

# Bearings for Agricultural Machinery

NSK's high-performance bearings provide high reliability and efficiency for agricultural implements and machinery.





# NSK's advanced technology supports agriculture around the world.

Agricultural machinery must meet a variety of performance and environmental demands that change not only with type of crop but also with world location. NSK assists in the development of highly reliable and efficient agricultural machinery by offering a wide range of bearing types and technologies as well as global support.

## Development of bearings for agricultural machinery

● NSK technologies support the development of bearings for agricultural machinery.

### Design Technology

- Automatic design system for integrating analysis and field databases
- Designs utilizing materials developed for longer service life under harsh conditions (such as debris-resistant and wear-resistant materials)

### Evaluation Technology

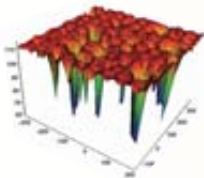
- Field simulation technology
- Bearing selection
- Lubrication recommendation

### Analysis and Diagnostic Technology

- Bearing analysis technology
- Fatigue analysis technology
- Diagnostic technology

● Four core technologies supporting the product development of NSK.

### Tribology



Advanced tribology (lubrication technology) including grease, solid lubricants, and surface processing that increase the load bearing, durability, high-speed performance, and quietness is utilized in our bearing products.

### Material Technology



NSK utilizes materials design, heat treatment, performance evaluation, and material analysis technologies for our bearing products to improve product performance and durability while reducing costs and increasing productivity.

### Analytical Technology



NSK utilizes the computer simulations in a virtual environment and reflects the optimum design by an advanced analysis technology in our bearing products.

### Mechatronics Technology



Advanced mechatronics technology combining highly functional sensors, mechanical element and electronics are used to produce our bearing products.





# Product Lineup



## Power Train

Engine/Electrical Accessories



Plastic Pulley for  
Accessory & Timing Belt



Water Pump Bearings

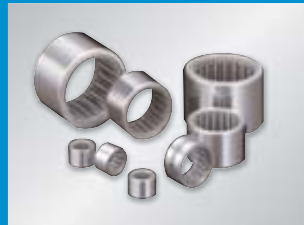
## Other



Ball Bearing Units

## Drive Train

Transmission/Differential Gear/Propeller shaft



Needle Roller Bearings



Creep-Free Bearings™ Series



HR Series Tapered Roller Bearings



EW/EM Series  
Cylindrical Roller Bearings



NSKHPS Spherical  
Roller Bearings



Hub Unit Bearings (HUB I)



Hi-TF Bearings



Double-Row Angular  
Contact Ball Bearings



Thrust Ball Bearings



Long-Life Pinion Shaft  
with Cage and Rollers



TM Series  
Sealed Deep Groove Ball Bearings

## Chassis

Wheel/Steering





## NSKHPS Spherical Roller Bearings

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

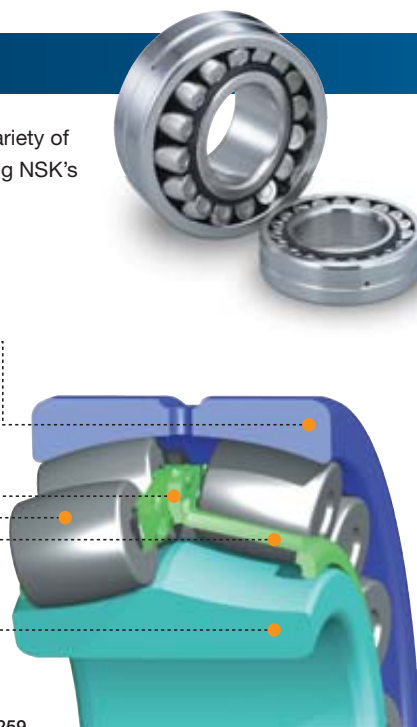
### Features Compared to the conventional EA Series:



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

- Outer Ring** ..... High-temperature operability (dimensional stability) and lubrication groove and holes
- Cage Flange** ..... High limiting speed
- Rollers** ..... Increased size and number
- Cage** ..... High-strength pressed steel with special surface treatment
- Inner Ring** ..... High-temperature operability (dimensional stability)

