

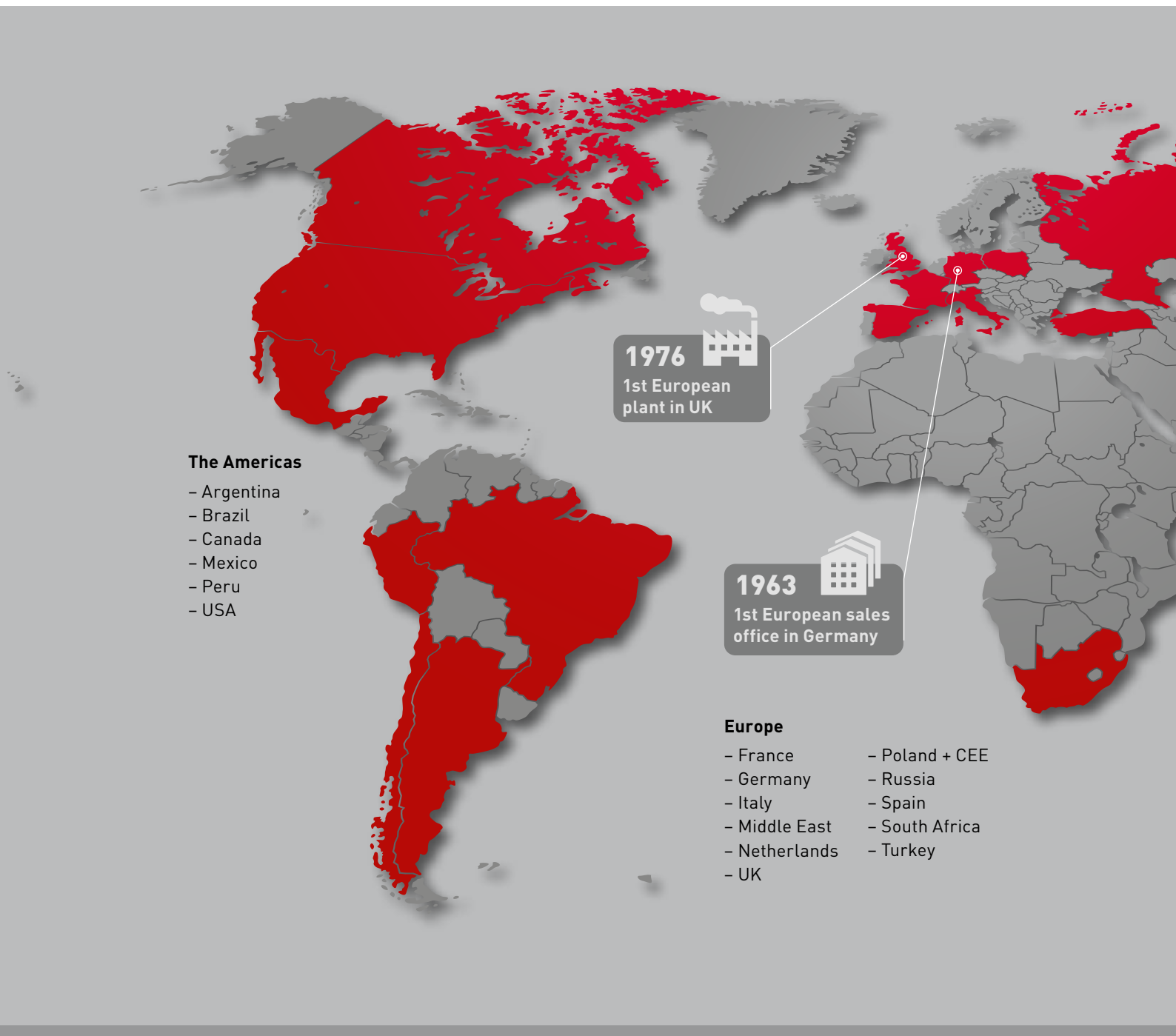
UTILITIES

MOTION & CONTROL
NSK



OUR MOST IMPORTANT PRODUCT: OUR CUSTOMERS' SATISFACTION

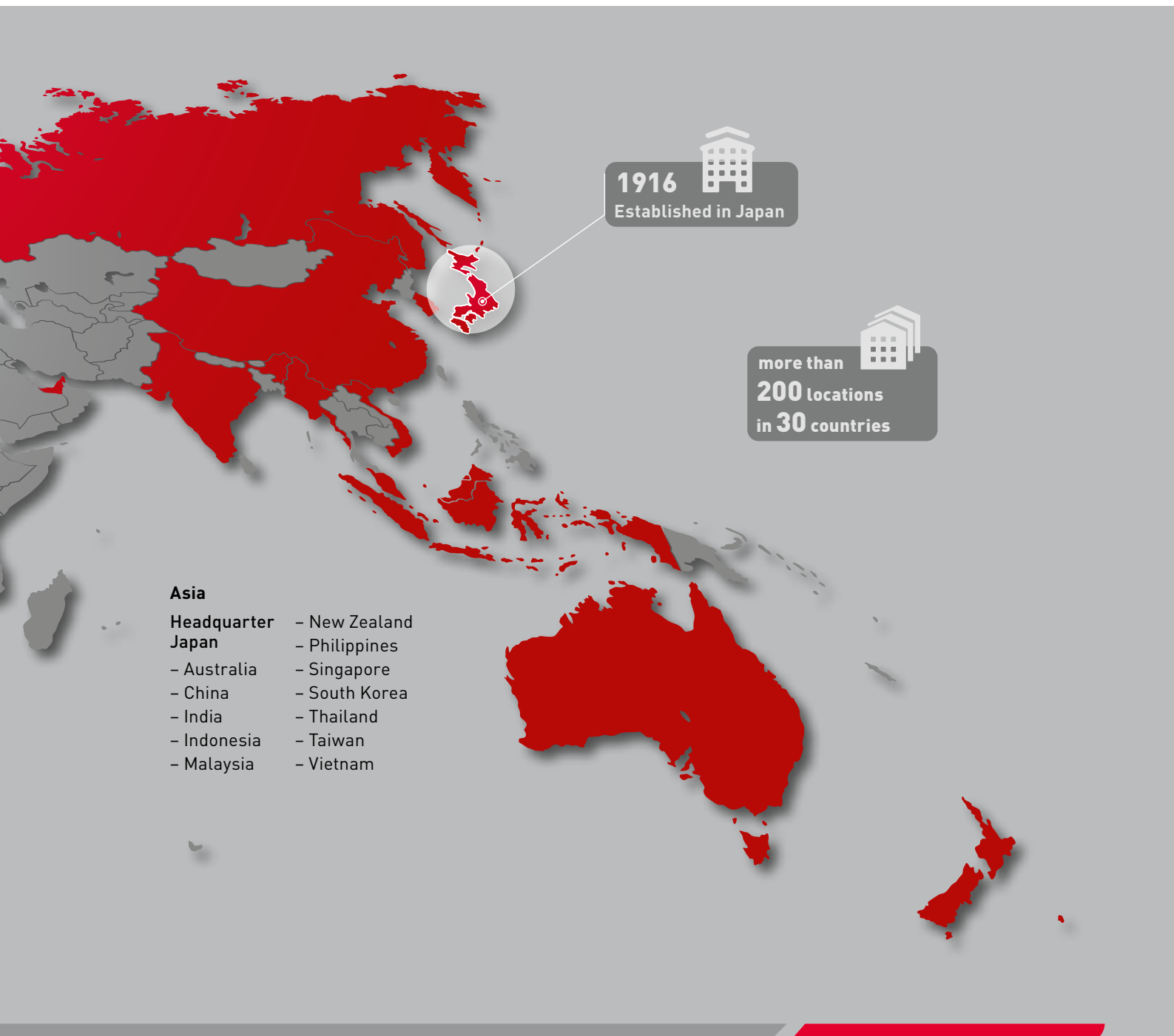
We are among the leading manufacturers worldwide for rolling bearings, linear technology components and steering systems. One reason for this is that our products are reliable and energy efficient in demanding environments and even under the harshest conditions. To achieve this, we do research in core technology areas such as material engineering and tribology, we are always optimising every process phase in terms of quality and our products undergo continuous development for applications



in a wide variety of industries. One thing motivates us here: we want to help you increase the reliability of your vehicles and equipment, not only with excellent products, but above all with excellent service. Our experienced engineers have a deep understanding of systems – together with you, they work to optimise products and processes and develop solutions for the future. The goal that we are dedicated to every day is ensuring that you remain competitive over the long run.



Dr. Ulrich Nass, CEO of NSK Europe Ltd.





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Catalogues

“Bearings for Pumps
and Compressors”

BEARINGS FOR
PUMPS AND COMPRESSORS



As one of the world's leading manufacturers of rolling bearings, linear technology components and steering systems, we can be found on almost every continent – with production facilities, sales offices and technology centres – because our customers appreciate short decision-making channels, prompt deliveries and local service.



The NSK company

NSK commenced operations as the first Japanese manufacturer of rolling bearings back in 1916. Ever since, we have been continuously expanding and improving not only our product portfolio but also our range of services for various industrial sectors. In this context, we develop technologies in the fields of rolling bearings, linear systems, components for the automotive industry and mechatronic systems. Our research and production facilities in Europe, Americas and Asia are linked together in a global technology

network. Here we concentrate not only on the development of new technologies, but also on the continuous optimisation of quality – at every process stage.

