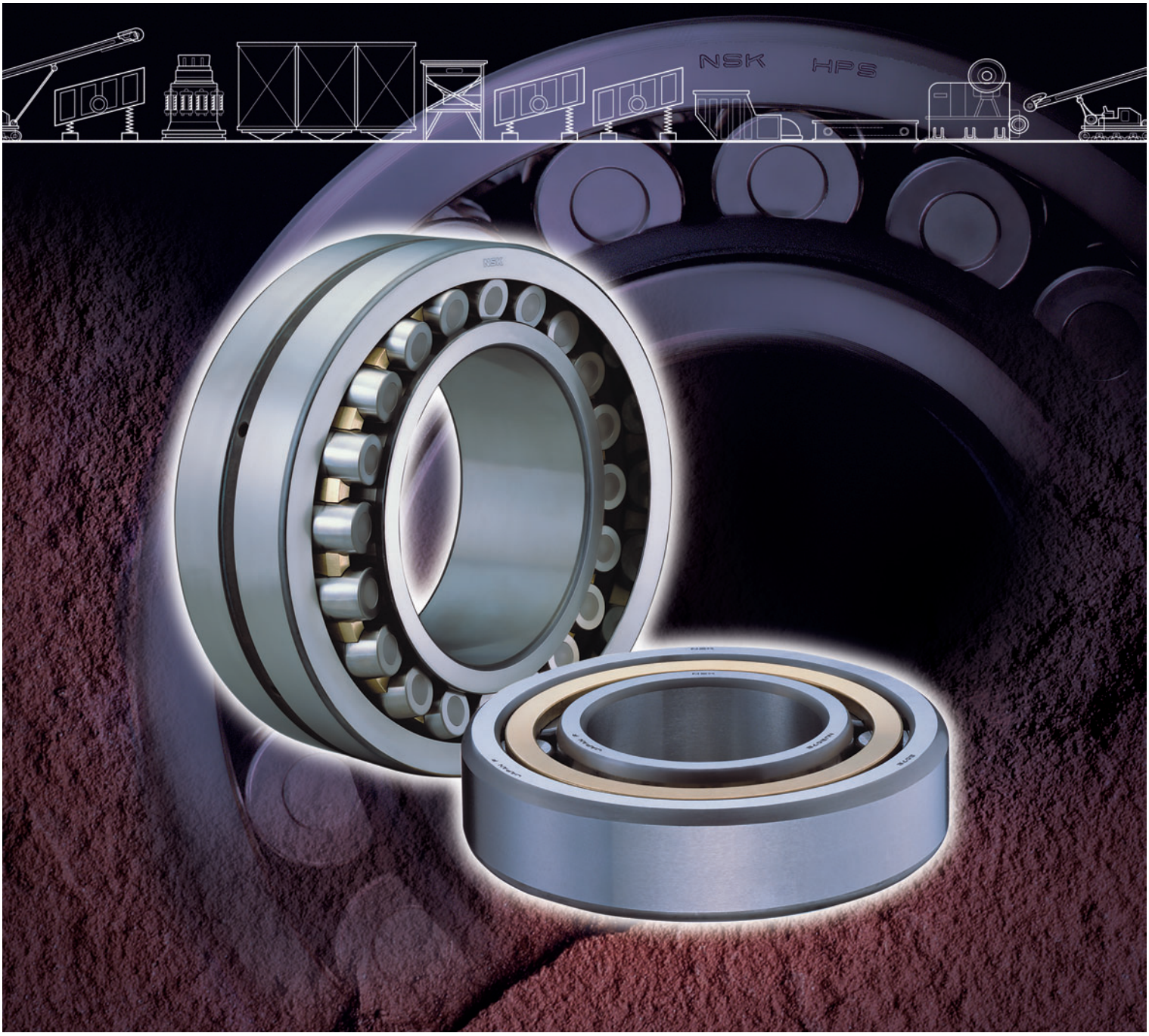
MOTION & CONTROL™

NSK

Bearings for Mining Machinery

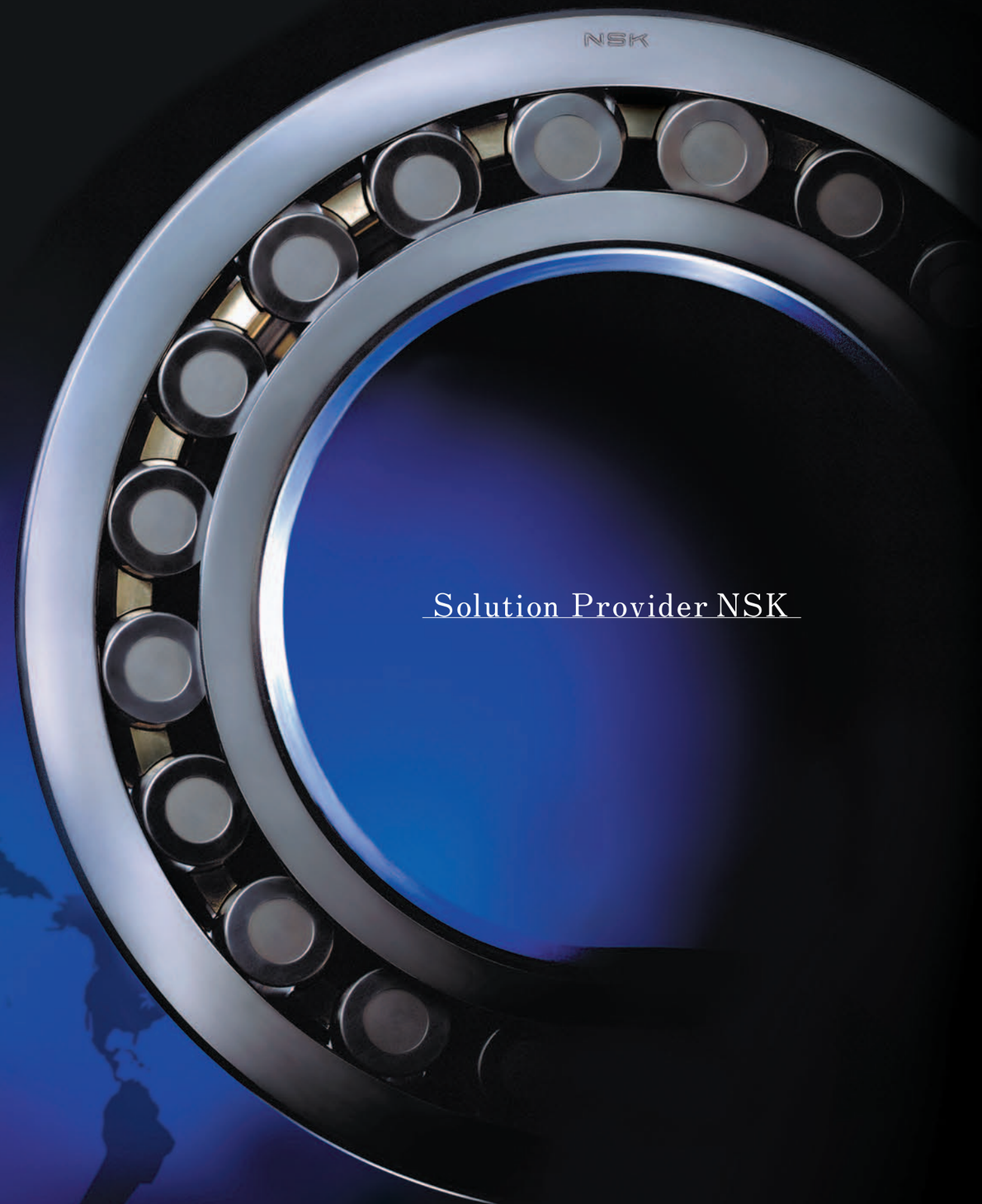
Tough bearings offer longer service life under demanding mining conditions through NSK's wealth of outstanding technologies.

Choose NSK



The NSK brand, recognized around the world

From home electric appliances, automobiles, and large-scale equipment to the aerospace industry—NSK bearings are used in an extensive range of fields. NSK established its global-scale enterprise on technology that has met the exacting requirements of Japanese industry. We have also established R&D systems and support services to meet the diverse needs of our customers throughout the world.
As a brand recognized around the world, NSK continues to lead the industry with its technical prowess.



Solution Provider NSK

NSK is on the move, across the globe

Headquarters

Japan
- Tokyo

North and South America
- Ann Arbor

Europe
- Maidenhead

Asia
- Shanghai
- Singapore

Technical offices

Japan
- Fujisawa
- Maebashi

North and South America
- Ann Arbor

Europe
- Newark
- Kielce

Asia
- Kunshan

Plants

Japan
- Fujisawa
- Hanyu
- Otsu
- Konan
- Takasaki
- Haruna
- Maebashi
- Tanakura
- Ukiha

North America
- Ann Arbor
- Clarinda
- Franklin
- Liberty
- Bennington

South America
- Suzano

Europe
- Peterlee
- Newark
- Kielce
- Munderkingen
- Torino

Asia
- Kunshan
- Anshun
- Dongguan
- Zhangjiagang
- Suzhou
- Changshu
- Chennai
- Jakarta
- Changwon
- Balakong
- Chonburi
- Chachoengsao

Sales offices

Japan
- Tokyo
- Nagoya
- Osaka
- 27 other offices

North America
- Ann Arbor
- Indianapolis
- Chicago
- San Jose
- Los Angeles
- Bennington
- Miami
- Atlanta
- Montreal
- Toronto
- Vancouver

South America
- Buenos Aires
- Sao Paulo
- Belo Horizonte
- Joinville
- Porto Alegre
- Recife
- Mexico City

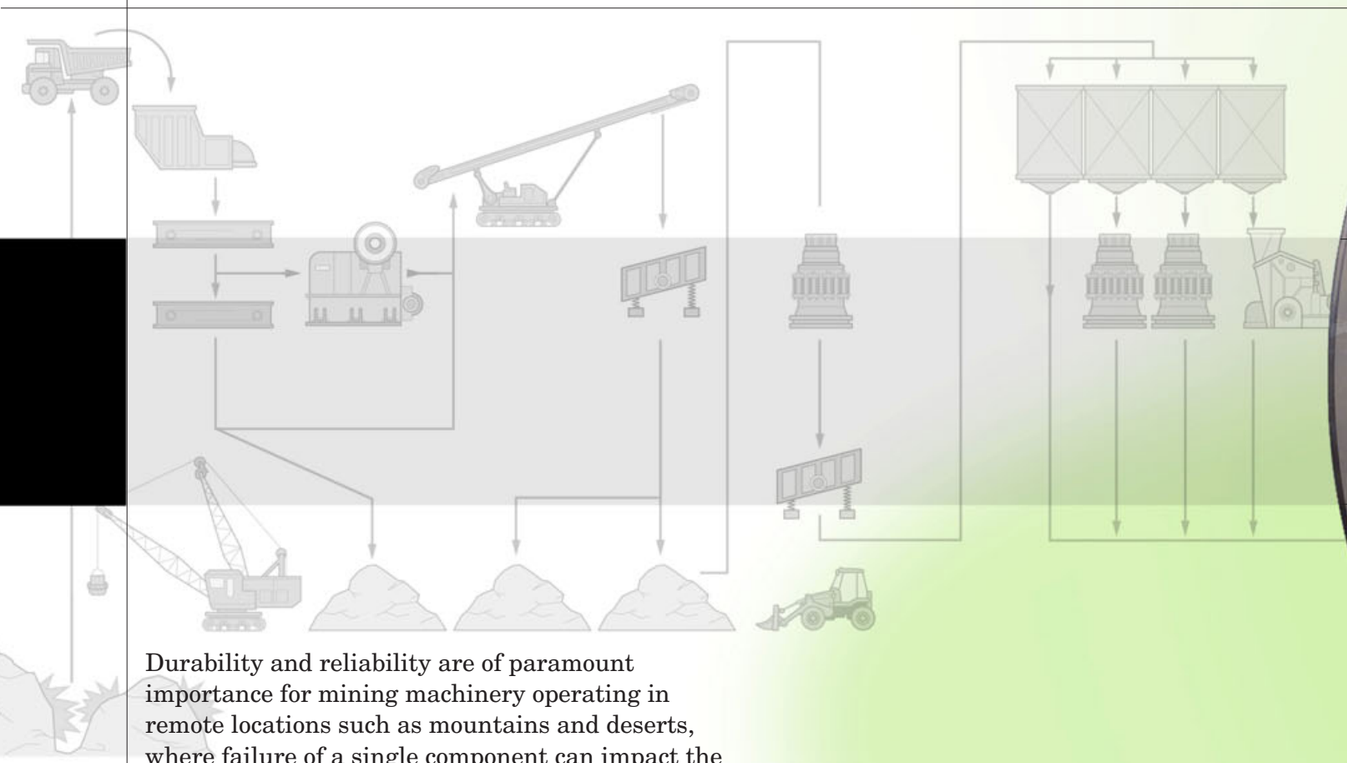
Europe
- Maidenhead
- Newark
- Coventry
- Paris
- Dusseldorf
- Stuttgart
- Leipzig
- Milano
- Tilburg
- Barcelona
- Warsaw
- Istanbul

Africa
- Johannesburg

Asia
- Beijing
- Shanghai
- Guangzhou
- Anshun
- Chengdu
- Hong Kong
- Taipei
- Taichung
- Tainan
- Seoul
- Chennai
- Jakarta
- Manila
- Bangkok
- Kuala Lumpur
- Prai
- Johor Bahru
- Kota Kinabalu
- Singapore

Oceania
- Melbourne
- Sydney
- Brisbane
- Adelaide
- Perth
- Auckland

NSK bearings offer mine operators longer service life under the most challenging operating conditions to maximize uptime and reduce maintenance costs for improved productivity at mining sites.