Catalog No. E1259



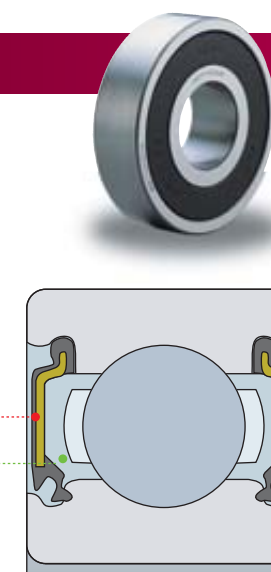
## TM Series Sealed Deep Groove Ball Bearings

The TM series delivers longer operating life under environments contaminated with foreign particles by incorporating a special seal that prevents the entry of foreign particles and has been especially effective in agricultural machinery and automobile transmission systems.

### Features

- Seal lip structure prevents entry of foreign matter while allowing entry of oil.
- Lower torque than conventional contact seal bearings.
- Sealed-in grease with a high affinity for gear oil to aid initial lubrication.

**Bearing Series** TM302-TM314 / TM203-TM214 Major dimensions are the same as the Series 62 and Series 63 of deep groove ball bearings.



## Long-Life Pinion Shaft with Cage and Rollers

These bearings have improved durability and reliability and achieve long service life under harsh operating conditions, such as continuous operation for long periods of time, by utilizing a pinion shaft with a cage and rollers as a single assembly.

### Features

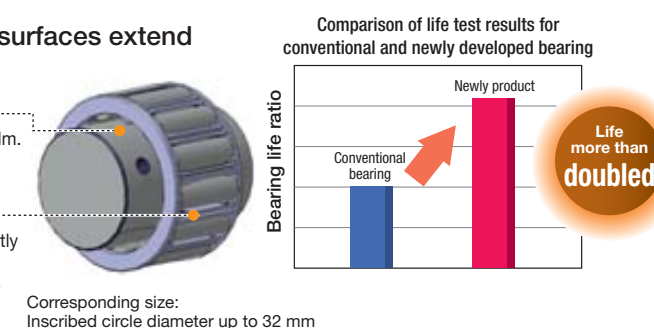
- Special heat treatment and improved raceway surfaces extend service life by more than twofold.

#### Pinion shaft

- Raceway polished to a mirror-smooth finish to ensure a sufficiently thick oil film.
- Special heat treatment applied to pinion shaft as a measure against contaminated-lubricant conditions.

#### Cage and rollers

- Roller running surface polished to a mirror-smooth finish to ensure a sufficiently thick oil film.
- Special heat treatment applied to rollers as a measure against contaminated-lubricant conditions.



## HR Series High-load Bearings (Tapered Roller Bearings/Deep Groove Ball Bearings)

The HR series of high-load bearings provides excellent performance in diverse applications.

### Features

- Higher load-carrying capacity and longer operating life.

#### Tapered roller bearings

Optimal cage design allows increased size and number of rollers.

#### Deep groove ball bearings

The standard dimensions are the same as for the standard-size bearings and feature designs with optimized ball diameter and quantity.

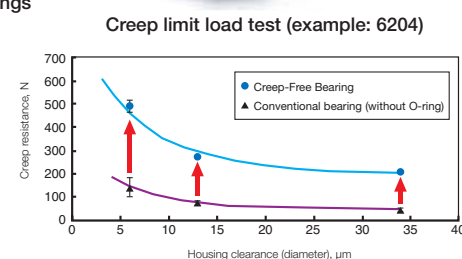
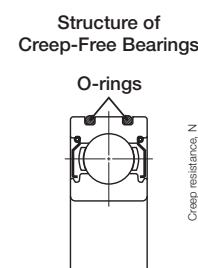


## Creep-Free Bearing™ Series

These bearings have two O-rings mounted in the outer ring to enhance creep prevention.

### Features

- O-rings enhance creep prevention.
- Assembly is easy since bearings can be fitted with a loose tolerance.
- Very little abrasion occurs on the bore surface of the housing, making reuse possible.
- Bearings can be replaced since boundary dimensions are identical to standard bearings. No reworking of the housing is required.