Among other things, our research activities include product design, simulation applications using a variety of analytical systems and the development of different steels and lubricants for rolling bearings.

Partnership based on trust – and trust based on quality

Total Quality by NSK: The synergies of our global network of NSK Technology Centres.
Just one example of how we meet our requirements for high quality.

NSK is one of the leading companies with a long tradition in patent applications for machine parts. In our worldwide research centres, we not only concentrate on the development of new technologies, but also on the continual

improvement of quality based on the integrated technology platform of tribology, material technology, analysis and mechatronics.

More about NSK at www.nskeurope.com or call us on +44(0)1636 605123



NSK is serving the Pumps & Compressors Industry



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As a global supplier to world leading pumps and compressors manufacturing companies, NSK has the experience and understanding of helping its customers to manage their costs and improve production efficiencies.

Pumps and Compressors are used in a wide range of process industries where requirements are for bearings offering long life in order to increase Mean Time Between Failures (MTBF). Downtime in production processes leads to huge costs and loss of productivity. At the same time, Pump and Compressor manufacturers are looking for more compact machines leading to downsizing of bearings.

The combination of increased life time and downsizing places increasingly severe demands on ball and roller bearings; and satisfying those needs call for bearings of the highest quality and reliability.

For pump applications, depending on the pump type, bearings can run under axial loads, radial loads or combined loads; small to high speeds and different lubrication conditions. In any case, conditions are quite tough and the need for high MTBF is a challenge for bearings.

For compressor applications, bearings are subjected to high axial and radial loads. They play a key role as they have to ensure correct positioning of the rotors in the axial and radial direction. This is extremely important as good positioning of the rotors is directly linked to compressor efficiency. Therefore, axial and radial deflection of the bearings must be kept as small as possible.

All the products developed by NSK specifically for these applications, are featured in this brochure. In addition to our standard product range, our research and development centres around the world continue to develop the next generation of application-dedicated products by understanding the unique requirements of our customers so that we can help them to continuously improve their machines. For screw compressors, we have developed cylindrical roller bearings and HPS angular contact ball bearings fitted with a patented plastic cage in Linear Poly-Phenylene Sulfide (L-PPS) offering superior characteristics compared to standard plastic cages.

Our team of application engineers, local to your operation, are in contact with OEM R&D teams helping them to find new bearing solutions at each stage of their projects. The experience accumulated after years of involvement in pump and compressor applications is the key for mutual success.

We invite you to have a look through our unique range of innovative problem solving products and if you have an interest in any of our products, please contact your NSK Sales office.

Standard Bearing Range



Single Row Radial Ball Bearings

Available ranges: 600, 6800, 6900, 16000, 16100, 6000, 6200, 6300, 6400 Series

- › Standard and special applications
- › Steel, brass or polyamide cage
- › Low noise
- › Full sealing options
- › Wide range of greases
- › Standard or special steels



Single Row Cylindrical Roller Bearings with Brass Cage, Steel Cage or Polyamide Cage

- › Pressed steel cage series: EW
- › Polyamide cage series: ET
- › Machined brass cage series: EM



Single Row Angular Contact Ball Bearings*

- › Pressed steel cage series
- › Polyamide cage series
- › Machined brass cage series

*See also the new HPS range: page 16



Double Row Angular Contact Ball Bearings

Available ranges: 3200 – 3300 / 5200 – 5300 Series

- › Steel or polyamide cage
- › Open
- › Shielded ZZ or 2Z
- › Sealed DDU or 2RS



Tapered Roller Bearing

- › Inch & metric sizes
- › Standard steel / carburized steel / HTF treatment
- › Custom made sets with spacers



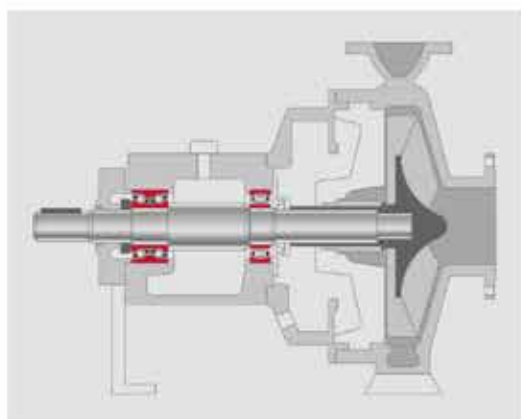
HPS Spherical Roller Bearings

- › High load capacity
- › High limiting speed
- › High strength cage
- › Low noise and vibration

This is a non-exhaustive overview of NSK bearings used in Pumps & Compressors.

If you require additional bearings, please contact NSK.

Bearing Solutions for Pumps



Centrifugal Pumps

Bearing Selection

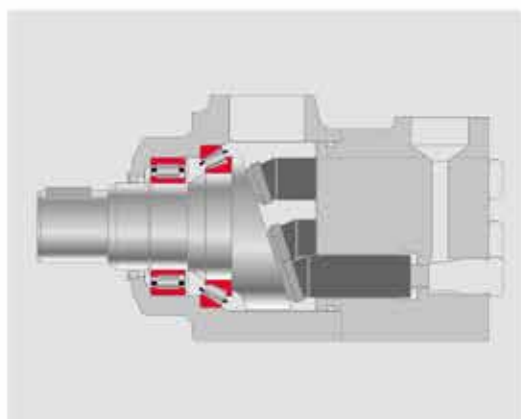
- › Cylindrical Roller Bearings
- › Angular Contact Ball Bearings
- › Double Row Angular Contact Ball Bearings
- › Deep Groove Ball Bearings – special: HR series*

Operating Conditions

- › Speed: 1500 rpm – 3000 rpm
- › Axial & radial loads

Bearing Requirements

- › Long life under high axial loads
- › Small axial free play



Piston Pumps

Bearing Selection

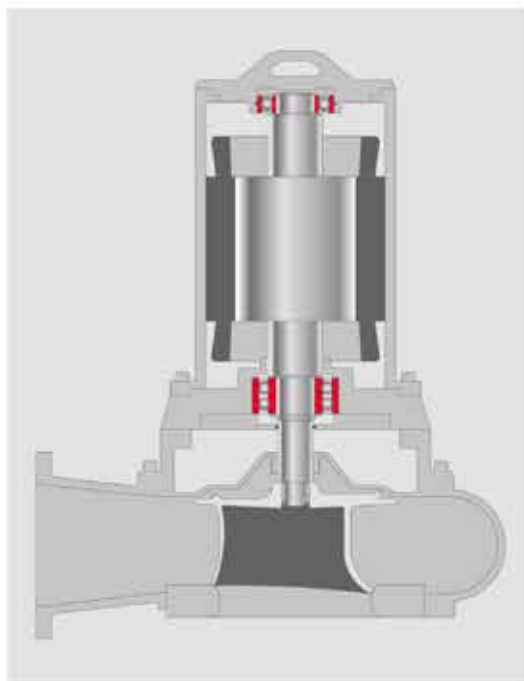
- › Cylindrical Roller Bearings – Special L-PPS cage
- › Tapered Roller Bearings – P6X accuracy – Carburized steel
- › Needle Roller Bearings

Operating Conditions

- › Heavy axial and radial load
- › Medium speed

Bearing Requirements

- › Reduced width tolerance for precise mounting
- › Oil compatibility with cage



Submersible Pumps

Bearing Selection

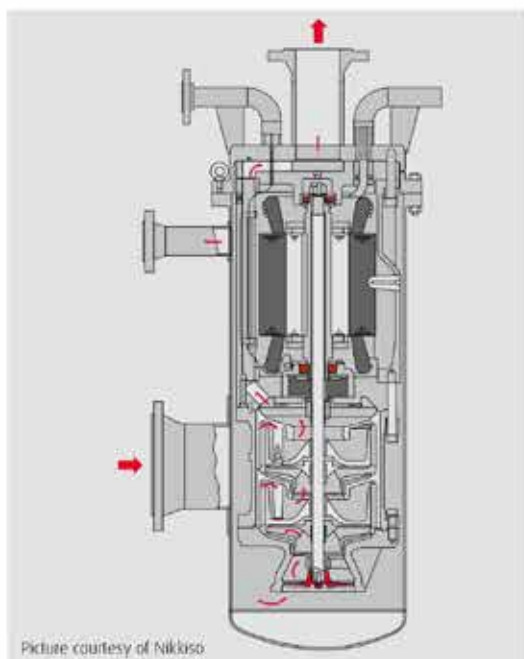
- › Cylindrical Roller Bearings
- › Angular Contact Ball Bearings
- › Double Row Angular Contact Ball Bearings
- › Deep Groove Ball Bearings – special: Creep-Free bearings*

Operating Conditions

- › Vertical shaft
- › Axial load
- › Large temperature difference between inner & outer rings.