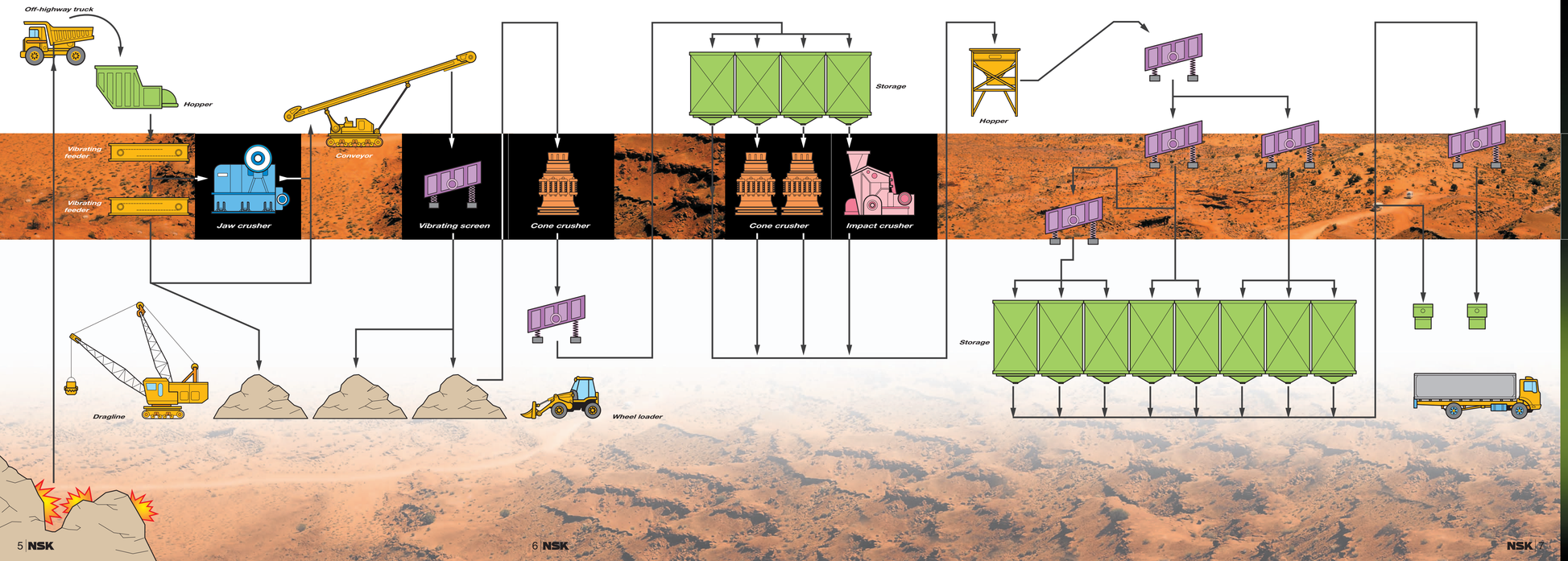


Durability and reliability are of paramount importance for mining machinery operating in remote locations such as mountains and deserts, where failure of a single component can impact the entire mining operation.
NSK has applied state-of-the-art technology to exceed the life and limiting speed of conventional bearings. Our superior bearings offer higher limiting speed and longer operating life, thereby reducing maintenance costs for mine operators.

CRUSH GRIND SCREEN BLAST

砕、挽、篩、撃

NSK bearings support construction machinery for the challenging task of raising efficiency and productivity of operations under harsh environments.



Jaw Crusher

Work material is crushed between two opposing jaw plates. One plate opens and shuts, crushing raw material against the stationary jaw plate.

Cone Crusher

Material is fed into the crusher cavity and processed by the eccentric rotating action of the inner cone against the outer cone. Work can be reduced to a diameter ranging from 50 mm to 100 mm.

Vibrating Screen

The vibrating screen consists of a case with a shaft and housing installed inside, with springs supporting the case. The swing and rotation of the shaft is produced by the attached unbalanced weight, which generates vibration. This vibration sifts the material set on the screen on the top of the case.

Impact Crusher

As indicated by its name, this machine crushes ore through impact, and steadily reduces the size of the crushed particles through sharp, repeated impact with a rapidly spinning hammer, steel plate, or stick.

A Product Line that Matches Specific Applications

CA series bearings are double-row self-aligning spherical roller bearings with a machined brass cage that have a high load capacity, superior durability, and are resistant to wear. The CA series are especially suitable for applications that operate under heavy or shock load conditions.

CA Series Spherical Roller Bearings

CA-VS series bearings are CA series bearings that have been optimized for harsh vibrating applications, including vibrating screens and feeders.

CA-VS Series Spherical Roller Bearings

HPS series bearings are double-row self-aligning spherical roller bearings capable of carrying heavy radial loads with moderate axial loads in either direction. The spherical profile of the rollers, the inner ring raceway, and the outer ring raceway, enable a self-aligning function that allows full capacity loading. The HPS series offers high performance standard-size bearings with longer operating life and higher limiting speeds than conventional bearings.

HPS. Spherical Roller Bearings

EM and EW series bearings are cylindrical roller bearings capable of carrying particularly large radial loads and are suitable for high-speed applications. The EW series features a pressed steel cage and the EM series features a one-piece machined brass cage. Both cages offer high-load capacity for standard-size bearings, in addition to excellent functionality and longer operating life.

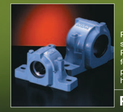
EW/EM Series Cylindrical Roller Bearings

Hi-TF bearings were developed with innovative materials and heat treatment technology for increased durability under harsh conditions. They combine long service life with good resistance to wear and seizure even under contaminated lubrication to achieve outstanding cost performance.

Hi-TF Bearings

Full-complement double-row cylindrical roller bearings featuring a thin-section profile and broad width specially designed for crane rope sheaves. Other applications include machinery operated at low-speed under a high load. These non-separable bearings can withstand heavy shock loads and moment loads, and have sufficient axial load capacity for use in sheaves.

Full-Complement Cylindrical Roller Bearings for Sheaves



Plummer blocks are bearing housings that provide high rigidity and sealing capability for large machinery and heavy load applications. Plummer blocks are available in a wide range of types and models for various applications. The two global-standard types of plummer blocks, N and SD, are available from NSK for large-scale heavy-load applications.

Plummer Blocks

CA-VS Series Spherical Roller Bearings

The CA series is a standard-size bearing with a machined brass cage, tough and wear-resistant capabilities, and is ideal for applications operating under heavy or shock load conditions. NSK offers the U15 and VS units specifically for vibrating screens, feeders, and other vibrating applications.

Features

- Highly resistant to heavy or shock loads.
- Long service life for vibrating applications.

- Excellent self-aligning ability.
- Preventive measure against shaft deflection.

Easy to install

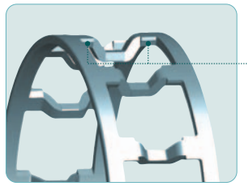
EW/EM Series Cylindrical Roller Bearings

The EW and EM series of high-load capacity, standard-size cylindrical roller bearings deliver outstanding performance across a wide range of applications. High-load capacity is achieved by using more rollers than conventional bearings based on an innovative NSK concept. We also offer standard-size cylindrical roller bearings for today's needs that provide longer service life and low-noise and low-vibration performance through an optimally designed one-piece cage with high rigidity and low wear.
This cage feature is incorporated in the EW series as a pressed steel cage and in the EM series as a one-piece machined brass cage.

EW Series (pressed cage)

Features Compared to the NSK's conventional type:

- Approximately **twice** the bearing life
- **30**% to **40**% **less** noise and vibrations
- Cage strength increased **1.5** to **2 times**
- **10**% to **25**% **higher** limiting speed



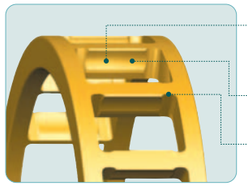
Series offers bearing inner bore dimensions ranging from 25 mm to 65 mm

Catalog No. E1238

EM Series (machined cage)

Features Compared to the NSK's conventional type:

- Approximately **twice** the bearing life
- **50**% to **60**% **less** noise and vibrations
- **Enhanced** cage strength



High precision cage

Series offers bearing inner bore dimensions ranging from 25 mm to 200 mm

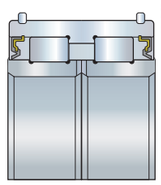
Catalog No. E1237

Full Complement Cylindrical Roller Bearings for Crane Sheaves

This cylindrical roller bearing incorporates seals to prevent the entry of foreign matter.

Features

- Improved seal: Contact seal increases resistance to entry of foreign matter or water.
- High load capacity: Larger radial load and axial load capacity compared to conventional sheave bearings.
- Corrosion resistance: Phosphate surface treatment improves resistance to rust.
- Easier grease replenishment: Sealed bearing includes inner ring holes to facilitate grease replenishment.
- Fewer mounted components: With snap rings for the outer ring, fewer components are required around the bearing, making for a more cost-effective sheave.



Catalog No. E1206

HPS™ Spherical Roller Bearings

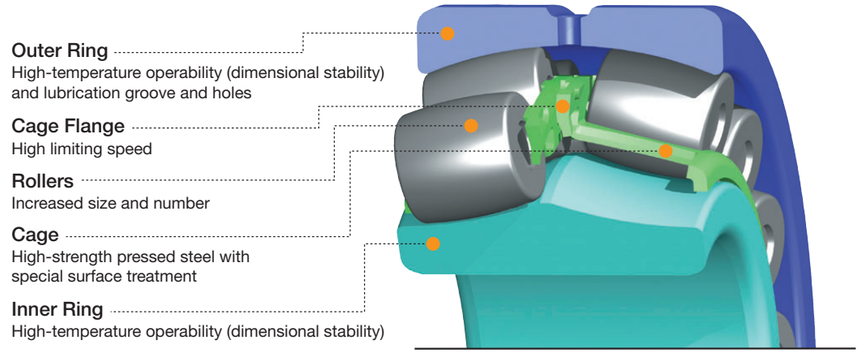
Bearings are expected to reduce maintenance costs and enhance performance for a variety of equipment. HPS spherical roller bearings satisfy these requirements by fully utilizing NSK's experience and expertise to deliver longer life and higher limiting speed.