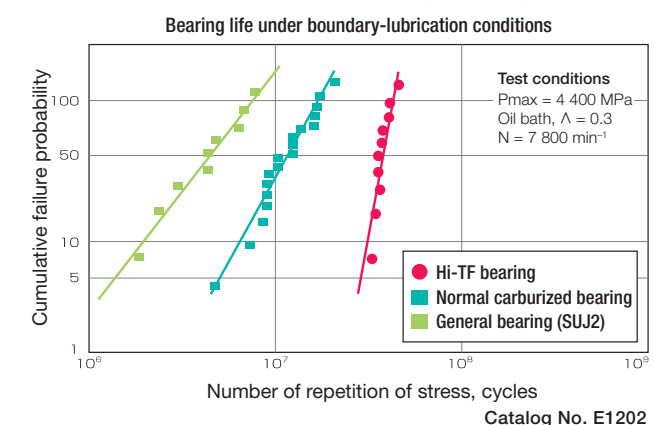
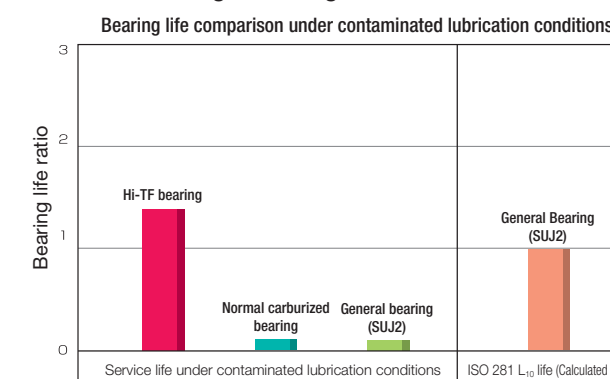
Catalog No. E1224

## Hi-TF Bearings

These bearings developed using new materials and new heat treatment methods specifically designed to improve durability provide long service life under the harsh lubrication conditions with the superior resistance to wear and seizure. Hi-TF bearings are capable of handling the foreseeable needs of the future as well as meeting today's requirements.