Bearing Requirements

- › Sealing performance
- › Prevent top bearing creeping in housing



LNG Pumps*

Bearing Selection

- › Deep Groove Ball Bearings
- › Angular Contact Ball Bearings

Operating Conditions:

- › Speed: 1160 rpm – 3600 rpm
- › Gas temperature: -196 °C up to 0 °C
- › Mainly axial load
- › Very poor lubrication

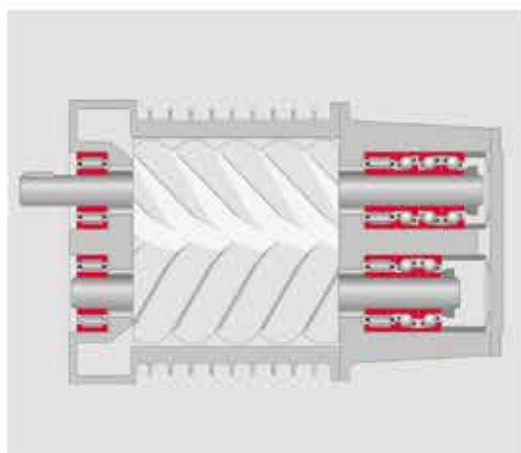
Bearing Requirements:

- › Self lubricating
- › Corrosion resistance

Picture courtesy of Nikkiso

* See further information on page 12 to 15

Bearing Solutions for Compressors



Oil Injected Screw Compressor

Bearing Selection

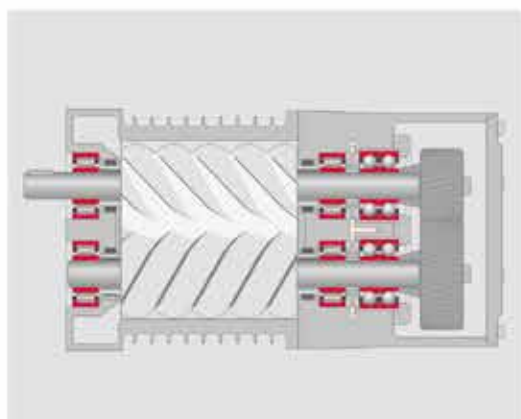
- › Cylindrical Roller Bearings – with L-PPS cage*
- › HPS Angular Contact Ball Bearings – with L-PPS cage*
- › Tapered Roller Bearings
- › Needle Roller Bearings

Operating Conditions

- › Medium speed
- › Large axial & radial loads
- › Oil circulation

Bearing Requirements

- › Specific axial & radial clearances to provide precise screw guidance
- › Plastic cage compatibility with special oils.



Oil free Screw Compressor

Bearing Selection

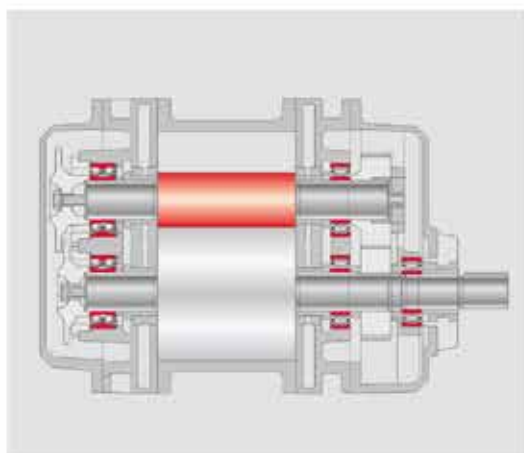
- › Cylindrical Roller Bearings – with outer ring guided brass cage, P6 or P5 accuracy
- › Angular Contact Ball Bearings – with outer ring guided brass cage, P6 or P5 accuracy
- › 4-point contact ball bearings – with outer ring guided brass cage, P6 accuracy, reduced axial clearance

Operating Conditions

- › High speed (0.7 M.d/min-1.4 M.d/min)
- › Moderate axial & radial loads
- › Oil jet lubrication

Bearing Requirements

- › Specific axial & radial clearances to provide precise screw guidance
- › High speed performance
- › Heat resistance



Roots Blower

Bearing Selection

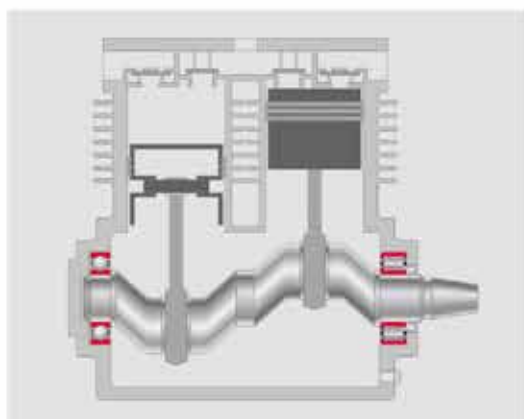
- › Cylindrical Roller Bearings
- › Angular Contact Ball Bearings
- › Double Row Angular Contact Ball Bearings
- › Deep Groove Ball Bearings

Bearing Requirements

- › Long life
- › Heat resistance

Operating Conditions

- › Oil-free
- › Medium to high temperature
- › Vibration



Piston Compressor

Bearing Selection

- › Cylindrical Roller Bearings
- › High Capacity Deep Groove Ball Bearings
- › Needle Roller Bearings
- › Special bearing solution for oil free types

Operating Conditions

- › High radial load associated with reciprocating motion

Bearing Requirements

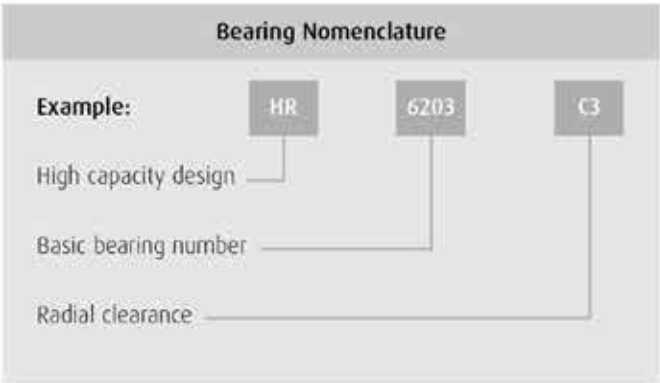
- › Long life under tough conditions

* See further information on page 20/21

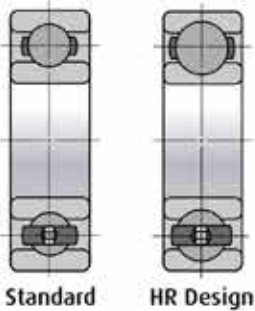
Special Deep Groove Ball Bearings for Pumps

High Capacity Deep Groove Ball Bearings

High capacity deep groove ball bearings (HR series) have bigger rolling elements than standard deep groove ball bearings. Typically this will provide a 7% to 19% increase in dynamic load rating, depending on size, resulting in a 22% to 68% increase in ISO L_{10} life. The HR series can dramatically improve the life of a machine or can be used to downsize existing machines.



Bigger rolling elements:
load capacity increased



Bore diameter (mm)	Parts No.	New HR Series		Standard		C_i increased ratio
		Basic load rating (N)		Basic load rating (N)		
		C_i	C_{in}	C_i	C_{in}	
15	6202	8 550	3 950	7 650	3 750	1.12
	6302	13 300	5 900	11 400	5 450	1.17
17	6203	11 300	5 350	9 550	4 800	1.18
	6303	15 600	7 100	13 600	6 650	1.15
20	6304	18 200	9 050	15 900	7 900	1.14
25	6205	15 300	8 100	14 000	7 850	1.09
	6305	23 700	12 200	20 600	11 200	1.15
30	6206	23 300	12 800	19 500	11 300	1.19
	6306	29 800	15 800	26 700	15 000	1.12
35	6207	28 300	16 000	25 700	15 300	1.10
	6307	39 500	21 500	33 500	19 200	1.18
40	6208	32 500	19 900	29 100	17 800	1.12
	6308	47 000	26 200	40 500	24 000	1.16
45	6209	36 500	22 600	31 500	20 400	1.16
	6309	57 000	34 500	53 000	32 000	1.08
50	6210	39 400	25 800	35 000	23 200	1.11
	6310	66 500	40 500	62 000	38 500	1.07
55	6211	48 000	32 000	43 500	29 300	1.10
	6311	78 000	46 000	71 500	44 500	1.09
60	6212	58 000	38 000	52 500	36 000	1.10

Standard HR series are open types. Shielded and sealed versions are also being produced. Please contact NSK.

Special Deep Groove Ball Bearings for Pumps

LNG Pump Bearings

LNG pump bearings are employed as upper and lower support bearings on the mainshaft of a motor which drives the special pumps used for receiving and discharging LNG to road tankers and storage tanks. The bearings, immersed in Liquefied Natural Gas (LNG) at -162°C , are using the cryogenic liquid as a lubricant while operating at speeds up to 3,600 rev/min.