Features Compared to the conventional EA Series:

Bearing life
Maximum **2 times**
Increased dynamic load rating to maximum of 25%

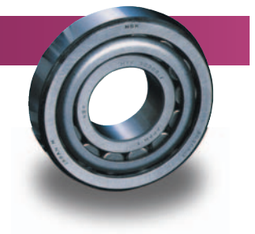
Limiting speed
Maximum **20**% **higher**

HPS bearings are available with inner bore dimensions ranging from 40 mm to 130 mm



Catalog No. E1259

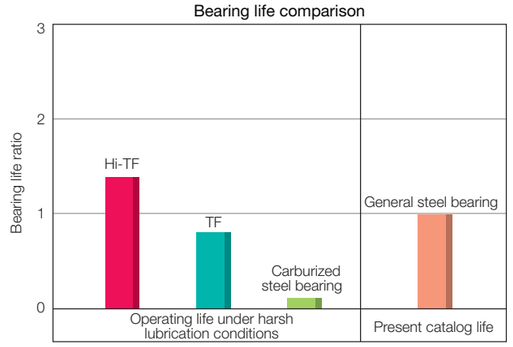
Hi-TF Bearings



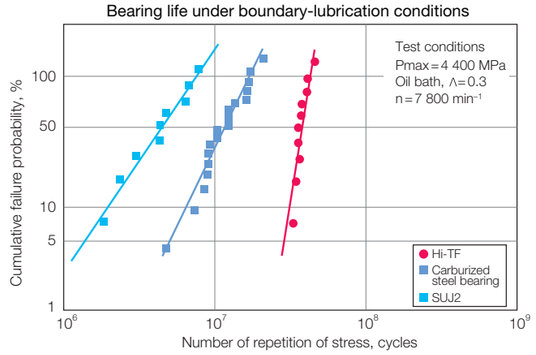
Bearings manufactured from NSK's Hi-TF material have been specifically designed for outstanding toughness under harsh operating conditions, surpassing even NSK's earlier TF bearings. Hi-TF bearings incorporating this new material and a new heat-treatment technology provide long service life under contaminated lubrication conditions with superior resistance to wear, seizure, and heat. Hi-TF bearings are capable of handling the foreseeable needs of the future as well as meeting today's requirements.

Features Achieves longer bearing life even under harsh conditions with excellent resistance to wear, seizure, and heat

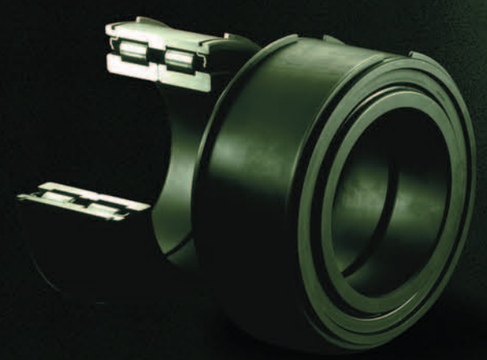
Bearing life comparison



Bearing life under boundary-lubrication conditions



Catalog No. E1202



Example: **223 20 CAM E4 C3 U15 -VS**

- Bearing series symbols (Bearing type+width series+diameter series)
- Bearing bore (Bore number)
- Cage type symbol CAM: High load capacity machined brass cage
- Outer ring with oil groove and oil hole (External features symbol)
- Radial clearance (Internal clearance symbol)
- Symbols of special dimensional tolerance for vibrating machines
- Bearing symbols for vibrating machines

Dimensional tolerance and radial clearance

NSK's U15 specifications stabilize the load distribution by controlling the internal clearance and the dimensional tolerance of the bearing.

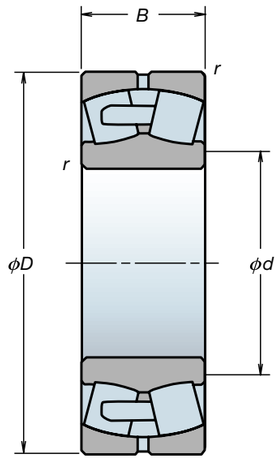
- The dimensional tolerance bearing is set at 1/2 relative to the outer diameter tolerance and the internal diameter tolerance.
- The radial internal clearance is set at 2/3 relative to the standard.

Bearing numbers	Bore diameter		Outside diameter		Radial clearance (Cylindrical bore)	
	Nominal (mm)	Tolerance (μm)	Nominal (mm)	Tolerance (μm)	C3U15 (μm)	C4U15 (μm)
22308	40	0 / –7	90	–5 / –13	50 to 60	65 to 80
22309	45		100		60 to 75	85 to 100
22310	50		110			
22311	55	0 / –9	120		75 to 90	100 to 120
22312	60		130			
22313	65		140			
22314	70		150		90 to 110	120 to 145
22315	75		160	–5 / –18		
22316	80		170			
22317	85	0 / –12	180		110 to 135	150 to 180
22318	90		190	–10 / –23		
22319	95		200			
22320	100		215			
22322	110		240		135 to 160	180 to 210
22324	120		260			
22326	130	0 / –15	280		160 to 190	205 to 240
22328	140		300			
22330	150		320	–13 / –28	190 to 220	240 to 280
22332	160		340			
22334	170		360		200 to 240	260 to 310
22336	180		380			
22338	190	0 / –18	400		220 to 260	285 to 340
22340	200		420	–13 / –30		

Dimension table

Boundary dimensions (mm)				Basic load ratings (kN)		Limiting speeds (min⁻¹)		Bearing numbers
Bore diameter d	Outside diameter D	Width B	Chamfer dimension r (min)	C_r	C_{0r}	Grease	Oil	Cylindrical bore
40	90	33	1.5	122	129	4120	5240	22308CAME4C3U15-VS
45	100	36	1.5	148	167	3610	4600	22309CAME4C3U15-VS
50	110	40	2	186	211	3320	4230	22310CAME4C3U15-VS
55	120	43	2	209	241	3040	3870	22311CAME4C3U15-VS
60	130	46	2.1	246	288	2790	3550	22312CAME4C3U15-VS
65	140	48	2.1	265	315	2590	3290	22313CAME4C3U15-VS
70	150	51	2.1	305	370	2400	3060	22314CAME4C3U15-VS
75	160	55	2.1	340	415	2250	2870	22315CAME4C3U15-VS
80	170	58	2.1	390	480	2120	2700	22316CAME4C3U15-VS
85	180	60	3	415	510	1980	2530	22317CAME4C3U15-VS
90	190	64	3	485	595	1910	2440	22318CAME4C3U15-VS
95	200	67	3	525	675	1790	2280	22319CAME4C3U15-VS
100	215	73	3	600	785	1650	2100	22320CAME4C3U15-VS
110	240	80	3	740	980	1490	1900	22322CAME4C3U15-VS
120	260	86	3	845	1120	1380	1760	22324CAME4C3U15-VS
130	280	93	4	995	1350	1280	1630	22326CAME4C3U15-VS
140	300	102	4	1160	1590	1100	1400	22328CAME4C3U15-VS
150	320	108	4	1220	1690	1100	1400	22330CAME4C3U15-VS
160	340	114	4	1360	1900	1100	1300	22332CAME4C3U15-VS
170	360	120	4	1580	2110	1000	1200	22334CAME4C3U15-VS
180	380	126	4	1740	2340	950	1200	22336CAME4C3U15-VS
190	400	132	5	1890	2590	900	1100	22338CAME4C3U15-VS
200	420	138	5	2000	2990	850	1000	22340CAME4C3U15-VS

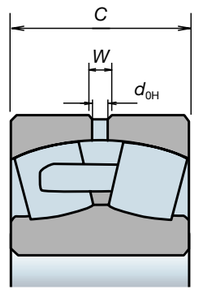
*Internal clearance of C3 and C4 is standard specification for the CA-VS series.



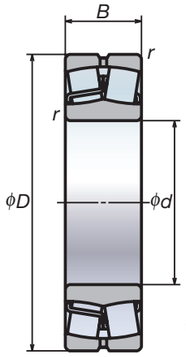
Dimensions of oil grooves and holes

Unit: mm

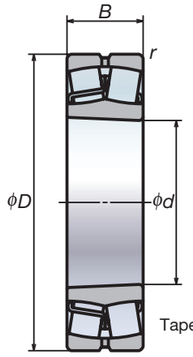
Nominal outer ring width C over	Nominal outer ring width C incl.	Oil groove width W	Hole diameter d_{0H}
30	40	6	3
40	50	7	4
50	65	8	5
65	80	10	6
80	100	12	8
100	120	15	10
120	160	20	12



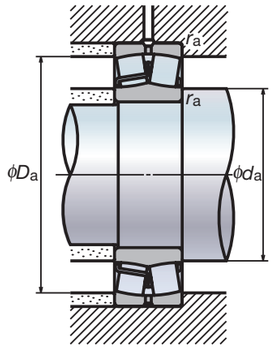
HPS Spherical Roller Bearings



Cylindrical bore



Tapered bore



Dynamic equivalent load

$P=XF_r+YF_a$

$F_a / F_r \leq e$		$F_a / F_r > e$	
X	Y	X	Y
1	Y_3	0.67	Y_2

Static equivalent load

$P_0=F_r+Y_0F_a$

The values for e, Y_2, Y_3 and Y_0 are given in the table below.

Table 1 Dimensions of oil grooves and holes Unit: mm

Nominal outer ring width C over	incl.	Oil groove width W	Hole diameter d_{0H}
18	30	5	2.5
30	40	6	3
40	50	7	4
50	65	8	5
65	80	10	6
80	100	12	8

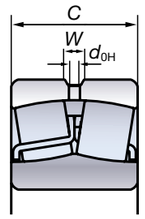


Table 2 Number of oil holes

Nominal outer ring diameter (mm) over	incl.	Number of holes
–	180	4
180	250	6
250	315	6