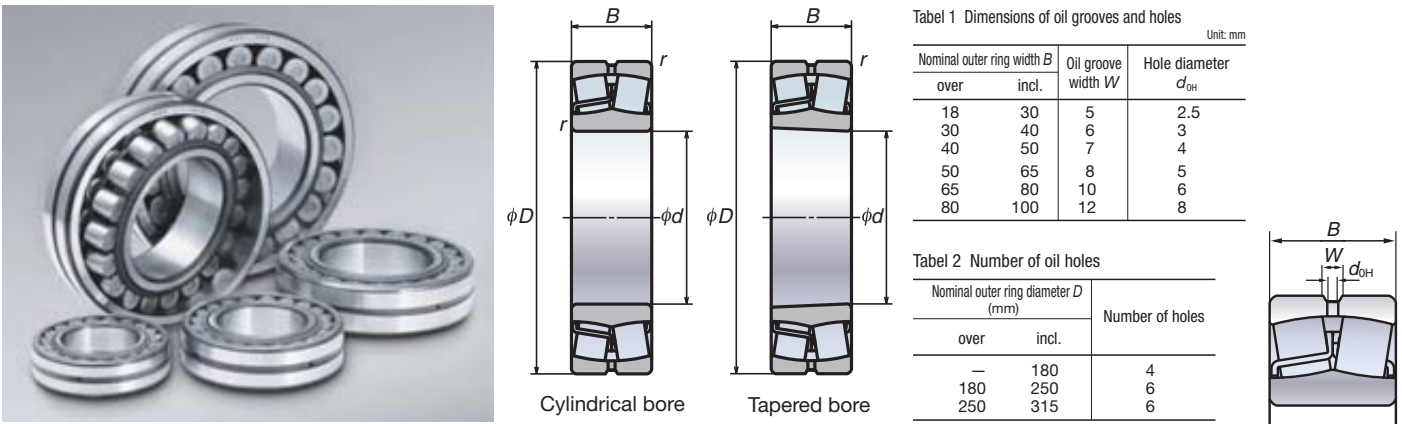
### Features

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



Catalog No. E1202

NSKHPS Spherical Roller Bearings



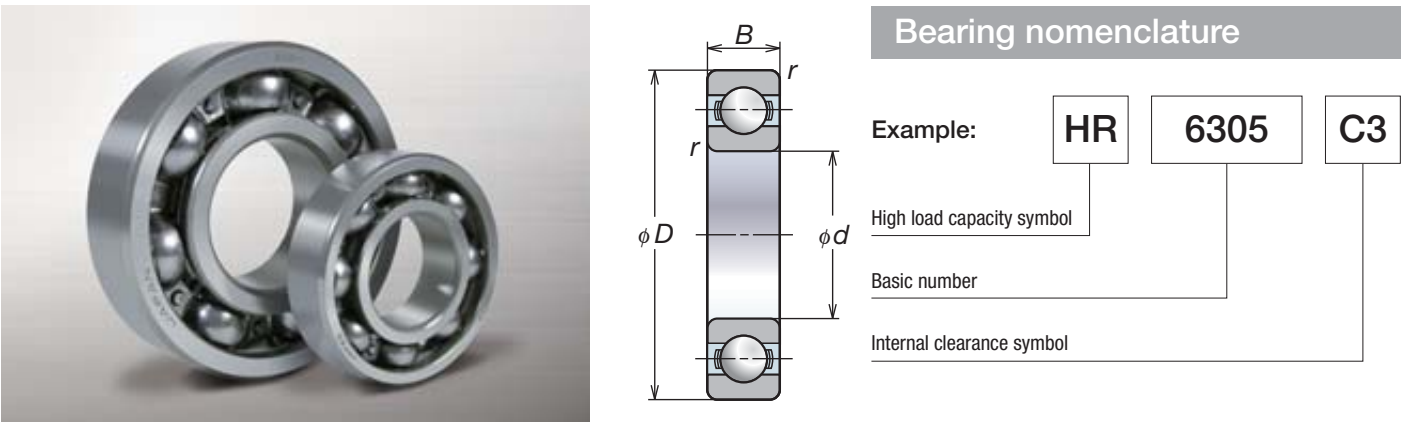
Boundary dimensions (mm)				Basic load ratings (N)		Limiting speeds (min <sup>-1</sup> )		Bearing numbers	
d	D	B	r (min.)	C <sub>r</sub>	C <sub>0r</sub>	Grease	Oil	Cylindrical bore	Tapered bore (¹)
40	80	23	1.1	113 000	99 500	6 700	8 500	22208EAE4	22208EAKE4
	90	23	1.5	118 000	111 000	6 000	7 500	21308EAE4	21308EAKE4
	90	33	1.5	170 000	153 000	5 300	6 700	22308EAE4	22308EAKE4
45	85	23	1.1	118 000	111 000	6 000	7 500	22209EAE4	22209EAKE4
	100	25	1.5	149 000	144 000	5 000	6 300	21309EAE4	21309EAKE4
	100	36	1.5	207 000	195 000	4 500	5 600	22309EAE4	22309EAKE4
50	90	23	1.1	124 000	119 000	5 600	7 100	22210EAE4	22210EAKE4
	110	27	2.0	178 000	174 000	4 500	5 600	21310EAE4	21310EAKE4
	110	40	2.0	246 000	234 000	4 300	5 300	22310EAE4	22310EAKE4
55	100	25	1.5	149 000	144 000	5 300	6 700	22211EAE4	22211EAKE4
	120	29	2.0	178 000	174 000	4 500	5 600	21311EAE4	21311EAKE4
	120	43	2.0	292 000	292 000	3 800	4 800	22311EAE4	22311EAKE4
60	110	28	1.5	178 000	174 000	4 800	6 000	22212EAE4	22212EAKE4
	130	31	2.1	238 000	244 000	3 800	4 800	21312EAE4	21312EAKE4
	130	46	2.1	340 000	340 000	3 600	4 500	22312EAE4	22312EAKE4
65	120	31	1.5	221 000	230 000	4 300	5 300	22213EAE4	22213EAKE4
	140	33	2.1	264 000	275 000	3 600	4 500	21313EAE4	21313EAKE4
	140	48	2.1	375 000	380 000	3 200	4 000	22313EAE4	22313EAKE4