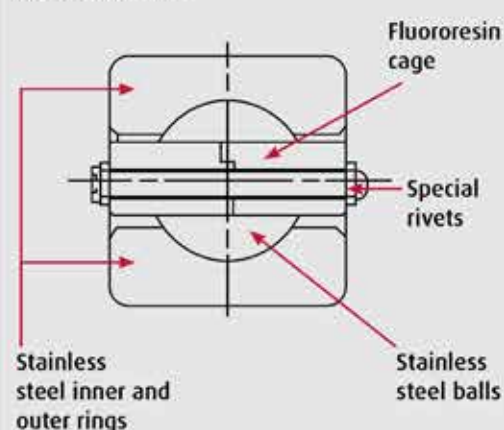
Bearing Nomenclature

Example:



To cope with these tough conditions, NSK developed deep groove* ball bearings using special materials. Rings and balls are made from martensitic stainless steel to provide corrosion resistance. The bearing cage is made from Fluororesin, a material that offers the extremely useful property of being self-lubricating, even at very low temperatures. This is significant because during operation, the cage – a two piece unit held together by special rivets – actually transfers a thin film of Fluororesin from the retainer pocket to the ball, and then to the raceway surface, maintaining good lubrication conditions. NSK LNG pump bearings extend service intervals in this very demanding environment.

Bearing structure



* Some sizes are also available as angular contact ball bearings.

Special Deep Groove Ball Bearings for Pumps

Creep-Free Bearings

NSK introduces a new bearing series that is indispensable in the pump free-end bearing position, and for any applications with creep problems. O-ring compression provides dramatically enhanced creep resistance. As the boundary dimensions are identical, the housing does not need to be reworked when replacing standard bearings. This results in reduced cost of the conversion.



Bearing Nomenclature

Example:

Creep-Free Bearing
(with O-ring)
Basic bearing number
Seal type
Radial clearance

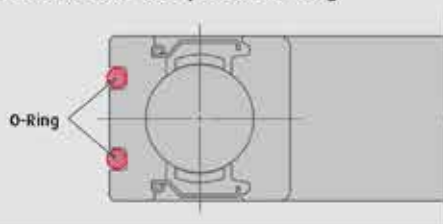
CX 6203 ZZ C3

Bearing bore diameter d mm	Bearing outer diameter D mm	Bearing width B mm	Bearing load ratings		Recommended Housing fits*	Bearing number			
			C _r (N)	C ₀ (N)		Open type	Shield type	Contact seal type**	Non-contact type
10	26	8	4 550	1 970	G6 or H7	CX-6000			
	30	9	5 100	2 390		CX-6200	ZZ	DDU	VV
	35	11	8 100	3 450		CX-6300			
12	28	8	5 100	2 370		CX-6001			
	32	10	6 800	3 050		CX-6201	ZZ	DDU	VV
	37	12	9 700	4 200		CX-6301			
15	32	9	5 600	2 830		CX-6002			
	35	11	7 650	3 750		CX-6202	ZZ	DDU	VV
	42	13	11 400	5 450		CX-6302			
17	35	10	6 000	3 250		CX-6003			
	40	12	9 550	4 800		CX-6203	ZZ	DDU	VV
	47	14	13 600	6 650		CX-6303			
20	42	12	9 400	5 000		CX-6004			
	47	14	12 800	6 600		CX-6204	ZZ	DDU	VV
	52	15	15 900	7 900		CX-6304			
25	47	12	10 100	5 850		CX-6005			
	52	15	14 000	7 850		CX-6205	ZZ	DDU	VV
	62	17	20 600	11 200		CX-6305			
30	55	13	13 200	8 300		CX-6006			
	62	16	19 500	11 300		CX-6206	ZZ	DDU	VV
	72	19	26 700	15 000		CX-6306			
35	62	14	16 000	10 300		CX-6007			
	72	17	25 700	15 300		CX-6207	ZZ	DDU	VV
	80	21	33 500	19 200		CX-6307			
40	68	15	16 800	11 500		CX-6008			
	80	18	29 100	17 900		CX-6208	ZZ	DDU	VV
	90	23	40 500	24 000		CX-6308			
45	75	16	20 900	15 200		CX-6009			
	85	19	31 500	20 400		CX-6209	ZZ	DDU	VV
	100	25	53 000	32 000		CX-6309			

* Although the recommended fits are G6 or H7, G6 is specified when conditions prioritize location under light pre-load.

** Low-contact seal available for seal type bearings. Contact NSK for details.

Structure of the Creep-Free Bearing



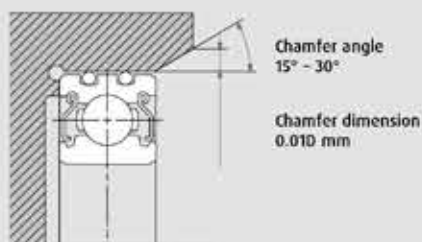
Creep limit load test (example: 6204)



Application example Pump Motor Bearings



Housing shape and dimension



1. Structure and performance of Creep-Free Bearings

Compression of the O-rings, which are mounted in two grooves on the outer ring, improve creep prevention. No special machining is required; bearings can be used with the same housing as standard bearings. In creep limit load tests, the more housing clearance is reduced, the greater the improvement in creep prevention. This is due to the compression of the O-ring mounted in the outer ring.

2. Features and applications of Creep-Free Bearings

- › **Prevents creeping**
O-ring compression prevents creep.
- › **No special machining of the housing is required**
Bearings can be replaced since boundary dimensions are identical to standard bearings.
- › **Easy to assemble**
Assembly is easy since bearings can be fitted with a loose tolerance.
- › **Reusable housing**
Very little abrasion occurs on the bore surface of the housing, making reuse possible.

3. Note on mounting Creep-Free Bearings

Housing shape and dimension: the housing shape must be in accordance with sketch. We recommend a groove and a chamfer, chamfer angle being between 15° and 30°, and its minimum dimension being 0.01 x Bearing Outer Diameter. For more information, please see NSK brochure "Creep Free Bearings".

HPS Angular Contact Ball Bearings



Centrifugal pump in a waste water treatment plant – Angular contact ball bearings are widely used in centrifugal pumps and screw compressors. Original Equipment Manufacturers are looking for more compact design of their machines leading to increasing load conditions for the bearings. The answer to this is the new HPS Series of angular contact ball bearings.

Continually developing products with greater strength and higher accuracy, NSK introduces HPS (High Performance Standard) angular contact ball bearings. These bearings fully incorporate the advantages of NSK's world-class design, materials, and manufacturing technology, setting a new standard for bearings. This allows premium performance in each feature you can expect from an angular contact ball bearing: high speed, high load capacity, excellent running accuracy, and high reliability.

Special features of the new HPS Angular Contact Ball Bearings

- › **High load capacity:** 5% increase compared to previous series. Thanks to improved steel cleanliness, optimum internal design and manufacturing process, NSK HPS bearings achieve higher load ratings resulting in an extended life time (up to 18%) or the possibility to downsize.
- › **High rotating speed:** Between 15 and 20% more than conventional series. Permissible speed has been increased by 15-20%, due to internal design, precise processing and manufacturing technology.
- › **High precision:** Improved dimensional and running accuracy. New HPS series are manufactured with P5 (ISO Class 5) running accuracy, and P6 (ISO Class 6) dimensional accuracy
- › **Universal matching:** In standard, every HPS bearing is manufactured with universal design to be mounted in a pair, triplex or quad set
- › **Tight axial clearance/preload tolerance:** From 8 to 12 μm enabling precise shaft positioning
- › **Three high performance cages available**
 T85: Polyamide 4-6, for general purpose applications
 T7: L-PPS (Linear Poly-Phenylene Sulphide), for oil-injected screw compressors
 MR: Machined brass (ball guided) for high reliability applications (including API pumps)



HPS Angular Contact Ball Bearings

Bearing Nomenclature

Example:

7310

B

EA

T85

SU

CNB

Series and bore number

Contact angle 40°

High load capacity

CNB: standard axial clearance

GA: light preload

Single Universal

T85: polyamide cage

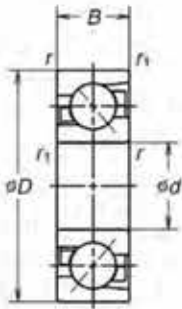
MR: ball guided brass cage

T7: L-PPS plastic cage

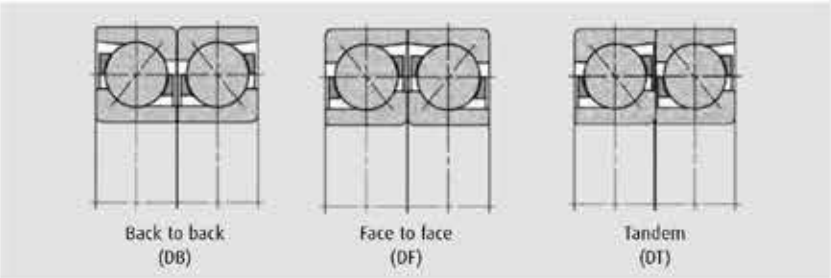
Matched Measured Axial Clearance (µm)

Bore diameter (mm)		CNB		GA	
over	Incl.	Min.	Max.	Min.	Max.
12	18	17	25	-2	6
18	30	20	28	-2	6
30	50	24	32	-2	6
50	80	29	41	-3	9

For DB and DF arrangements



Different possible arrangements: HPS bearings can be mounted in back-to-back pairs (DB) as well as face-to-face pairs (DF), or tandem (DT).