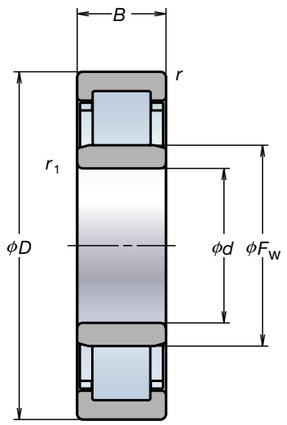
Boundary dimensions (mm)				Basic load ratings (N)		Limiting speeds (min-1)		Bearing numbers		Abutment and fillet dimensions (mm)					Constant	Axial load factors			Mass
d	D	B	r (min)	C_r	C_{0r}	Grease	Oil	Cylindrical bore	Tapered bore (1)	d_a (min)	d_a (max)	D_a (max)	D_a (min)	r_a (max)	e	Y_2	Y_3	Y_0	(kg) approx
40	80	23	1.1	113 000	99 500	6 700	8 500	22208EAE4	22208EAKE4	47	49	73	70	1	0.28	3.6	2.4	2.4	0.50
	90	23	1.5	118 000	111 000	6 000	7 500	21308EAE4	21308EAKE4	49	54	81	75	1.5	0.25	3.9	2.7	2.6	0.73
	90	33	1.5	170 000	153 000	5 300	6 700	22308EAE4	22308EAKE4	49	52	81	77	1.5	0.35	2.8	1.9	1.9	0.98
45	85	23	1.1	118 000	111 000	6 000	7 500	22209EAE4	22209EAKE4	52	54	78	75	1	0.25	3.9	2.7	2.6	0.55
	100	25	1.5	149 000	144 000	5 000	6 300	21309EAE4	21309EAKE4	54	65	91	89	1.5	0.23	4.3	2.9	2.8	0.96
	100	36	1.5	207 000	195 000	4 500	5 600	22309EAE4	22309EAKE4	54	59	91	86	1.5	0.34	2.9	2	1.9	1.34
50	90	23	1.1	124 000	119 000	5 600	7 100	22210EAE4	22210EAKE4	57	60	83	81	1	0.24	4.3	2.9	2.8	0.61
	110	27	2	178 000	174 000	4 500	5 600	21310EAE4	21310EAKE4	60	72	100	98	2	0.23	4.4	3	2.9	1.21
	110	40	2	246 000	234 000	4 300	5 300	22310EAE4	22310EAKE4	60	64	100	93	2	0.35	2.8	1.9	1.9	1.78
55	100	25	1.5	149 000	144 000	5 300	6 700	22211EAE4	22211EAKE4	64	65	91	89	1.5	0.23	4.3	2.9	2.8	0.81
	120	29	2	178 000	174 000	4 500	5 600	21311EAE4	21311EAKE4	65	72	110	98	2	0.23	4.4	3	2.9	1.58
	120	43	2	292 000	292 000	3 800	4 800	22311EAE4	22311EAKE4	65	73	110	103	2	0.34	2.9	2	1.9	2.30
60	110	28	1.5	178 000	174 000	4 800	6 000	22212EAE4	22212EAKE4	69	72	101	98	1.5	0.23	4.4	3	2.9	1.10
	130	31	2.1	238 000	244 000	3 800	4 800	21312EAE4	21312EAKE4	72	87	118	117	2	0.22	4.5	3	3	1.98
	130	46	2.1	340 000	340 000	3 600	4 500	22312EAE4	22312EAKE4	72	79	118	111	2	0.34	3	2	1.9	2.89
65	120	31	1.5	221 000	230 000	4 300	5 300	22213EAE4	22213EAKE4	74	80	111	107	1.5	0.24	4.2	2.8	2.7	1.51
	140	33	2.1	264 000	275 000	3 600	4 500	21313EAE4	21313EAKE4	77	94	128	126	2	0.22	4.6	3.1	3	2.45
	140	48	2.1	375 000	380 000	3 200	4 000	22313EAE4	22313EAKE4	77	84	128	119	2	0.33	3	2	2	3.52
70	125	31	1.5	225 000	232 000	4 000	5 300	22214EAE4	22214EAKE4	79	84	116	111	1.5	0.23	4.3	2.9	2.8	1.58
	150	35	2.1	310 000	325 000	3 200	4 000	21314EAE4	21314EAKE4	82	101	138	135	2	0.22	4.6	3.1	3	3.00
	150	51	2.1	425 000	435 000	3 000	3 800	22314EAE4	22314EAKE4	82	91	138	129	2	0.33	3	2	2	4.28
75	130	31	1.5	238 000	244 000	4 000	5 000	22215EAE4	22215EAKE4	84	87	121	117	1.5	0.22	4.5	3	3	1.64
	160	37	2.1	310 000	325 000	3 200	4 000	21315EAE4	21315EAKE4	87	101	148	134	2	0.22	4.6	3.1	3	3.64
	160	55	2.1	485 000	505 000	2 800	3 600	22315EAE4	22315EAKE4	87	97	148	137	2	0.33	3	2	2	5.26
80	140	33	2	264 000	275 000	3 600	4 500	22216EAE4	22216EAKE4	90	94	130	126	2	0.22	4.6	3.1	3	2.01
	170	39	2.1	355 000	375 000	3 000	3 800	21316EAE4	21316EAKE4	92	109	158	146	2	0.23	4.4	3	2.9	4.32
	170	58	2.1	540 000	565 000	2 600	3 400	22316EAE4	22316EAKE4	92	103	158	145	2	0.33	3	2	2	6.23
85	150	36	2	310 000	325 000	3 400	4 300	22217EAE4	22217EAKE4	95	101	140	135	2	0.22	4.6	3.1	3	2.54
	180	41	3	360 000	395 000	3 000	4 000	21317EAE4	21317EAKE4	99	108	166	142	2.5	0.24	4.3	2.9	2.8	5.20
	180	60	3	600 000	630 000	2 400	3 200	22317EAE4	22317EAKE4	99	110	166	155	2.5	0.33	3.1	2.1	2	7.23
90	160	40	2	360 000	395 000	3 200	4 000	22218EAE4	22218EAKE4	100	108	150	142	2	0.24	4.3	2.9	2.8	3.30
	190	43	3	415 000	450 000	2 800	3 600	21318EAE4	21318EAKE4	104	115	176	152	2.5	0.24	4.3	2.9	2.8	6.10
	190	64	3	665 000	705 000	2 400	3 000	22318EAE4	22318EAKE4	104	115	176	163	2.5	0.33	3.1	2.1	2	8.56
95	170	43	2.1	415 000	450 000	3 000	3 800	22219EAE4	22219EAKE4	107	115	158	152	2	0.24	4.3	2.9	2.8	4.04
	200	67	3	735 000	780 000	2 200	2 800	22319EAE4	22319EAKE4	109	121	186	172	2.5	0.33	3.1	2.1	2	9.91
100	180	46	2.1	455 000	490 000	2 800	3 600	22220EAE4	22220EAKE4	112	119	168	160	2	0.24	4.3	2.9	2.8	4.84
	215	73	3	860 000	930 000	2 000	2 600	22320EAE4	22320EAKE4	114	130	201	184	2.5	0.33	3	2	2	12.7
110	200	53	2.1	605 000	645 000	2 600	3 200	22222EAE4	22222EAKE4	122	129	188	178	2	0.25	4	2.7	2.6	6.99
	240	80	3	1 030 000	1 120 000	1 900	2 400	22322EAE4	22322EAKE4	124	145	226	206	2.5	0.33	3.1	2.1	2	17.6
120	215	58	2.1	685 000	765 000	2 400	3 000	22224EAE4	22224EAKE4	132	142	203	190	2	0.25	3.9	2.7	2.6	8.80
	260	86	3	1 190 000	1 320 000	1 700	2 200	22324EAE4	22324EAKE4	134	157	246	222	2.5	0.32	3.1	2.1	2	22.2
130	230	64	3	820 000	940 000	2 200	2 600	22226EAE4	22226EAKE4	144	152	216	204	2.5	0.26	3.8	2.6	2.5	11.0

Note (1) The suffix K indicates that the bearing has a tapered bore (taper 1:12).

Remarks 1. The maximum operating temperature of standard HPS spherical roller bearings is 200℃.
2. The suffix E4 indicates that the bearing has an oil groove and holes.
(The numbers and dimensions of oil grooves and holes are shown in Tables 1 and 2.)

EW Cylindrical Roller Bearings

NU



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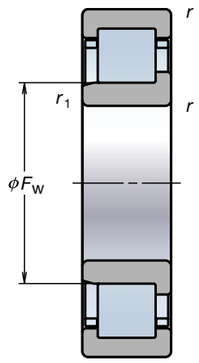

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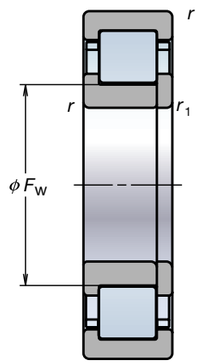
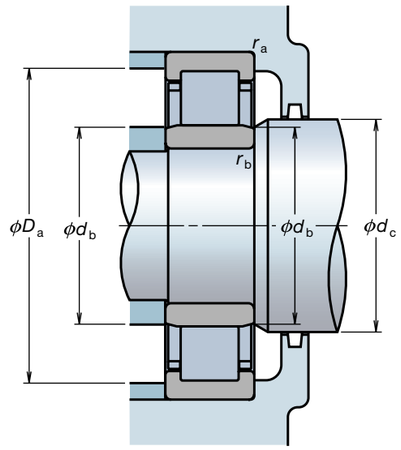
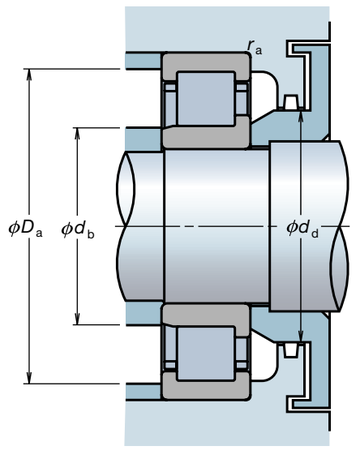




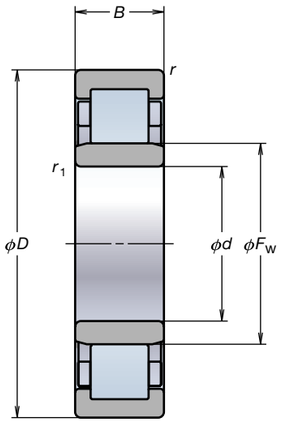


Boundary dimensions (mm)						Basic load ratings (N)		Limiting speeds (min-1)	
d	D	B	r (min)	r_1 (min)	F_w	C_r	C_{0r}	Grease	Oil
25	52	15	1	0.6	31.5	29 300	27 700	12 000	14 000
	62	17	1.1	1.1	34	41 500	37 500	10 000	12 000
30	62	16	1	0.6	37.5	39 000	37 500	9 500	12 000
	72	19	1.1	1.1	40.5	53 000	50 000	8 500	10 000
35	72	17	1.1	0.6	44	50 500	50 000	8 500	10 000
	80	21	1.5	1.1	46.2	66 500	65 500	7 500	9 500
40	80	18	1.1	1.1	49.5	55 500	55 500	7 500	9 000
	90	23	1.5	1.5	52	83 000	81 500	6 700	8 000
45	85	19	1.1	1.1	54.5	63 000	66 500	6 700	8 000
	100	25	1.5	1.5	58.5	97 500	98 500	6 000	7 500
50	90	20	1.1	1.1	59.5	69 000	76 500	6 300	7 500
	110	27	2	2	65	110 000	113 000	5 000	6 000
55	100	21	1.5	1.1	66	86 500	98 500	5 600	7 100
	120	29	2	2	70.5	137 000	143 000	4 500	5 600
60	110	22	1.5	1.5	72	97 500	107 000	5 300	6 300
65	120	23	1.5	1.5	78.5	108 000	119 000	4 800	5 600

Bearing numbers			Abutment and fillet dimensions (mm)								Permissible
NU	NJ	NUP	d_a (min)	d_b (min)	d_b (max)	d_c (min)	d_d (min)	D_a (max)	r_a (max)	r_b (max)	axial movement S (mm)
NU205EW	NJ	NUP	30	29	30	34	37	47	1	0.6	1.2
NU305EW	NJ	NUP	31.5	31.5	32	37	40	55.5	1	1	1.2
NU206EW	NJ	NUP	35	34	36	40	44	57	1	0.6	1.2
NU306EW	NJ	NUP	36.5	36.5	39	44	48	65.5	1	1	1.2
NU207EW	NJ	NUP	41.5	39	42	46	50	65.5	1	0.6	1.2
NU307EW	NJ	NUP	43	41.5	44	48	53	72	1.5	1	1.2
NU208EW	NJ	NUP	46.5	46.5	48	52	56	73.5	1	1	1.2
NU308EW	NJ	NUP	48	48	50	55	60	82	1.5	1.5	1.2
NU209EW	NJ	NUP	51.5	51.5	52	57	61	78.5	1	1	1.2
NU309EW	NJ	NUP	53	53	56	60	66	92	1.5	1.5	1.4
NU210EW	NJ	NUP	56.5	56.5	57	62	67	83.5	1	1	1.7
NU310EW	NJ	NUP	59	59	63	67	73	101	2	2	1.4
NU211EW	NJ	NUP	63	61.5	64	68	73	92	1.5	1	1.2
NU311EW	NJ	NUP	64	64	68	72	80	111	2	2	1.4
NU212EW	NJ	NUP	68	68	70	75	80	102	1.5	1.5	1.2
NU213EW	NJ	NUP	73	73	76	81	87	112	1.5	1.5	1.4

EM Cylindrical Roller Bearings

NU



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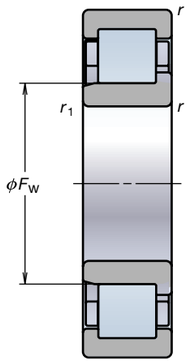

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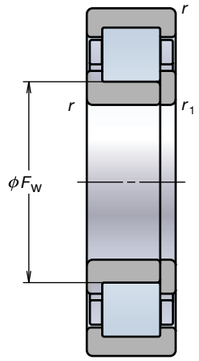