70	125	31	1.5	225 000	232 000	4 000	5 300	22214EAE4	22214EAKE4
	150	35	2.1	310 000	325 000	3 200	4 000	21314EAE4	21314EAKE4
	150	51	2.1	425 000	435 000	3 000	3 800	22314EAE4	22314EAKE4
75	130	31	1.5	238 000	244 000	4 000	5 000	22215EAE4	22215EAKE4
	160	37	2.1	310 000	325 000	3 200	4 000	21315EAE4	21315EAKE4
	160	55	2.1	485 000	505 000	2 800	3 600	22315EAE4	22315EAKE4
80	140	33	2.0	264 000	275 000	3 600	4 500	22216EAE4	22216EAKE4
	170	39	2.1	355 000	375 000	3 000	3 800	21316EAE4	21316EAKE4
	170	58	2.1	540 000	565 000	2 600	3 400	22316EAE4	22316EAKE4
85	150	36	2.0	310 000	325 000	3 400	4 300	22217EAE4	22217EAKE4
	180	41	3.0	360 000	395 000	3 000	4 000	21317EAE4	21317EAKE4
	180	60	3.0	600 000	630 000	2 400	3 200	22317EAE4	22317EAKE4
90	160	40	2.0	360 000	395 000	3 200	4 000	22218EAE4	22218EAKE4
	190	43	3.0	415 000	450 000	2 800	3 600	21318EAE4	21318EAKE4
	190	64	3.0	665 000	705 000	2 400	3 000	22318EAE4	22318EAKE4
95	170	43	2.1	415 000	450 000	3 000	3 800	22219EAE4	22219EAKE4
	200	67	3.0	735 000	780 000	2 200	2 800	22319EAE4	22319EAKE4
100	180	46	2.1	455 000	490 000	2 800	3 600	22220EAE4	22220EAKE4
	215	73	3.0	860 000	930 000	2 000	2 600	22320EAE4	22320EAKE4
110	200	53	2.1	605 000	645 000	2 600	3 200	22222EAE4	22222EAKE4
	240	80	3.0	1 030 000	1 120 000	1 900	2 400	22322EAE4	22322EAKE4
120	215	58	2.1	685 000	765 000	2 400	3 000	22224EAE4	22224EAKE4
	260	86	3.0	1 190 000	1 320 000	1 700	2 200	22324EAE4	22324EAKE4
	130	230	64	820 000	940 000	2 200	2 600	22226EAE4	22226EAKE4