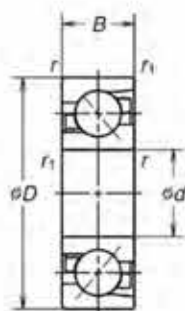
Bearing Numbers	Boundary Dimensions (mm)					Basic Load Ratings (N)		Limiting Speed (min ⁻¹)
	d	D	B	r (min)	r ₁ (min)	C _r	C ₀	
7201BEA	12	32	10	0.6	0.3	8 150	3 750	30 000
7301BEA	12	37	12	1.0	0.6	11 100	4 950	26 000
7202BEA	15	35	11	0.6	0.3	9 800	4 800	26 000
7302BEA	15	42	13	1.0	0.6	14 300	6 900	22 000
7203BEA	17	40	12	1.0	0.3	11 600	6 100	22 000
7303BEA	17	47	14	1.1	0.6	16 800	8 300	20 000
7204BEA	20	47	14	1.0	0.6	15 600	8 150	19 000
7304BEA	20	52	15	1.1	0.6	19 800	10 500	18 000
7205BEA	25	52	15	1.0	0.6	17 600	10 200	17 000
7305BEA	25	62	17	1.1	0.6	27 200	14 900	15 000
7206BEA	30	62	16	1.0	0.6	23 700	14 300	14 000
7306BEA	30	72	19	1.1	0.6	36 500	20 600	13 000
7207BEA	35	72	17	1.1	0.6	32 500	19 600	12 000
7307BEA	35	80	21	1.5	1.0	40 500	24 400	11 000
7208BEA	40	80	18	1.1	0.6	38 500	24 500	11 000
7308BEA	40	90	23	1.5	1.0	53 000	33 000	10 000
7209BEA	45	85	19	1.1	0.6	40 500	27 100	10 000
7309BEA	45	100	25	1.5	1.0	62 500	39 500	9 000
7210BEA	50	90	20	1.1	0.6	42 000	29 700	9 500
7310BEA	50	110	27	2.0	1.0	78 000	50 500	8 000
7211BEA	55	100	21	1.5	1.0	51 500	37 000	8 500
7311BEA	55	120	29	2.0	1.0	89 000	58 500	7 500
7212BEA	60	110	22	1.5	1.0	61 500	45 000	7 500
7312BEA	60	130	31	2.1	1.1	102 000	68 500	6 700
7213BEA	65	120	23	1.5	1.0	70 000	53 500	7 100
7313BEA	65	140	33	2.1	1.1	114 000	77 000	6 300
7214BEA	70	125	24	1.5	1.0	75 500	58 500	6 700
7314BEA	70	150	35	2.1	1.1	124 000	87 500	6 000
7215BEA	75	130	25	1.5	1.0	78 500	63 500	6 300
7216BEA	80	140	26	2.0	1.0	87 500	70 000	6 000

Special Bearings for Screw Compressors



Features of screw compressor bearings

- › **L-PPS plastic cage:** This plastic cage offers superior heat and wear resistance, cage strength, and chemical stability. These characteristics change little even if the bearing is exposed to compressor oil, refrigerants, or ammonia gas. L-PPS is greatly superior to traditional polyamide cage material.
- › **Increased load capacity:** The optimal bearing internal design associated with the L-PPS plastic cage provides higher bearing load ratings resulting in improved fatigue life.
- › **Increased axial load limit for angular contact bearings:** Higher load ratings result in increased axial load.
- › **Improved lubrication performance:** The optimised cage design is rolling element guided thereby allowing more internal free space, resulting in flow of lubricant improved.



Bearing Nomenclature (HPS Angular Contact Ball Bearing)

Example:

7310

B

EA

T7

SU

CNB

Series and bore number

Contact angle 40°

High load capacity

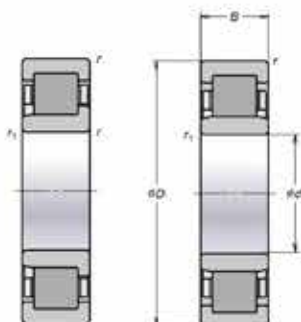
CNB: standard axial clearance

GA: light preload

Single Universal

L-PPS plastic cage

This screw compressor specification includes all HPS features, and L-PPS « T7 » cage.
Range: From 12 to 80 mm bore (7201BEA to 7216BEA))



Bearing Nomenclature (High Load Capacity Cylindrical Roller Bearings)

Example:

NU

310

E

T7

Bearing type

Series and bore number

High load capacity

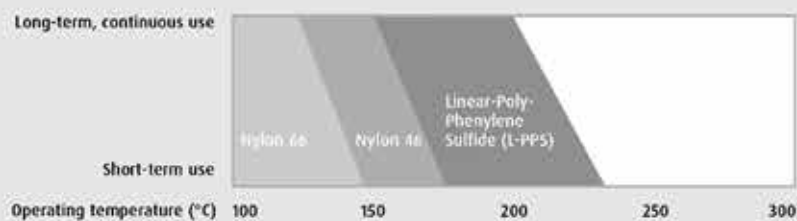
L-PPS plastic cage

This screw compressor specification includes high-capacity design, and L-PPS « T7 » cage.
Range: From 20 to 100 mm bore (NU204ET7 to NU2320ET7)

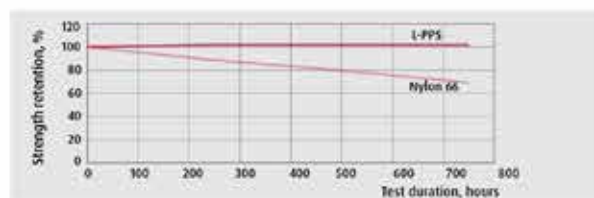
Features of cage material

Material	Nylon 66	Nylon 46	L-PPS
Features	<ul style="list-style-type: none"> Standard cage material 	<ul style="list-style-type: none"> High crystallization rate provides superior high temperature strength Superior heat resistance 	<ul style="list-style-type: none"> Greater heat resistance than nylon 46 Superior resistance to oil and chemicals Wear resistant Good dimensional stability
Standard grade	<ul style="list-style-type: none"> Contains fiberglass 	<ul style="list-style-type: none"> Contains fiberglass 	<ul style="list-style-type: none"> Contains fiberglass
Plastic melting point	<ul style="list-style-type: none"> 262 °C 	<ul style="list-style-type: none"> 290 °C 	<ul style="list-style-type: none"> 280 °C

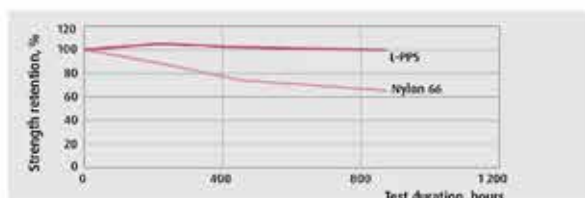
Target for heat resistance



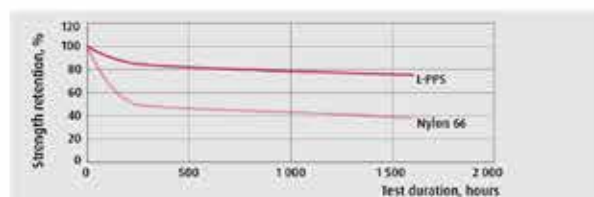
Performance of L-PPS cage material



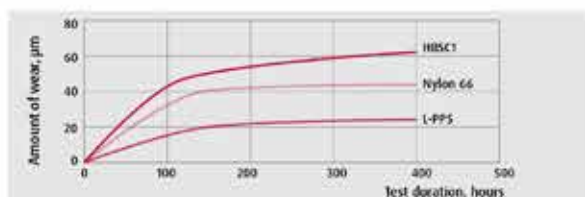
Resistance to compressor oil | Tensile strength - compressor oil at 150 °C



Heat resistance | Heat resistance at 180 °C



Resistance to gear oil | Tensile strength - gear oil at 180 °C



Wear resistance (µm)

Case Studies – Bearing Solutions for Pumps & Compressors

Preventing Creep on Submersible Pumps Bearings

Submersible pumps are widely used in a variety of applications such as construction, waste water, mining, agriculture and general industry. Most submersible pumps comprise of a vertical electric drive motor coupled directly to the impeller. They are required to operate for long periods with the minimum amount of maintenance.

Bearing Arrangement

The bottom, locating bearing, is generally a double row angular contact ball bearing or a pair of angular contact bearings. This reacts the axial load and radial load generated by the pumped fluid. The bearing is heavily loaded and needs to be correctly selected to reach target life. The top free bearing, is generally a deep groove ball bearing. This takes a light radial load. C3 clearance is generally used to compensate for clearance reduction due to heat generation from the electric motor.

Creep Phenomenon on Top Bearings

The lightly loaded top bearing should, theoretically, have a very long life. However, its life is sometimes drastically reduced by creep. The combined effect of light radial load and loose fit in the housing can result in creep between outer ring and housing. Creep is a phenomenon where relative slippage occurs between fitted surfaces. Creep produces a polish on the bearing ring surface, occasionally accompanied by scoring or wear.