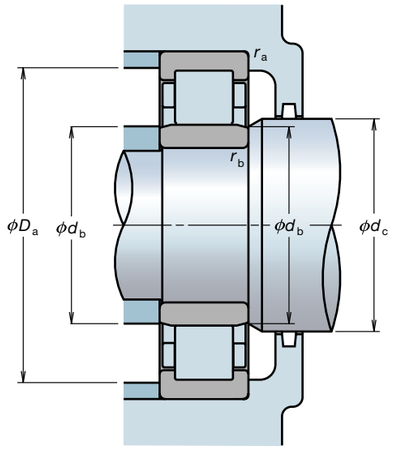

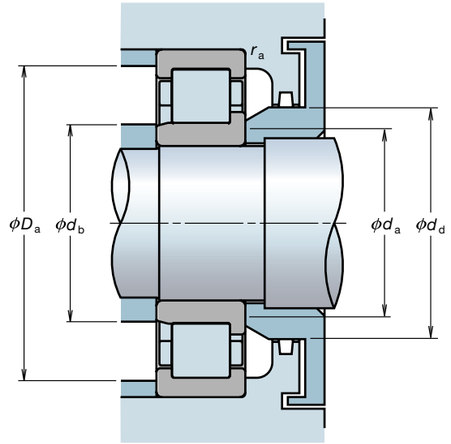

Boundary dimensions (mm)						Basic load ratings (N)		Limiting speeds (min-1)	
d	D	B	r min	r_1 min	F_w	C_r	C_{or}	Grease	Oil
25	52	15	1	0.6	31.5	29 300	27 700	13 000	16 000
	62	17	1.1	1.1	34	41 500	37 500	10 000	13 000
30	62	16	1	0.6	37.5	39 000	37 500	11 000	13 000
	72	19	1.1	1.1	40.5	53 000	50 000	8 500	11 000
35	72	17	1.1	0.6	44	50 500	50 000	9 500	11 000
	80	21	1.5	1.1	46.2	66 500	65 500	8 000	9 500
40	80	18	1.1	1.1	49.5	55 500	55 500	8 500	10 000
	90	23	1.5	1.5	52	83 000	81 500	6 700	8 500
45	85	19	1.1	1.1	54.5	63 000	66 500	7 500	9 000
	100	25	1.5	1.5	58.5	97 500	98 500	6 300	7 500
50	90	20	1.1	1.1	59.5	69 000	76 500	7 100	8 500
	110	27	2	2	65	110 000	113 000	5 600	6 700
55	100	21	1.5	1.1	66	86 500	98 500	6 300	7 500
	120	29	2	2	70.5	137 000	143 000	5 000	6 300
60	110	22	1.5	1.5	72	97 500	107 000	6 000	7 100
	130	31	2.1	2.1	77	150 000	157 000	4 800	5 600
65	120	23	1.5	1.5	78.5	108 000	119 000	5 300	6 300
	140	33	2.1	2.1	82.5	181 000	191 000	4 300	5 300
70	125	24	1.5	1.5	83.5	119 000	137 000	5 000	6 300
	150	35	2.1	2.1	89	205 000	222 000	4 000	5 000
75	130	25	1.5	1.5	88.5	130 000	156 000	4 800	6 000
	160	37	2.1	2.1	95	240 000	263 000	3 800	4 800
80	140	26	2	2	95.3	139 000	167 000	4 500	5 300
	170	39	2.1	2.1	101	256 000	282 000	3 600	4 300
85	150	28	2	2	100.5	167 000	199 000	4 300	5 000
	180	41	3	3	108	291 000	330 000	3 400	4 000
90	160	30	2	2	107	182 000	217 000	4 000	4 800
	190	43	3	3	113.5	315 000	355 000	3 200	3 800
95	170	32	2.1	2.1	112.5	220 000	265 000	3 800	4 500
	200	45	3	3	121.5	335 000	385 000	3 000	3 600
100	180	34	2.1	2.1	119	249 000	305 000	3 600	4 300
	215	47	3	3	127.5	380 000	425 000	2 800	3 400
105	190	36	2.1	2.1	125	262 000	310 000	3 400	4 000
	225	49	3	3	133	425 000	480 000	2 600	3 200
110	200	38	2.1	2.1	132.5	293 000	365 000	3 200	3 800
	200	53	2.1	2.1	132.5	385 000	515 000	2 800	3 400
	240	50	3	3	143	450 000	525 000	2 600	3 000

The following are also available: 1. N and NF type bearings 2. Cages with an outside diameter of less than 650 mm (Please contact NSK for details.)

Bearing numbers			Abutment and fillet dimensions (mm)								Permissible axial movement S (mm)
NU	NJ	NUP	d_a min	d_b min	d_b max	d_c min	d_d min	D_a max	r_a max	r_b max	
NU205EM	NJ	NUP	30	29	30	34	37	47	1	0.6	1.2
NU305EM	NJ	NUP	31.5	31.5	32	37	40	55.5	1	1	1.2
NU206EM	NJ	NUP	35	34	36	40	44	57	1	0.6	1.2
NU306EM	NJ	NUP	36.5	36.5	39	44	48	65.5	1	1	1.2
NU207EM	NJ	NUP	41.5	39	42	46	50	65.5	1	0.6	1.2
NU307EM	NJ	NUP	43	41.5	44	48	53	72	1.5	1	1.2
NU208EM	NJ	NUP	46.5	46.5	48	52	56	73.5	1	1	1.2
NU308EM	NJ	NUP	48	48	50	55	60	82	1.5	1.5	1.2
NU209EM	NJ	NUP	51.5	51.5	52	57	61	78.5	1	1	1.2
NU309EM	NJ	NUP	53	53	56	60	66	92	1.5	1.5	1.4
NU210EM	NJ	NUP	56.5	56.5	57	62	67	83.5	1	1	1.7
NU310EM	NJ	NUP	59	59	63	67	73	101	2	2	1.4
NU211EM	NJ	NUP	63	61.5	64	68	73	92	1.5	1	1.2
NU311EM	NJ	NUP	64	64	68	72	80	111	2	2	1.4
NU212EM	NJ	NUP	68	68	70	75	80	102	1.5	1.5	1.2
NU312EM	NJ	NUP	71	71	75	79	86	119	2	2	1.5
NU213EM	NJ	NUP	73	73	76	81	87	112	1.5	1.5	1.4
NU313EM	NJ	NUP	76	76	80	85	93	129	2	2	1.5
NU214EM	NJ	NUP	78	78	81	86	92	117	1.5	1.5	1.4
NU314EM	NJ	NUP	81	81	86	92	100	139	2	2	1.5
NU215EM	NJ	NUP	83	83	86	90	96	122	1.5	1.5	1.4
NU315EM	NJ	NUP	86	86	92	97	106	149	2	2	1.4
NU216EM	NJ	NUP	89	89	92	97	104	131	2	2	1.4
NU316EM	NJ	NUP	91	91	98	105	114	159	2	2	1.5
NU217EM	NJ	NUP	94	94	98	104	110	141	2	2	1.3
NU317EM	NJ	NUP	98	98	105	110	119	167	2.5	2.5	2
NU218EM	NJ	NUP	99	99	104	109	116	151	2	2	1.4
NU318EM	NJ	NUP	103	103	111	117	127	177	2.5	2.5	1.5
NU219EM	NJ	NUP	106	106	110	116	123	159	2	2	1.4
NU319EM	NJ	NUP	108	108	118	124	134	187	2.5	2.5	1.5
NU220EM	NJ	NUP	111	111	116	122	130	169	2	2	1.4
NU320EM	NJ	NUP	113	113	124	132	143	202	2.5	2.5	1.8
NU221EM	NJ	NUP	116	116	121	129	137	179	2	2	1.4
NU321EM	NJ	NUP	118	118	131	137	149	212	2.5	2.5	1.8
NU222EM	NJ	NUP	121	121	129	135	144	189	2	2	1.4
NU2222EM	NJ	NUP	121	121	129	135	144	189	2	2	1.4
NU322EM	NJ	NUP	123	123	139	145	158	227	2.5	2.5	3.8

EM Cylindrical Roller Bearings

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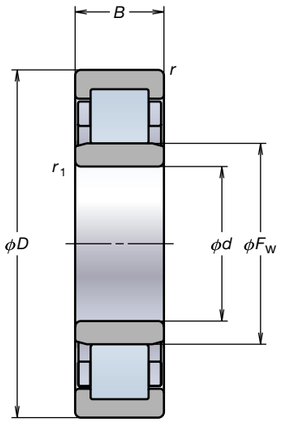

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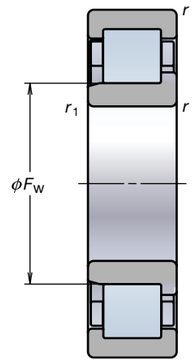

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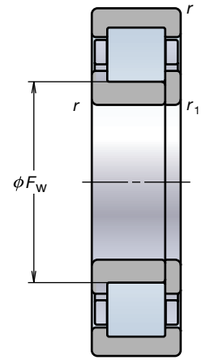
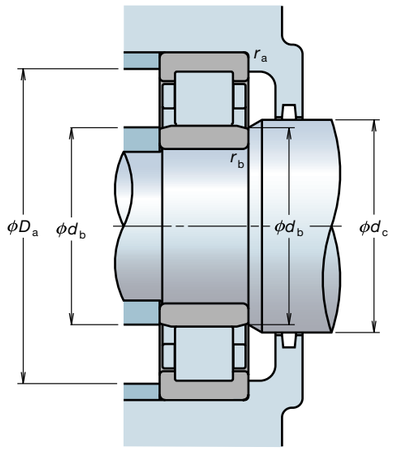
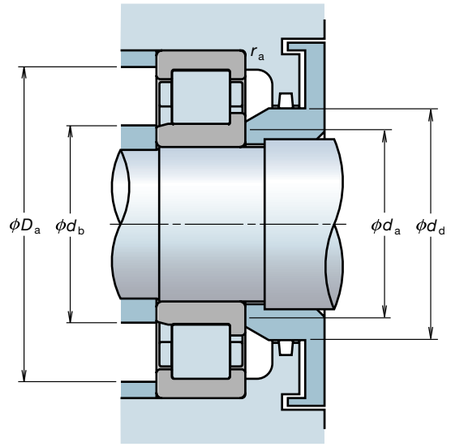




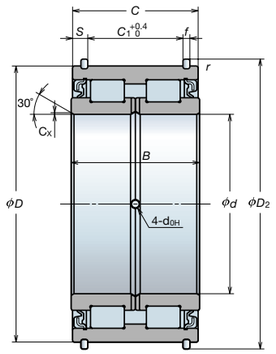


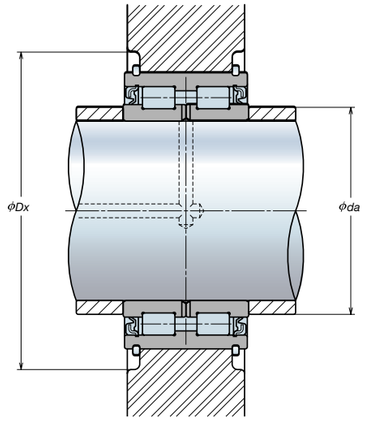
Boundary dimensions (mm)						Basic load ratings (N)		Limiting speeds (min-1)	
d	D	B	r min	r_1 min	F_w	C_r	C_{or}	Grease	Oil
120	215	40	2.1	2.1	143.5	335 000	420 000	3 000	3 400
	215	58	2.1	2.1	143.5	450 000	620 000	2 600	3 200
	260	55	3	3	154	530 000	610 000	2 200	2 800
	260	86	3	3	154	795 000	1 030 000	2 000	2 600
130	230	40	3	3	153.5	365 000	455 000	2 600	3 200
	230	64	3	3	153.5	530 000	735 000	2 400	3 000
	280	58	4	4	167	615 000	735 000	2 200	2 600
	280	93	4	4	167	920 000	1 230 000	1 900	2 400
140	250	42	3	3	169	395 000	515 000	2 400	3 000
	250	68	3	3	169	550 000	790 000	2 200	2 800
	300	62	4	4	180	665 000	795 000	2 000	2 400
	300	102	4	4	180	1 020 000	1 380 000	1 700	2 200
150	270	45	3	3	182	450 000	595 000	2 200	2 800
	270	73	3	3	182	635 000	930 000	2 000	2 600
	320	65	4	4	193	760 000	920 000	1 800	2 200
	320	108	4	4	193	1 160 000	1 600 000	1 600	2 000
160	290	48	3	3	195	500 000	665 000	2 200	2 600
	290	80	3	3	193	810 000	1 190 000	1 900	2 400
	340	68	4	4	204	860 000	1 050 000	1 700	2 000
	340	114	4	4	204	1 310 000	1 820 000	1 500	1 900
170	310	52	4	4	207	605 000	800 000	2 000	2 400
	310	86	4	4	205	925 000	1 330 000	1 800	2 200
	360	72	4	4	218	930 000	1 150 000	1 600	2 000
	360	120	4	4	216	1 490 000	2 070 000	1 400	1 800
180	320	52	4	4	217	625 000	850 000	1 900	2 200
	320	86	4	4	215	1 010 000	1 510 000	1 700	2 000
	380	75	4	4	231	985 000	1 230 000	1 500	1 800
	380	126	4	4	227	1 560 000	2 220 000	1 300	1 700
190	340	55	4	4	230	695 000	955 000	1 800	2 200
	340	92	4	4	228	1 100 000	1 670 000	1 600	2 000
	400	78	5	5	245	1 060 000	1 340 000	1 400	1 700
	400	132	5	5	240	1 770 000	2 520 000	1 300	1 600
200	360	58	4	4	243	765 000	1 060 000	1 700	2 000
	360	98	4	4	241	1 220 000	1 870 000	1 500	1 800
	420	80	5	5	258	1 140 000	1 450 000	1 300	1 600
	420	138	5	5	253	1 910 000	2 760 000	1 200	1 500

The following are also available: 1. N and NF type bearings 2. Cages with an outside diameter of less than 650 mm (Please contact NSK for details.)