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

Remarks 1. The maximum operating temperature of standard NSKHPS spherical roller bearings is 200 °C.

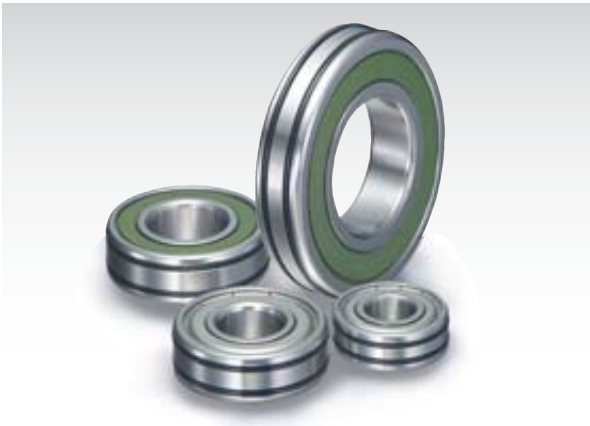
2. The suffix E4 indicates that the bearing has an oil groove and holes. (The numbers and dimensions of oil grooves and holes are shown in Tabela 1 and 2.)

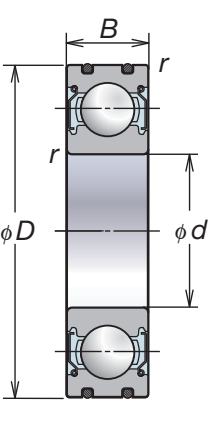
HR Series High-load Capacity Deep Groove Ball Bearings (open type)



Boundary dimensions (mm)				Basic load ratings (N)		Bearing numbers
d	D	B	r (min.)	C <sub>r</sub>	C <sub>0r</sub>	
15	35	11	0.6	8 550	3 950	HR 6202
15	42	13	1.0	13 300	5 900	HR 6302
17	40	12	0.6	11 300	5 350	HR 6203
17	47	14	1.0	15 600	7 100	HR 6303
20	52	15	1.1	18 200	9 050	HR 6304
25	52	15	1.0	15 300	8 100	HR 6205
25	62	17	1.1	23 700	12 200	HR 6305
30	62	16	1.0	23 300	12 800	HR 6206
30	72	19	1.1	29 800	15 800	HR 6306
35	72	17	1.1	28 300	16 000	HR 6207
35	80	21	1.5	39 500	21 500	HR 6307
40	80	18	1.1	32 500	19 900	HR 6208
40	90	23	1.5	47 000	26 200	HR 6308
45	85	19	1.1	36 500	22 600	HR 6209
45	100	25	1.5	57 000	34 500	HR 6309
50	90	20	1.1	39 000	25 800	HR 6210
50	110	27	2.0	66 500	40 500	HR 6310
55	100	21	1.5	48 000	32 000	HR 6211
55	120	29	2.0	78 000	46 000	HR 6311
60	110	22	1.5	58 000	38 000	HR 6212

Creep-Free Bearings™ Series





Bearing nomenclature

Example: 6205 CX C3

Basic number

Creep-free symbol

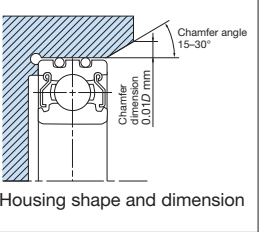
Internal clearance symbol

Boundary dimensions (mm)				Basic load ratings (N)		Bearing numbers
d	D	B	r (min.)	C <sub>r</sub>	C <sub>0r</sub>	
10	26	8	0.3	4 550	1 970	6000CX
10	30	9	0.6	5 100	2 390	6200CX
10	35	11	0.6	8 100	3 450	6300CX
12	28	8	0.3	5 100	2 370	6001CX
12	32	10	0.6	6 800	3 050	6201CX
12	37	12	1.0	9 700	4 200	6301CX
15	32	9	0.3	5 600	2 830	6002CX
15	35	11	0.6	7 650	3 750	6202CX
15	42	13	1.0	11 400	5 450	6302CX
17	35	10	0.3	6 000	3 250	6003CX
17	40	12	0.6	9 550	4 800	6203CX
17	47	14	1.0	13 600	6 650	6303CX
20	42	12	0.6	9 400	5 000	6004CX
20	47	14	1.0	12 800	6 600	6204CX
20	52	15	1.1	15 900	7 900	6304CX
25	47	12	0.6	10 100	5 850	6005CX
25	52	15	1.0	14 000	7 850	6205CX
25	62	17	1.1	20 600	11 200	6305CX
30	55	13	1.0	13 200	8 300	6006CX
30	62	16	1.0	19 500	11 300	6206CX
30	72	19	1.1	26 700	15 000	6306CX
35	62	14	1.0	16 000	10 300	6007CX
35	72	17	1.1	25 700	15 300	6207CX
35	80	21	1.5	33 500	19 200	6307CX
40	68	15	1.0	16 800	11 500	6008CX
40	80	18	1.1	29 100	17 900	6208CX
40	90	23	1.5	40 500	24 000	6308CX
45	75	16	1.0	20 900	15 200	6009CX
45	85	19	1.1	31 500	20 400	6209CX
45	100	25	1.5	53 000	32 000	6309CX