Countermeasure

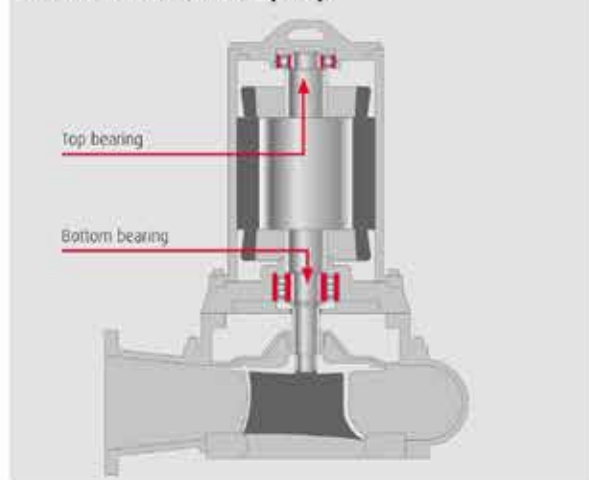
One popular countermeasure used by pump manufacturers is to machine an annular groove in the housing bore and to insert an O-ring. The O-ring prevents creep between bearing outside diameter and housing.

NSK Solution

NSK Creep-Free bearings offer more: with their integrated double O-rings, they provide better creep prevention. They provide submersible pump manufacturers with the following advantages:

- › Very good creep prevention
- › Easy assembly. The Creep-Free bearings can be fitted with a loose housing bore tolerance
- › Housing is re-usable as very little abrasion occurs on the housing bore
- › Cost reduction. Pump manufacturers do not need to machine a groove in the housing bore and insert their own O-ring.

Traditional submersible pump



Creep-Free bearing

Case Studies – Bearing Solutions for Pumps & Compressors

Refrigerant Screw Compressors working with Ammonia

Refrigerant compressors are designed specifically for air conditioning, heat pumping, and industrial refrigeration. Refrigerant compressors are specifically designed to be the heart of an industrial cooling or air-conditioning system (HVAC). They are integral components of the refrigeration cycle, in which refrigerant gases are cyclically evaporated and condensed. There are three main types of refrigerant compressors: scroll, screw, and piston.

Bearing Arrangement

Refrigerant screw compressors comprise of two screws in mesh. Gas enters at the inlet side and is gradually compressed along the screw. Compressed gas leaves through the outlet port. At the inlet, a cylindrical roller bearing is used on both male and female screw to carry the radial load. At the outlet, a cylindrical roller bearing is also used for radial loads. However, it is combined with a set of angular contact ball bearings which reach the high axial load associated with the compression. The common refrigerant gases such as Chlorofluorocarbons (CFCs) are now banned substances. New compressors are now exposed to Hydrochlorofluorocarbons (HCFCs) or Hydrofluorocarbons (HFCs). The problem of global warming and ozone layer depletion is driving the use of “natural” refrigerants such as carbon dioxide (CO_2) or ammonia (NH_3).

Troubles with Cages when using Ammonia

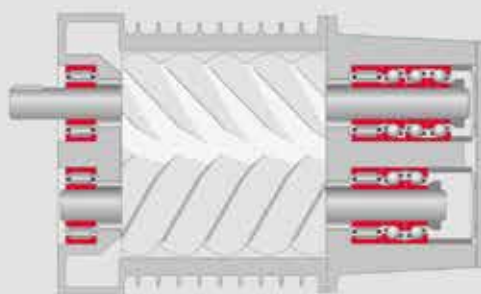
When using ammonia as a refrigerant, the oil used for lubrication should be miscible with ammonia. Consequently synthetic oils are necessary. Polyamide cages which are quite popular in screw compressors bearings are not suitable

when operating above 70 °C with synthetic oils (which could contain additives). Ammonia also has an adverse effect on polyamide. There is a rapid ageing of the cage and a decrease in the strength which can lead to cage failure. Brass cages show corrosion crack when in contact with ammonia. In the past, cages made of cast iron were used for ammonia compressors. Cast iron cages show good results but are not popular and are quite expensive.

NSK Solution

For refrigerant screw compressors NSK offers its L-PPS cage for both cylindrical roller bearings and angular contact ball bearings. The L-PPS cage provides superior heat and wear resistance, cage strength and chemical stability characteristics that change little, even if exposed to compressor oil, refrigerants or ammonia gas.

Typical Refrigerant – Screw Compressor



Catalogues

“Industrial Motor Bearings”

+ INDUSTRIAL MOTOR BEARINGS



INDUSTRIAL MOTOR

All industries are powered by motors. NSK's proven bearings take loads and support smooth and quiet rotation in rotating motor components.

Our top priority is to deliver solutions that protect the environment. To this end, we focus on Tribology to create technologies that reduce energy loss and improve life. We address trends towards electric power by offering high-performance bearings with low energy loss, high reliability, and long product life.

This catalog details NSK's industrial motor bearings, including products with low torque, long life, and low heat generation.



BEARINGS

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NSK Solutions for Industrial Motor Needs

	Issues/Needs	NSK's Response	Outer Ring/Inner Ring	
			Ceramic-Coated Insulated Bearings	Creep-Free Bearings
			P. 12-13	P. 20-21
Servomotors P. 6-9	Encoder error and brake slip	Low-particle-emission bearings		
	Longer maintenance intervals	Longer seizure life		
	Improved reliability under harsh operating conditions	Improved fretting resistance		○
High-Efficiency Motors P. 10-11	Reduced motor loss	Reduced rotating resistance		
	Longer maintenance intervals	Longer seizure life		
	Vibrating and unbalanced loads	Improved creep resistance		○
Inverter Motors P. 12-13	Electical erosion Maintenance-free operation	Bearings as insulator	●	
EV Motors P. 14-15	High-speed rotation	Longer seizure life		
	Longer maintenance intervals	Longer seizure life		
	High-speed rotation and unbalanced loads	Improved creep resistance		○

Bearing Components							
Ball		Cage		Seal	Grease		
Ceramic Balls	Seizure-Resistant Heat-Treated Steel Balls	Plastic Cages for EV Motors	Plastic Cages	DW Seal	EA7	LGU	EA9
P. 18-19	P. 14-15	P. 14-15	P. 16-17	P. 8-9	P. 6	P. 7	P. 10-11
				●		●	
○			○		●		
○					●		
			○		●		○
○			○		●		○
○							
○	●	●					
○	●	●			●		○

● :Recommended ○ :Option



High-Reliability EA7 Grease for Servomotors

Machine tools, robots, and carrier equipment require servomotors to endure repeated start/stop/reverse operations under harsh conditions with microvibrations caused by slight positioning errors during servo-lock.

These conditions may lead to an insufficient oil film on the bearing raceway surface, resulting in fretting damage. In response, NSK developed EA7 grease with excellent fretting resistance, long life, and improved reliability.

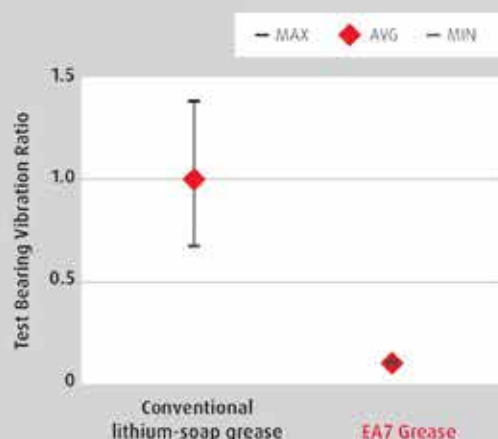
Features

Better Reliability Under Harsh Operating Conditions

EA7 grease improves fretting resistance in environments with micro-vibrations, reducing vibration and achieving longer bearing life.

Fretting: Wear due to repeated sliding between two surfaces. When bearings face vibrations or oscillations while stopped, an insufficient oil film may result, leading to this damage.

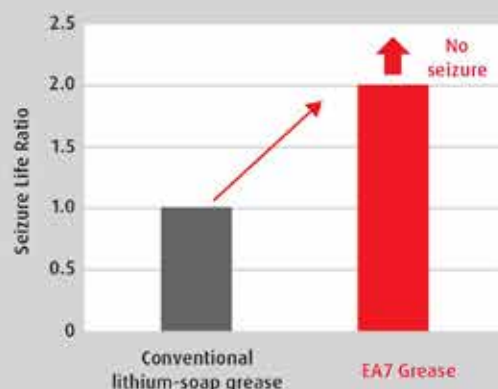
Tested bearings: $\phi 8 \times \phi 22 \times 7$
 Preload: 49 N
 Oscillation angle: $1^\circ (\pm 0.5^\circ)$
 Oscillation frequency: 30 Hz
 Oscillations: 5 000 000



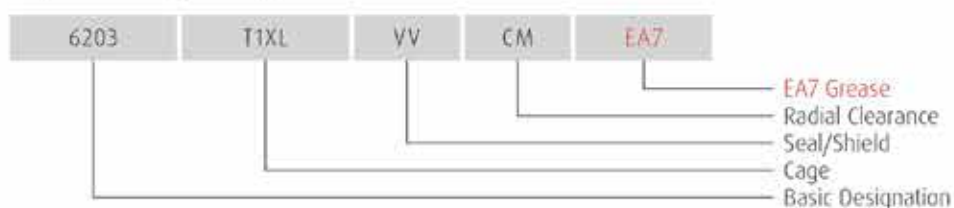
Longer Maintenance Intervals

Bearings filled with EA7 Grease have a much longer life than those with conventional lithium-soap grease.