Bearing numbers			Abutment and fillet dimensions (mm)								Permissible axial movement S (mm)
NU	NJ	NUP	d_a min	d_b min	d_b max	d_c min	d_d min	D_a max	r_a max	r_b max	
NU224EM	NJ	NUP	131	131	140	146	156	204	2	2	1.5
NU2224EM	NJ	NUP	131	131	140	146	156	204	2	2	2
NU324EM	NJ	NUP	133	133	150	156	171	247	2.5	2.5	1.8
NU2324EM	NJ	NUP	133	133	150	156	171	247	2.5	2.5	2.8
NU226EM	NJ	NUP	143	143	150	158	168	217	2.5	2.5	1.5
NU2226EM	NJ	NUP	143	143	150	158	168	217	2.5	2.5	3
NU326EM	NJ	NUP	146	146	163	169	184	264	3	3	2.3
NU2326EM	NJ	NUP	146	146	163	169	184	264	3	3	2.3
NU228EM	NJ	NUP	153	153	165	171	182	237	2.5	2.5	1.5
NU2228EM	NJ	NUP	153	153	165	171	182	237	2.5	2.5	2.5
NU328EM	NJ	NUP	156	156	176	182	198	284	3	3	3.3
NU2328EM	NJ	NUP	156	156	176	182	198	284	3	3	2.8
NU230EM	NJ	NUP	163	163	177	184	196	257	2.5	2.5	1.5
NU2230EM	NJ	NUP	163	163	177	184	196	257	2.5	2.5	3
NU330EM	NJ	NUP	166	166	188	195	213	304	3	3	3.2
NU2330EM	NJ	NUP	166	166	188	195	213	304	3	3	2.2
NU232EM	NJ	NUP	173	173	190	197	210	277	2.5	2.5	1.8
NU2232EM	NJ	NUP	173	173	188	197	210	277	2.5	2.5	3.3
NU332EM	NJ	NUP	176	176	199	211	228	324	3	3	3.2
NU2332EM	NJ	NUP	176	176	199	211	228	324	3	3	2.7
NU234EM	NJ	NUP	186	186	202	211	223	294	3	3	3.8
NU2234EM	NJ	NUP	186	186	200	211	223	294	3	3	2.8
NU334EM	NJ	NUP	186	186	213	223	241	344	3	3	1.7
NU2334EM	NJ	NUP	186	186	210	223	241	344	3	3	6.2
NU236EM	NJ	NUP	196	196	212	221	233	304	3	3	2.2
NU2236EM	NJ	NUP	196	196	210	221	233	304	3	3	2.7
NU336EM	NJ	NUP	196	196	226	235	255	364	3	3	2.2
NU2336EM	NJ	NUP	196	196	222	235	255	364	3	3	6.2
NU238EM	NJ	NUP	206	206	225	234	247	324	3	3	1.7
NU2238EM	NJ	NUP	206	206	223	234	247	324	3	3	1.7
NU338EM	NJ	NUP	210	210	240	248	268	380	4	4	1.7
NU2338EM	NJ	NUP	210	210	235	248	268	380	4	4	6.2
NU240EM	NJ	NUP	216	216	238	247	261	344	3	3	2.2
NU2240EM	NJ	NUP	216	216	235	247	261	344	3	3	2.2
NU340EM	NJ	NUP	220	220	252	263	283	400	4	4	1.2
NU2340EM	NJ	NUP	220	220	247	263	283	400	4	4	7.7

Full-Complement Cylindrical Roller Bearings for Crane Sheaves





Recommended fitting and bearing internal clearance

When a crane sheave and wheel are used with an outer ring rotating load, bearing fitting and radial internal clearance are as follows:

Load conditions		Tolerance range class of shaft	Tolerance range class of housing	Recommended internal clearance
Outer ring rotating	Heavy load with thin housing	g6 or h6	P7	C3
	Normal load or heavy load	g6 or h6	N7	C3
	Light load or fluctuating load	g6 or h6	M7	CN

Handling precautions

Be sure to push on the end face of the outer ring when mounting the bearing into a sheave. When mounting the bearing on a shaft, push on the end face of the inner ring.

Bearing numbers	Boundary dimensions (mm)						Basic load ratings (N)		Snap ring dimensions (mm)				Oil hole (mm)	Abutment dimensions (mm)		Mass (kg)
	d	D	B	C	C_x (min)	r (min)	C_r	C_{0r}	C_1	S	D_2	f	d_{0H}	d_a (min)	D_x (min)	approx
RS-5008DSNR	40	68	38	37	0.4	0.6	79 500	116 000	28	4.5	71.8	2	2.5	43.5	77.5	0.56
RS-5009DSNR	45	75	40	39	0.4	0.6	95 500	144 000	30	4.5	78.8	2	2.5	48.5	84.5	0.70
RS-5010DSNR	50	80	40	39	0.4	0.6	100 000	158 000	30	4.5	83.8	2	2.5	53.5	89.5	0.76
RS-5011DSNR	55	90	46	45	0.6	0.6	118 000	193 000	34	5.5	94.8	2.5	3	60	101	1.17
RS-5012DSNR	60	95	46	45	0.6	0.6	123 000	208 000	34	5.5	99.8	2.5	3	65	106	1.25
RS-5013DSNR	65	100	46	45	0.6	0.6	128 000	224 000	34	5.5	104.8	2.5	3	70	111	1.32
RS-5014DSNR	70	110	54	53	0.6	0.6	171 000	285 000	42	5.5	114.5	2.5	3	75	121	1.87
RS-5015DSNR	75	115	54	53	0.6	0.6	179 000	305 000	42	5.5	119.5	2.5	3	80	126	2.00
RS-5016DSNR	80	125	60	59	0.6	0.6	251 000	430 000	48	5.5	129.5	2.5	3	85	136	2.65
RS-5017DSNR	85	130	60	59	0.6	0.6	256 000	445 000	48	5.5	134.5	2.5	3	90	141	2.75
RS-5018DSNR	90	140	67	66	1	0.6	305 000	540 000	54	6	145.4	2.5	4	96	153.5	3.75
RS-5019DSNR	95	145	67	66	1	0.6	310 000	565 000	54	6	150.4	2.5	4	101	158.5	3.95
RS-5020DSNR	100	150	67	66	1	0.6	320 000	585 000	54	6	155.4	2.5	4	106	163.5	4.05

Note 1. Bearings No. DS indicates seal is included.
2. Shield type can be provided upon request. Please contact NSK for details.
3. For specification higher than RS-5022, please contact NSK.
4. Grease is factory-packed into the bearing. NSK recommends lithium grease for replenishing.
5. Bearing without snap ring groove, or without snap rings are also available upon request.

Radial Clearance in Spherical Roller Bearings with Tapered Bores

Bearings with tapered bores are directly mounted onto tapered shafts or onto cylindrical shafts with adapters or withdrawal sleeves (Fig. 1).
Large bearings are often mounted using hydraulic pressure. Fig. 2 shows a bearing mounting utilizing a sleeve and hydraulic nut. Another mounting method is to drill holes in the sleeve which are used to feed oil under pressure to seat the bearing. As the bearing expands radially, the sleeve is inserted axially with adjusting bolts.
The bearing should be mounted with a suitable interference fit by checking residual clearance while measuring their radial-clearance reduction and referring to the amount of axial movement listed in Table 1.
Radial clearance must be measured using clearance gauges. As shown in Fig 3, radial clearance for both rows of rollers must be measured simultaneously, and those two values should be kept roughly the same.
When a large bearing is mounted on a shaft, the outer ring may be deformed into an oval shape by its own weight. If radial clearance is measured at the lowest part of the deformed bearing, the measured value may be greater than the true value. If an incorrect radial internal clearance is obtained in this manner and the value in Table 1 are used, then the interference fit may become too tight and the true residual clearance may become too small. In this case, as shown in Fig. 4, one half of the total clearance at points a and b (which are on a horizontal line passing through the bearing center) and c (which is the lowest position of the bearing) may be used as the residual clearance.

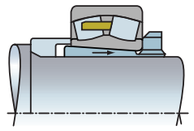


Fig. 1 Mounting with adapter

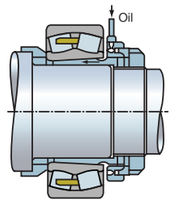


Fig. 2 Mounting with hydraulic nut

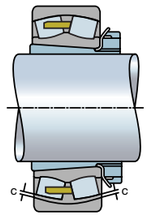
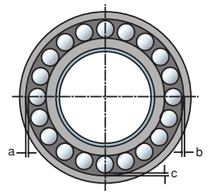


Fig. 3 Clearance measurement of spherical roller bearing



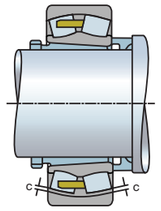


Fig. 4 Measuring clearance in large spherical roller bearing

Table 1 Radial Clearance in Spherical Roller Bearings with Tapered Bores (Unit: mm)

Bearing bore diameter d		Clearance in bearings with tapered bores						Reduction in radical clearance		Axial movement				Minimum permissible residual clearance		
		CN		C3		C4				Taper 1:12		Taper 1:30		CN	C3	C4
over	incl	min	max	min	max	min	max	min	max	min	max	min	max			
30	40	0.035	0.050	0.050	0.065	0.065	0.085	0.025	0.030	0.40	0.45	—	—	0.010	0.025	0.035
40	50	0.045	0.060	0.060	0.080	0.080	0.100	0.030	0.035	0.45	0.55	—	—	0.015	0.030	0.045
50	65	0.055	0.075	0.075	0.095	0.095	0.120	0.030	0.035	0.45	0.55	—	—	0.025	0.035	0.060
65	80	0.070	0.095	0.095	0.120	0.120	0.150	0.040	0.045	0.60	0.70	—	—	0.030	0.040	0.075
80	100	0.080	0.110	0.110	0.140	0.140	0.180	0.045	0.055	0.70	0.85	1.75	2.15	0.035	0.050	0.085
100	120	0.100	0.135	0.135	0.170	0.170	0.220	0.050	0.060	0.75	0.90	1.9	2.25	0.045	0.065	0.110
120	140	0.120	0.160	0.160	0.200	0.200	0.260	0.060	0.070	0.90	1.1	2.25	2.75	0.055	0.080	0.130
140	160	0.130	0.180	0.180	0.230	0.230	0.300	0.065	0.080	1.0	1.3	2.5	3.25	0.060	0.100	0.150
160	180	0.140	0.200	0.200	0.260	0.260	0.340	0.070	0.090	1.1	1.4	2.75	3.5	0.070	0.110	0.170
180	200	0.160	0.220	0.220	0.290	0.290	0.370	0.080	0.100	1.3	1.6	3.25	4.0	0.070	0.110	0.190
200	225	0.180	0.250	0.250	0.320	0.320	0.410	0.090	0.110	1.4	1.7	3.5	4.25	0.080	0.130	0.210
225	250	0.200	0.270	0.270	0.350	0.350	0.450	0.100	0.120	1.6	1.9	4.0	4.75	0.090	0.140	0.230
250	280	0.220	0.300	0.300	0.390	0.390	0.490	0.110	0.140	1.7	2.2	4.25	5.5	0.100	0.150	0.250
280	315	0.240	0.330	0.330	0.430	0.430	0.540	0.120	0.150	1.9	2.4	4.75	6.0	0.110	0.160	0.280
315	355	0.270	0.360	0.360	0.470	0.470	0.590	0.140	0.170	2.2	2.7	5.5	6.75	0.120	0.180	0.300
355	400	0.300	0.400	0.400	0.520	0.520	0.650	0.150	0.190	2.4	3.0	6.0	7.5	0.130	0.200	0.330
400	450	0.330	0.440	0.440	0.570	0.570	0.720	0.170	0.210	2.7	3.3	6.75	8.25	0.140	0.220	0.360
450	500	0.370	0.490	0.490	0.630	0.630	0.790	0.190	0.240	3.0	3.7	7.5	9.25	0.160	0.240	0.390
500	560	0.410	0.540	0.540	0.680	0.680	0.870	0.210	0.270	3.4	4.3	8.5	11.0	0.170	0.270	0.410
560	630	0.460	0.600	0.600	0.760	0.760	0.980	0.230	0.300	3.7	4.8	9.25	12.0	0.200	0.310	0.460
630	710	0.510	0.670	0.670	0.850	0.850	1.090	0.260	0.330	4.2	5.3	10.5	13.0	0.220	0.330	0.520
710	800	0.570	0.750	0.750	0.960	0.960	1.220	0.280	0.370	4.5	5.9	11.5	15.0	0.240	0.390	0.590
800	900	0.640	0.840	0.840	1.070	1.070	1.370	0.310	0.410	5.0	6.6	12.5	16.5	0.280	0.430	0.660
900	1 000	0.710	0.930	0.930	1.190	1.190	1.520	0.340	0.460	5.5	7.4	14.0	18.5	0.310	0.470	0.730
1 000	1 120	0.770	1.030	1.030	1.300	1.300	1.670	0.370	0.500	5.9	8.0	15.0	20.0	0.360	0.530	0.800

Bearing Maintenance and Inspection

Maintenance

Bearings and operating conditions must be periodically inspected and maintained to maximize bearing life to prevent mechanical failure, ensure reliable operation, raise productivity, and enhance cost performance.
Maintenance should be performed regularly according to work standards that may vary according to machine operating conditions. Operating conditions should be monitored, lubricant replenished or changed, and the machine periodically disassembled and overhauled.