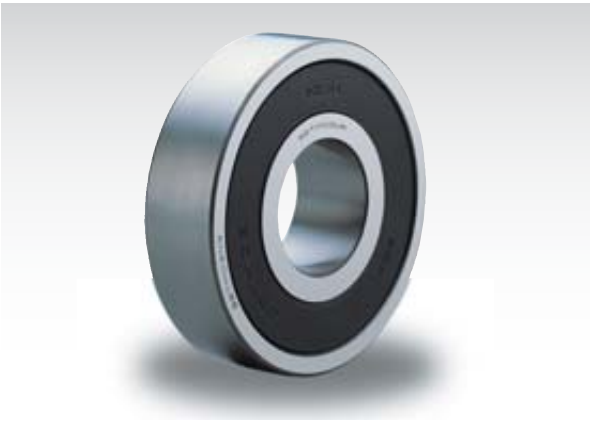
Note 1. Although recommended fits are G6 or H7, G6 is recommended when used under conditions that prioritize insertion under light pre-load.  
2. Please contact NSK for seal and shield selection.

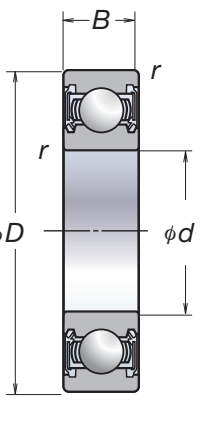
Note on mounting Creep-Free Bearings

- When oil or grease is applied to the outer diameter of the bearing, use a mineral oil or a synthetic hydrocarbon oil (NSK's EA2, etc.).
- O-ring material is nitrile rubber (operating temperature range: -30 to 120 °C) as a standard specification. Please contact NSK for use under special environments such as high temperatures.



TM Series Sealed Deep Groove Ball Bearings





Bearing nomenclature

Example: TM 205 C3

TM series symbol

Basic number

Internal clearance symbol

Boundary dimensions (mm)			Basic load ratings (N)		Bearing numbers
d	D	B	C <sub>r</sub>	C <sub>0r</sub>	
17	40	12	9 550	4 800	TM203
17	47	14	13 600	6 650	TM303
20	47	14	12 800	6 600	TM204
20	52	15	15 900	7 900	TM304
22	50	14	12 900	6 800	TM2/22
22	56	16	18 400	9 250	TM3/22
25	52	15	14 000	7 850	TM205
25	62	17	20 600	11 200	TM305
28	58	16	16 600	9 500	TM2/28
28	68	18	26 700	14 000	TM3/28
30	62	16	19 500	11 300	TM206
30	72	19	26 700	15 000	TM306
32	65	17	20 700	11 600	TM2/32
32	75	20	29 400	17 000	TM3/32
35	72	17	25 700	15 300	TM207
35	80	21	33 500	19 200	TM307
40	80	18	29 100	17 800	TM208
40	90	23	40 500	24 000	TM308
45	85	19	31 500	20 400	TM209
45	100	25	53 000	32 000	TM309
50	90	20	35 000	23 200	TM210
50	110	27	62 000	38 500	TM310
55	100	21	43 500	29 300	TM211
55	120	29	71 500	44 500	TM311
60	110	22	52 500	36 000	TM212
60	130	31	82 000	52 000	TM312
65	120	23	57 500	40 000	TM213
65	140	33	92 500	60 000	TM313
70	125	24	62 000	44 000	TM214
70	150	35	104 000	68 000	TM314

Note: Maximum continuous operating temperature for standard nitrile rubber seals is 110 °C.



# Bearing Damage and Countermeasures

## Flaking

Damage Condition	Possible Cause	Measures depending on the operating conditions	Measures depending on the bearing
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.	<ul style="list-style-type: none"><li>Excessive load</li><li>Incorrect mounting (misalignment)</li><li>Moment load</li><li>Entry of foreign matter, water penetration</li><li>Poor lubrication, Improper lubricant</li><li>Unsuitable bearing clearance</li><li>Improper precision for shaft or housing, unevenness in housing rigidity, large shaft bending</li><li>Progression from rust, corrosion pits, smearing, dents (brinelling)</li></ul>	<ul style="list-style-type: none"><li>Reconfirm the bearing application and check the load conditions</li><li>Improve the mounting method</li><li>Improve the sealing mechanism, prevent rust during idle periods</li><li>Use a lubricant with a proper viscosity, improve the lubrication method</li><li>Check the precision of shaft and housing</li><li>Check the bearing internal clearance</li></ul>	<ul style="list-style-type: none"><li>Hi-TF Bearing</li><li>TM Series Sealed Deep Groove Ball Bearings</li><li>HR Series High-load Bearings</li></ul>