Tested bearings: $\phi 25 \times \phi 62 \times 17$
 Rotational speed: 10 000 min⁻¹
 Temperature: 140 °C



Example Bearing Designation





Low-Particle-Emission LGU Grease for Servomotors

LGU grease features an optimized grease composition free of sulfur and metal elements.

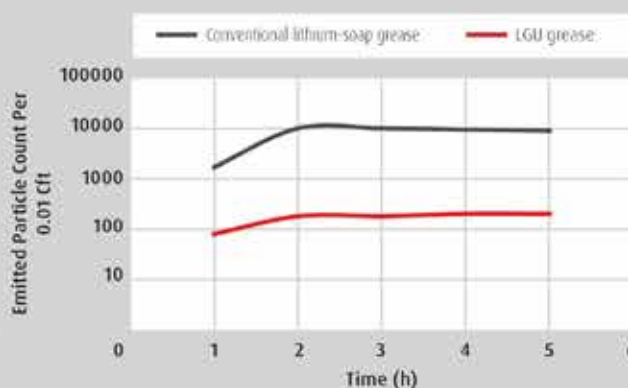
This greatly reduces particle emissions, helping to prevent encoder contamination and brake slip.

Features

1 Less Encoder Contamination and Brake Slip

LGU grease has nearly 90% less particle emissions than conventional lithium-soap grease.

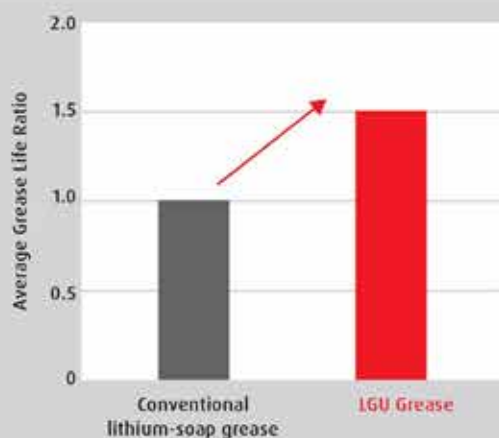
Tested bearings: $\phi 8 \times \phi 22 \times 7$
Grease Fill: Light (L)
Rotational Speed: 1 800 min⁻¹
Particle Size: Over 0.1 μm



2 Longer Maintenance Intervals

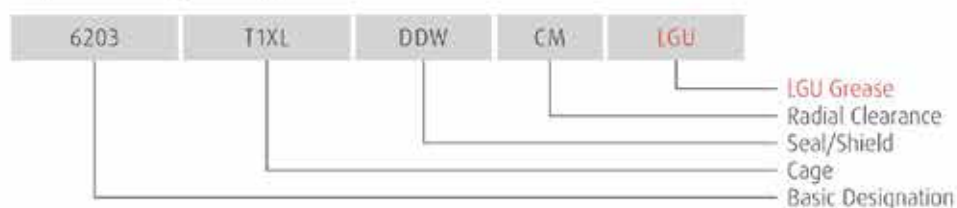
Bearings with LGU grease realize a grease life 1.5 times longer than that with conventional lithium-soap grease.

Tested bearings: $\phi 25 \times \phi 62 \times 17$
Rotational speed: 10 000 min⁻¹
Temperature: 140 °C



DATA

Example Bearing Designation





Low-Particle-Emission DW Seal for Servomotors

Light-contact DW seals have an optimized seal lip structure that prevents grease from leaking from the bearing and realizes low torque. These features help prevent encoder contamination and brake slip in servomotors.

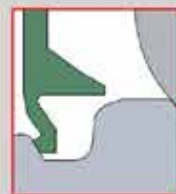
Features

1 Light-Contact Seal Lip

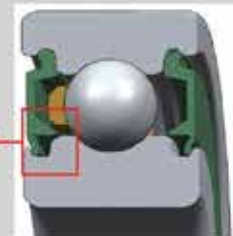
A special seal lip structure lowers lip pressure, resulting in low torque. The main lip has outward contact with the beveled portion of the inner ring seal groove. This prevents the seal from opening due to internal pressure and prevents grease leakage.



ODU Seal (Ref.)



DW Seal

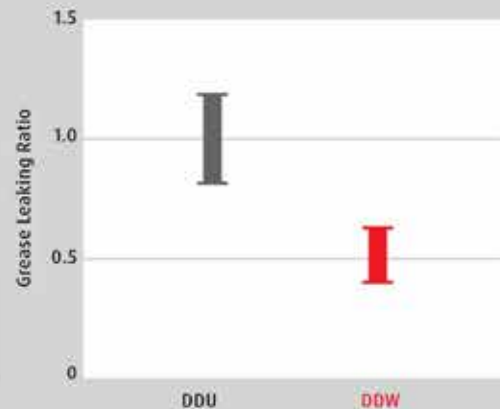


DW Seal Bearing

2 Less Encoder Contamination and Brake Slip

DW seals minimize grease leakage.

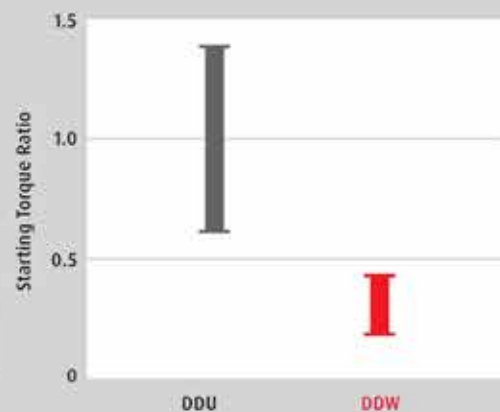
Tested Bearings: $\phi 17 \times \phi 26 \times 5$
Rotational Speed: 10,000 min⁻¹
Temperature: 50 °C
Time: 50 h



3 Lower Energy Consumption

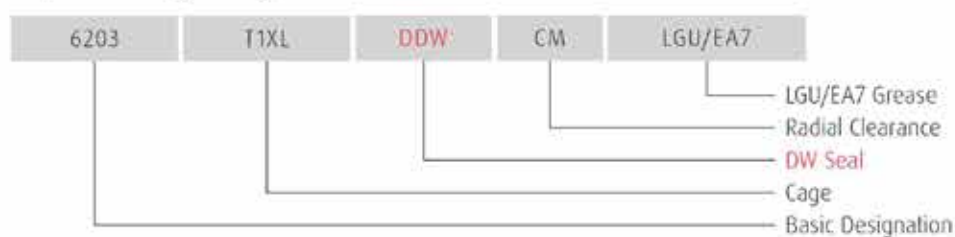
DW seals greatly reduce starting torque compared to ODU seals.

Tested bearings: $\phi 17 \times \phi 40 \times 12$
Temperature: 25 °C



DATA

Example Bearing Designation



Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6000	10	26	8
6200		30	9
6300		35	11
6001	12	28	8
6201		32	10
6301		37	12
6002	15	32	9
6202		35	11
6302		42	13
6003	17	35	10
6203		40	12
6303		47	14
6004	20	42	12
6204		47	14
6304		52	15
6005	25	47	12
6205		52	15
6305		62	17

Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6006	30	55	13
6206		62	16
6306		72	19
6007	35	62	14
6207		72	17
6307		80	21
6008	40	68	15
6208		80	18
6308		90	23
6209	45	85	19
6309		100	25
6010	50	80	16
6210		90	20
6310		110	27
6311	55	120	29

DW seals are made of nitrile rubber (operating temp: -30 to 110 °C)



Low Torque & Long-Life Bearings for High-Efficiency Motors

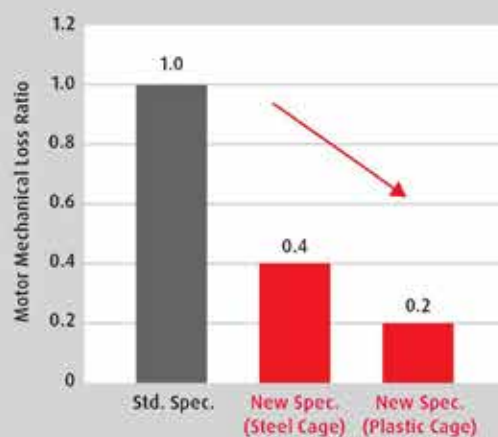
NSK optimized the type of grease and fill amount, grease shear, and agitation resistance during bearing rotation to not only realize low torque and long life, but also save energy. Using a plastic cage allows for even lower torque and longer life.

Features

1 Increases Motor Efficiency

Our new specification steel cages achieve 60% less mechanical loss than conventional products. For even less mechanical loss, new plastic cages achieve a huge 80% reduction.