1. Inspection under operating conditions

Review lubricant properties, check operating temperatures, and inspect for any vibrations and bearing noise to determine bearing replacement periods and replenishment intervals of the lubricant.

2. Inspection of the bearing

Be sure to thoroughly examine the bearings during periodic machine inspections and part replacement. Check the raceway for any damage and confirm if the bearing can be reused or should be replaced.

Inspection points

Items to be checked while the machine is running should include bearing noise, vibrations, temperature, and lubricant condition.

1. Bearing noise

Sound detection instruments can be used during operation to ascertain the volume and characteristics of bearing rotation noise through sound patterns that are readily distinguishable, which can reveal the presence of bearing damage such as slight flaking. Three typical noise conditions are described in Table 2.

2. Bearing vibration

Bearing irregularities can be analyzed by performing a quantitative analysis of vibration amplitude and frequency using a frequency spectrum analyzer. Measured data varies depending on the operating conditions of the bearing and the location of the vibration pick-up. Therefore, this method requires the determination of evaluation standards for each measured machine.

Table 1 Bearing irregularity causes and countermeasures

Irregularities		Possible causes	Countermeasures
Noise	Loud metallic sound	Abnormal load	Improve the fit, internal clearance, preload, or position of housing shoulder.
		Incorrect mounting	Improve machining accuracy, alignment accuracy or mounting accuracy of shaft and housing, or use the correct mounting method.
		Insufficient or improper lubricant	Replenish the lubricant or select another lubricant.
		Contact of rotating parts	Modify the labyrinth seal.
	Loud regular sound	Flaws, corrosion, or scratches on raceways caused by foreign particles	Replace or clean the bearing, improve sealing conditions, or use clean lubricant.
		Brinelling	Replace the bearing and use care when handling.
		Flaking on raceway	Replace the bearing.
	Irregular sound	Excessive clearance	Improve the fit, clearance, or preload.
		Contamination by foreign particles	Replace or clean the bearing, improve the seals, and use clean lubricant.
		Flaws or flaking on balls	Replace the bearing.
Abnormal temperature rise		Excessively small clearance	Improve the fit, clearance, or preload.
		Excessive amount of lubricant	Reduce amount of lubricant and select stiffer grease.
		Insufficient or improper lubricant	Replenish lubricant or select a proper one.
		Abnormal load	Improve the fit, internal clearance, preload, or position of housing shoulder.
		Incorrect mounting	Improve machining accuracy, alignment accuracy or mounting accuracy of shaft and housing, or use the correct mounting method.
		Creep on fitted surface, or excessive seal friction	Correct the seals, replace the bearing, and correct the fitting or mounting.
Vibration (Axial runout)		Brinelling	Replace the bearing, and use care when handling bearings.
		Flaking	Replace the bearing.
		Incorrect mounting	Correct the squareness between the shaft and housing shoulder or side of spacer.
		Penetration of foreign particles	Replace or clean the bearing components and improve sealing.
Leakage or discoloration of lubricant		Too much lubricant, or contamination by foreign particles or wear debris	Reduce the amount of lubricant. Select a stiffer grease. Replace the bearing or lubricant. Clean the housing and adjacent parts.

Running Traces and Applied Loads

As the bearing rotates, the raceways of the inner ring and the outer ring make contact with the rolling elements. This results in a darkening of both the rolling elements and raceways. It is normal for the running trace to be marked on the raceway, and the extent and shape of this running trace provides a useful indication of loading conditions.
It is possible to determine from careful observation of the running traces whether the bearing is carrying a radial load, a large axial load, or a moment load, or if there are extreme rigidity variations of the housing. Unexpected load applied to the bearing, excessive mounting error, or others can also be determined, providing a clue to the investigation of causes for bearing failure.
Typical running traces of deep groove ball bearings are shown in Fig. 1, and representative running traces of roller bearings are shown in Fig. 2.

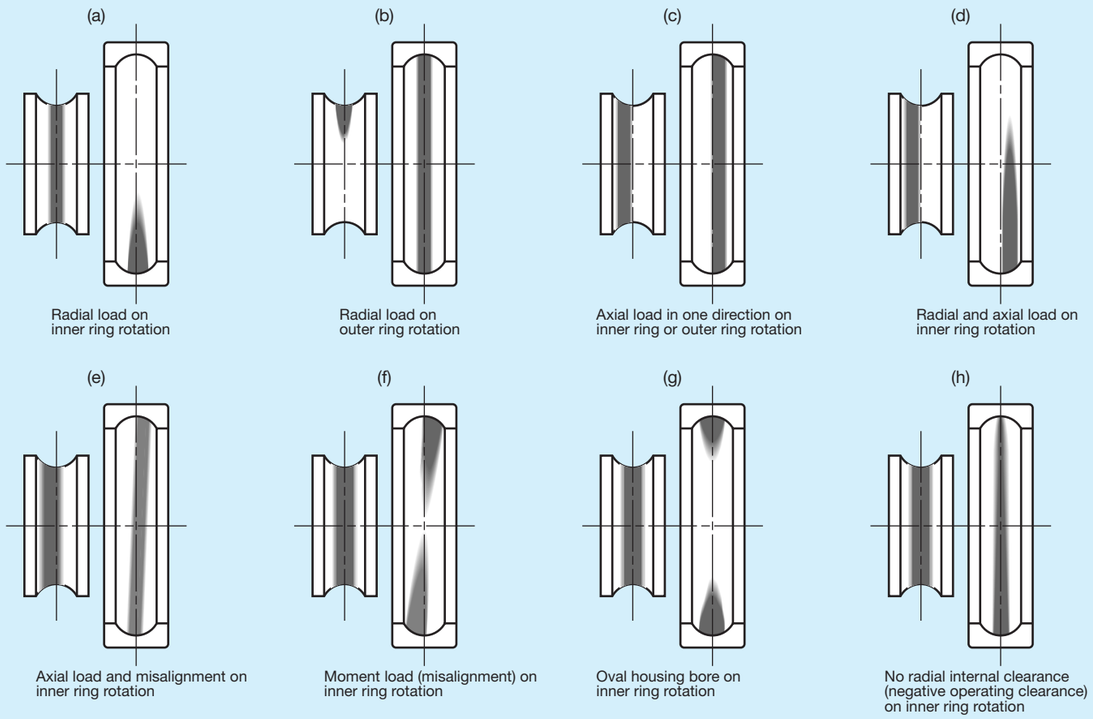


Fig. 1 Typical running traces of deep groove ball bearings

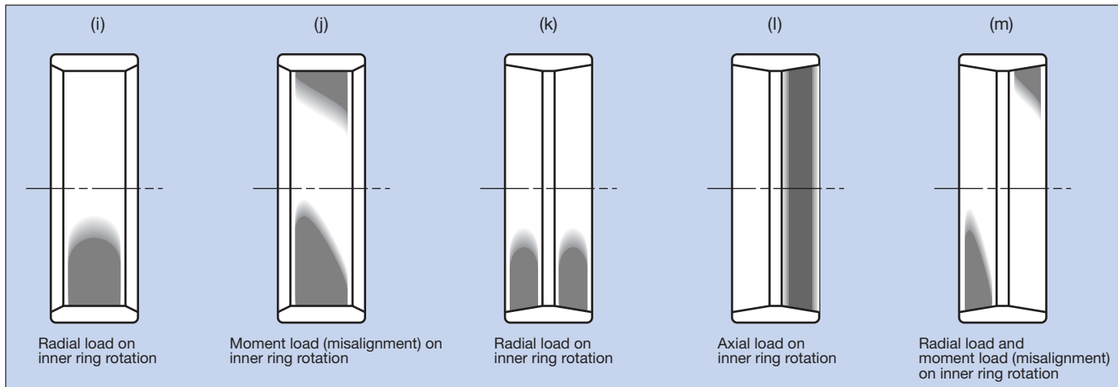
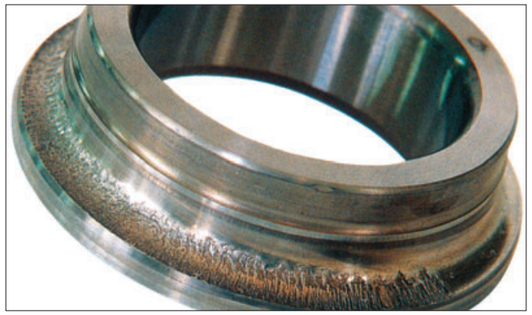


Fig. 2 Typical running traces of roller bearings

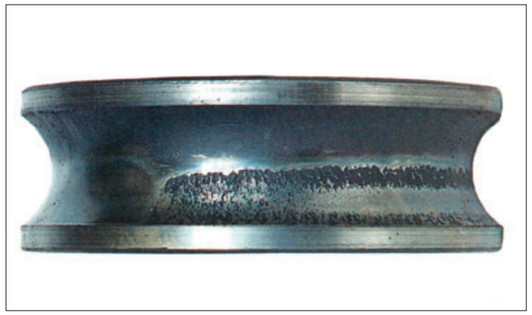
Bearing Damage and Countermeasures

Flaking

Damage condition	Possible causes	Countermeasures
Flaking occurs when fragments of bearing material chip off from the smooth surface of the raceway or rolling elements due to rolling fatigue, thereby creating regions having rough and coarse texture.	• Excessive load • Incorrect mounting (misalignment) • Moment load • Entry of foreign matter, water penetration • Poor lubrication, improper lubricant • Unsuitable bearing clearance • Improper precision for shaft or housing, unevenness in housing rigidity, large shaft bending • Progression from rust, corrosion pits, smearing, dens (brinelling)	• Reconfirm the bearing application and check the load conditions • Improve the mounting method • Improve the sealing mechanism, prevent rust during non-running • Use a lubricant with a proper viscosity, improve the lubrication method • Check the precision of shaft and housing • Check the bearing internal clearance

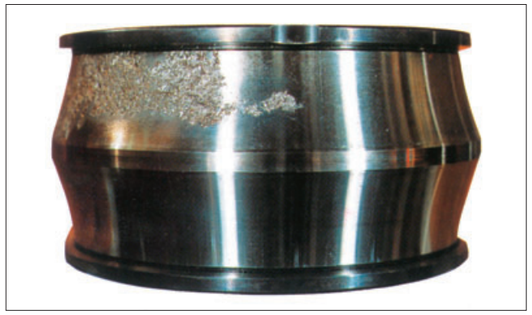


Part: Inner ring of an angular contact ball bearing
Symptom: Flaking occurs around half of the circumference of the raceway surface
Cause: Incorrect lubrication due to entry of cutting coolant into bearing



Part: Inner ring of an angular contact ball bearing
Symptom: Flaking occurs diagonally along raceway
Cause: Improper alignment between shaft and housing during mounting

Part: Inner ring of a spherical roller bearing
Symptom: Flaking of only one raceway over its entire circumference
Cause: Excessive axial load

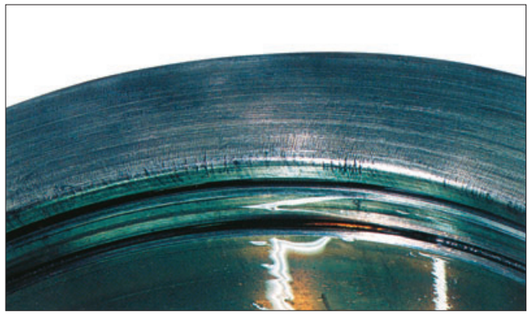


Part: Inner ring of a spherical roller bearing
Symptom: Flaking of only one row of raceway
Cause: Incorrect lubrication