- Part: Inner ring of an angular contact ball bearing
- Symptom: Flaking occurs around half of the circumference of the raceway surface
- Cause: Incorrect lubrication



- 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 deep groove ball bearing
- Symptom: Flaking of raceway at ball pitch
- Cause: Dents due to shock load during mounting



- Part: Inner ring of an angular contact ball bearing
- Symptom: Flaking of raceway at ball pitch
- Cause: Dents due to shock load while stationary

## Creep

Damage Condition	Possible Cause	Measures depending on the operating conditions	Measures depending on the bearing
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.	<ul style="list-style-type: none"><li>Insufficient interference or loose fit</li><li>Insufficient sleeve tightening</li></ul>	<ul style="list-style-type: none"><li>Check the interference, and prevent rotation</li><li>Correct the sleeve tightening</li><li>Investigate the shaft and housing precision</li><li>Preload in the axial direction</li><li>Prevent axial movement of ring</li><li>Apply adhesive to the fitting surface</li><li>Apply a film of lubricant to the fitting surface</li></ul>	<ul style="list-style-type: none"><li>Creep-Free Bearings™ Series</li></ul>



- Part: Outer ring of a deep groove ball bearing
- Symptom: Creep occurs over entire circumference of outside surface
- Cause: Loose fit between outer ring and housing



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

# Bearing Damage and Countermeasures

## Cage Damage

Damage Condition	Possible Cause	Measures depending on the operating conditions	Measures depending on the bearing
Cage damage includes cage deformation, fracture, and wear. • Fracture of cage pillar • Deformation of side face • Wear of pocket surface • Wear of guide surface	• Incorrect mounting (Bearing misalignment) • Incorrect handling • Large moment load • Shock and large vibration • Excessive rotation speed, sudden acceleration and deceleration • Incorrect lubrication • Temperature rise	● Check the mounting method ● Check the temperature, rotation, and load conditions ● Reduce the vibration ● Select a cage type ● Select a lubrication method and lubricant	● <b>Cage selection revision</b>



- Part: Cage of a deep groove ball bearing
- Symptom: Fracture of pressed-steel cage-pocket

## Fretting

Damage Condition	Possible Cause	Measures depending on the operating conditions
Wear occurs due to repeated sliding between the two surfaces. Fretting occurs at fitting surface and also at contact area 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

## [Reference Catalog]

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



NSKHPS 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)



Rolling Bearings (CAT.No. E1102)



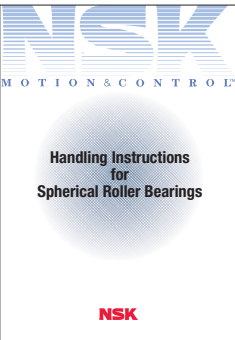
Large-Size Rolling Bearings (CAT.No. E125)



Needle Roller Bearings (CAT.No. E1419)



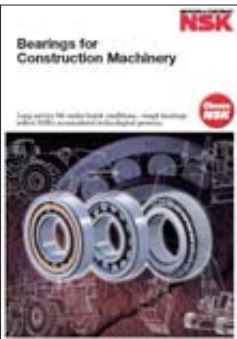
Handling Instructions for Bearings (CAT.No. E9010)



Handling Instructions for Spherical Roller Bearings (CAT.No. E9003)



New Bearing Doctor (CAT.No. E7005)



Bearings for Construction Machinery (CAT.No. E1264)



## Related Websites

- **NSK web site** ————— <http://www.nsk.com>
- **NSK Agriculture page** ————— <http://www.nsk.com/industries/agriculture.html>
- **NSK Online Tools** ————— <http://www.nsk.com/services/onlinetools>
- **Downloads [Catalogs and CAD drawings]** — <http://www.jp.nsk.com/app01/en/ctr>



## Worldwide Sales Offices

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