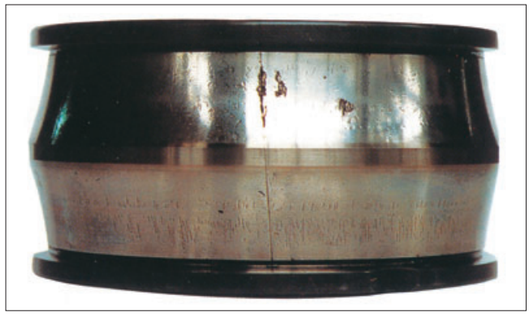
Bearing Damage and Countermeasures

Cracks

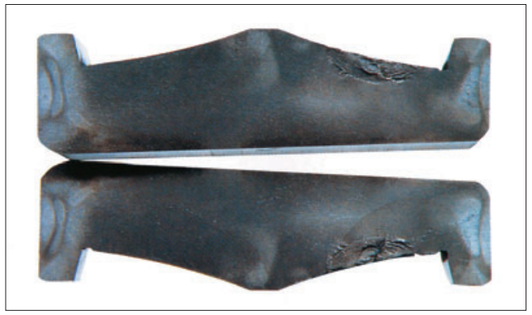
Damage condition	Possible causes	Countermeasures
Cracks in the raceway ring and rolling elements. Continued use under this condition leads to larger cracks or fractures.	• Excessive interference • Excessive load, shock load • Progression of flaking • Heat generation and fretting caused by contact between mounting parts and raceway ring • Heat generation due to creep • Improper taper angle of tapered shaft • Improper cylindricality of shaft • Interference with bearing chamfer due to a shaft corner radius that is larger than bearing chamfer dimension	• Correct the interference • Check the load conditions • Improve the mounting method • Use an appropriate shaft shape



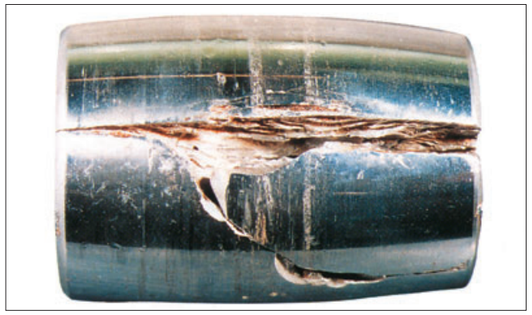
Part: Outer ring of a double-row cylindrical roller bearing
Symptom: Thermal cracks occur on the outer ring side face
Cause: Abnormal heat generation due to contact sliding between mating part and face of outer ring



Part: Inner ring of a spherical roller bearing
Symptom: Axial cracks occur on raceway surface
Cause: Large fitting stress due to temperature difference between shaft and inner ring



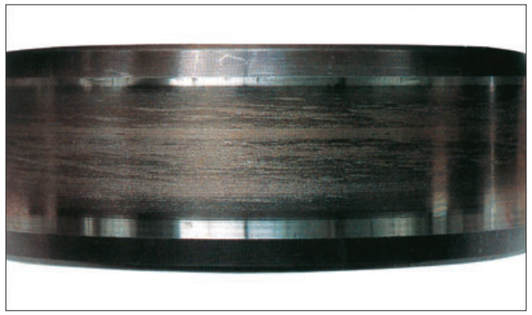
Part: Cross section of a fractured inner ring in a spherical roller bearing
Symptom: Origin is directly beneath the raceway surface



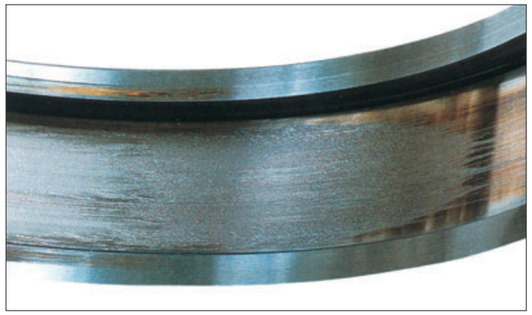
Part: Roller of a spherical roller bearing
Symptom: Axial cracks occurs on rolling surface

Smearing

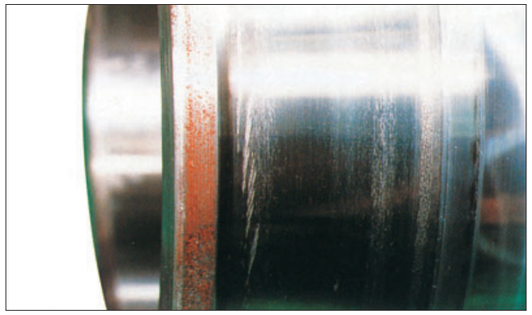
Damage condition	Possible causes	Countermeasures
Smearing is surface damage which occurs from a collection of small seizures between bearing components caused by oil film rupture and/or sliding. Surface roughening occurs along with melting.	• High speed and light load • Sudden acceleration/deceleration • Improper lubricant • Entry of water	• Improve the preload • Improve the bearing clearance • Use a lubricant with good oil film formation ability • Improve the lubrication method • Improve the sealing mechanism



Part: Inner ring of a cylindrical roller bearing
Symptom: Smearing occurs circumferentially on raceway surface
Cause: Roller slipping due to excessive grease filling



Part: Outer ring of a cylindrical roller bearing
Symptom: Smearing occurs circumferentially on raceway surface
Cause: Roller slipping due to excessive grease filling



Part: Inner ring of a spherical roller bearing
Symptom: Partial smearing occurs circumferentially on raceway surface
Cause: Incorrect lubrication

Part: Convex rollers of a spherical roller bearing
Symptom: Smearing occurs at the center of the rolling surface
Cause: Incorrect lubrication

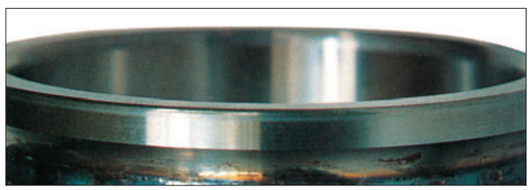
Bearing Damage and Countermeasures

Seizure

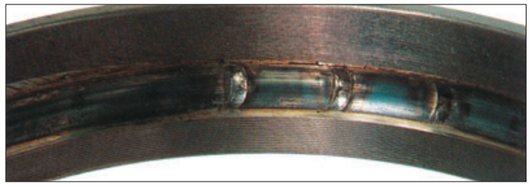
Damage condition	Possible causes	Countermeasures
When sudden overheating occurs during rotation, the bearing becomes discolored, and the raceway rings, rolling elements, and cage soften, melt, and deform as damage accumulates.	• Incorrect lubrication • Excessive load (excessive preload) • Excessive rotational speed • Excessively small internal clearance • Entry of water and foreign matter • Poor precision of shaft and housing, excessive shaft bending	• Investigate the lubricant and lubrication method • Reinvestigate the suitability of the bearing type selected • Investigate the preload, bearing clearance, and fitting • Improve the sealing mechanism • Check the precision of the shaft and housing • Improve the mounting method

Part: Inner ring of a spherical roller bearing
Symptom: Discoloration and melting of raceway; worn particles from the cage were rolled and attached to the raceway
Cause: Insufficient lubrication

Part: Convex rollers of a spherical roller bearing
Symptom: Discoloration and melting of roller rolling surface, adhesion of abrasion fragments from cage
Cause: Insufficient lubrication



Part: Inner ring of an angular contact ball bearing
Symptom: Raceway discoloration; melting occurs at ball pitch intervals
Cause: Excessive preload



Part: Outer ring of an angular contact ball bearing
Symptom: Raceway discoloration; melting occurs at ball pitch intervals
Cause: Excessive preload

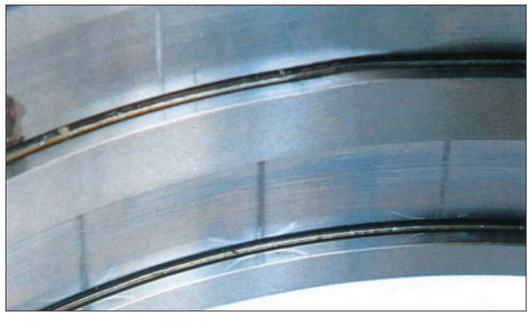
Part: Balls and cage of an angular contact ball bearing
Symptom: Cage is damaged by melting; balls becomes discolored and melted
Cause: Excessive preload

Fretting

Damage condition	Possible causes	Countermeasures
Wear occurs due to repeated sliding between two surfaces (bore, shaft, roller, etc.) Fretting occurs at fitting surface and also at contact areas between raceway and rolling elements. Fretting corrosion is another term used to describe the reddish brown or black wear debris.	• Incorrect lubrication • Vibration with a small amplitude • Insufficient interference	• Use a proper lubricant • Apply preload • Check the interference fit • Apply a film of lubricant to the fitting surface

Part: Inner ring of a deep groove ball bearing
Symptom: Fretting occurs on the bore surface
Cause: Vibration

Part: Inner ring of an angular contact ball bearing
Symptom: Notable fretting occurs over entire circumference of bore surface
Cause: Insufficient interference fit



Part: Outer ring of a double-row cylindrical roller bearing
Symptom: Fretting occurs on the raceway surface at roller pitch intervals

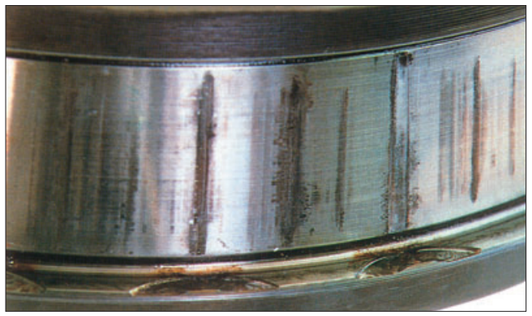
Bearing Damage and Countermeasures

Wear

Damage condition	Possible causes	Countermeasures
Wear is surface deterioration due to sliding friction at the surface of the raceway, rolling elements, roller end faces, rib face, cage pockets, etc.	• Entry of foreign matter • Progression from rust and electrical corrosion • Incorrect lubrication • Sliding due to irregular motion of rolling elements	• Improve the sealing mechanism • Clean the housing • Filter the lubrication oil thoroughly • Check the lubricant and lubrication method • Prevent misalignment

Part: Inner ring of a cylindrical roller bearing
Symptom: Many pits occurs due to electrical corrosion; wave-shaped wear on raceway surface
Cause: Electrical corrosion

Part: Outer ring of a spherical roller bearing
Symptom: Wear having a wavy or concave-and-convex texture on loaded side of raceway surface
Cause: Entry of foreign matter under repeated vibration while stationary



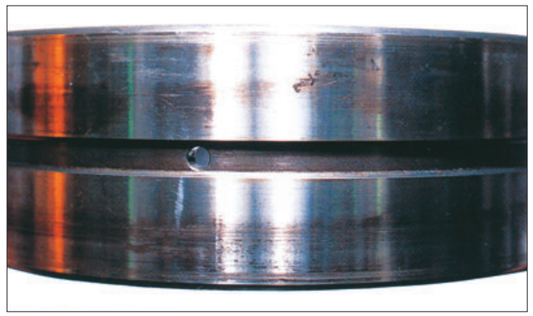
Part: Inner ring of a double-row tapered roller bearing
Symptom: Fretting wear of raceway and stepped wear on the rib face
Cause: Fretting progression due to excessive load while stationary

Part: Tapered rollers of a double-row tapered roller bearing
Symptom: Stepped wear on the roller end face
Cause: Fretting progression due to excessive load while stationary

Creep

Damage Condition	Possible causes	Countermeasures
Creep is a phenomenon in bearings where relative slipping occurs at the fitting surfaces and thereby creates a clearance at the fitting surface. Creep causes a shiny appearance, occasionally with scoring or wear.	• Insufficient interference or loose fit • Insufficient sleeve tightening	• Check the interference, and prevent rotation • Correct the sleeve tightening • Investigate the shaft and housing precision • Preload in the axial direction • Prevent axial movement of ring • Apply adhesive to the fitting surface • Apply a film of lubricant to the fitting surface

Part: Inner ring of a spherical roller bearing
Symptom: Creep accompanied by scoring of bore surface
Cause: Insufficient interference



Part: Outer ring of a spherical roller bearing
Symptom: Creep occurs over entire circumference of outside surface
Cause: Loose fit between outer ring and housing

Reference catalog

Please refer to the following catalogs for details of each product.

HPS$_{TM}$ Spherical Roller Bearings	(CAT. No. E1259)
Cylindrical Roller Bearings EW Series	(CAT. No. E1238)
Cylindrical Roller Bearings EM Series	(CAT. No. E1237)
Large Hi-TF Bearings	(CAT. No. E1202)
Full Complement Cylindrical Roller Bearings for Crane Sheaves	(CAT. No. E1206)
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Handling Instructions for Bearings	(CAT. No. E9010)
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