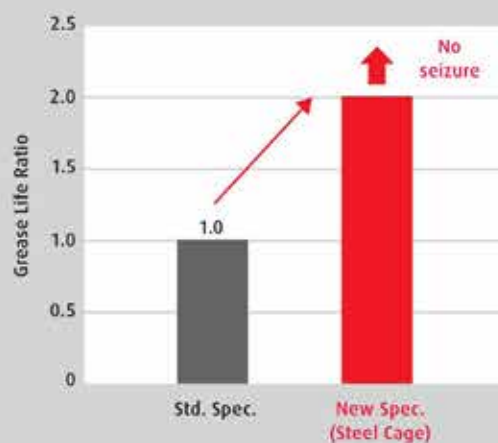
Motor: 7.5 kW 2P 200 V 50 Hz
Temperature: 25 °C



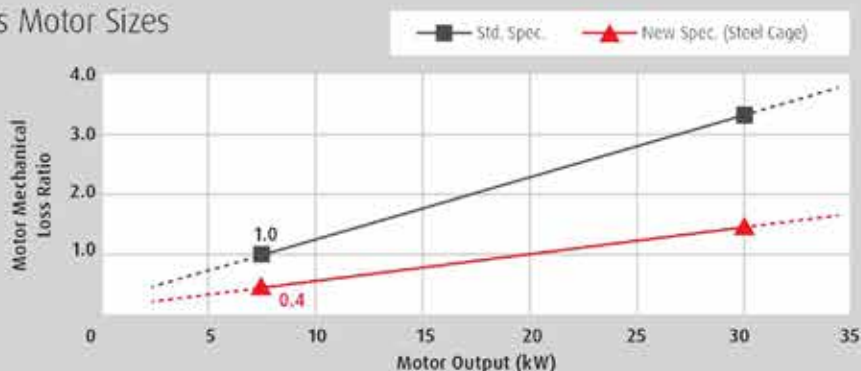
2 Longer Motor Maintenance Intervals

Using new EA9 grease makes seizure life over 2 times longer, improving durability.

Tested bearings: $\phi 25 \times \phi 62 \times 17$
Rotational speed: 10 000 min⁻¹
Temperature: 140 °C

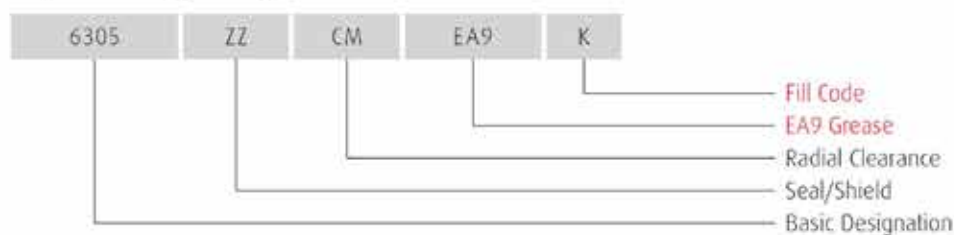


3 Effective for Various Motor Sizes



*Please contact NSK regarding bearings used in pumps and compressors.

Example Bearing Designation



Designation	Boundary Dimensions (mm)			Grease Fill Code
	Bore Dia.	Outside Dia.	Width	
6200	10	26	8	K
6300		35	11	K
6201	12	32	10	K
6301		37	12	K
6202	15	35	11	K
6302		42	13	K
6203	17	40	12	K
6303		47	14	K
6204	20	47	14	K
6304		52	15	K
6205	25	52	15	K
6305		62	17	K
6206	30	62	16	K
6306		72	19	K
6207	35	72	17	K
6307		80	21	K
6208	40	80	18	K
6308		90	23	K

Designation	Boundary Dimensions (mm)			Grease Fill Code
	Bore Dia.	Outside Dia.	Width	
6209	45	85	19	L
6309		100	25	L
6210	50	90	20	L
6310		110	27	L
6211	55	100	21	L
6311		120	29	L
6212	60	110	22	L
6312		130	31	L
6213	65	120	23	L
6313		140	33	L
6214	70	125	24	L
6314		150	35	L
6215	75	130	25	L
6315		160	37	L
6216	80	140	26	L
6316		170	39	L

*The filling code indicates how much grease should be applied into the bearing, in increasing quantity from K to L to S. For low torque specifications, K or L fills are recommended.



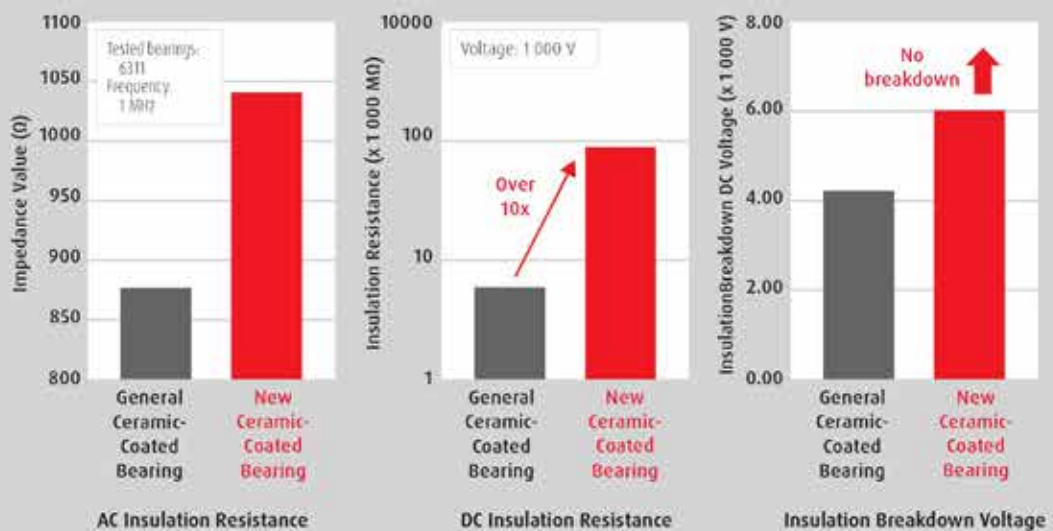
Ceramic-Coated Insulated Bearings for Inverter Motors

By coating the outer ring with insulating ceramic material, electric current cannot pass through the bearing and cause electrical erosion.

Features

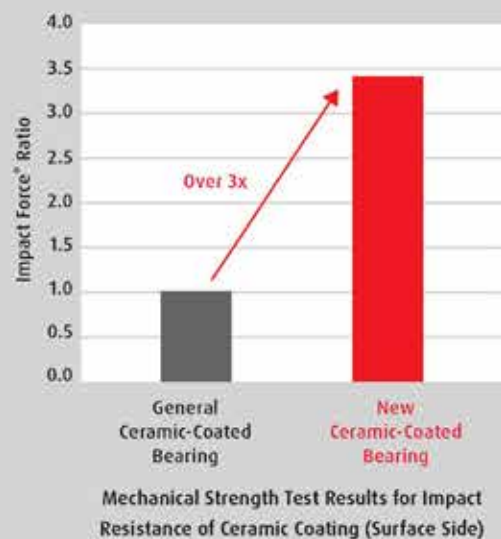
A Solution to Electrical Erosion in Large Motors

We've enhanced the ceramic coating to dramatically improve insulation performance over regular ceramic-coated bearings.



Easy to Handle and Mount

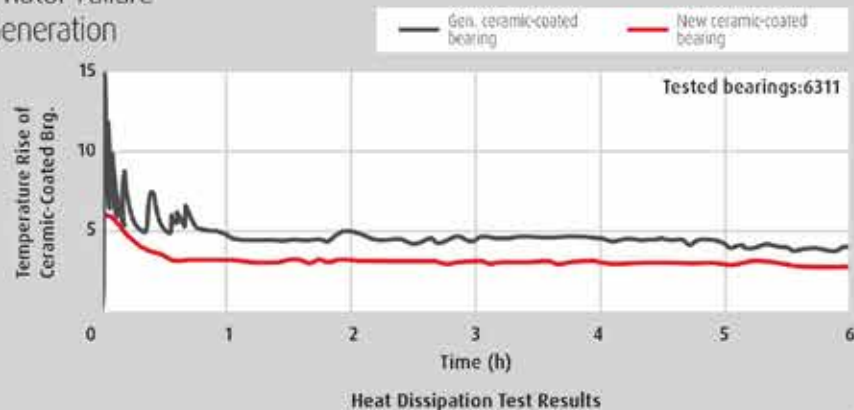
Optimized specifications make the impact resistance of our new ceramic-coated bearings over 3 times higher than conventional products.



*Refers to force on the surface coating

Reduced Premature Motor Failure From Bearing Heat Generation

Our optimized ceramic coating more effectively dissipates heat.



Example Bearing Designation



Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6312	60	130	31
6313	65	140	33
6215	75	130	25
6315		160	37
6216	80	140	26
6316		170	39
6217	85	150	28
6317		180	41

* Listed bearings are offered as standard open bearings with C3 clearance.

Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6218	90	160	30
6318		190	43
6219	95	170	32
6319		200	45
6220	100	180	41
6320		215	47
6322	110	240	50
6224	120	215	40
6226	130	230	40

- Please handle ceramic bearings with the same care as standard bearings.
- Be sure to avoid strong impacts to the outer ring when mounting the bearing using methods involving a hammer or similar. Excessive impacts may cause breaking or cracking of the ceramic coating and/or scratches on the bearing raceway. Bearings cannot be used if damaged.



Electric Vehicle (EV) Motor Bearings

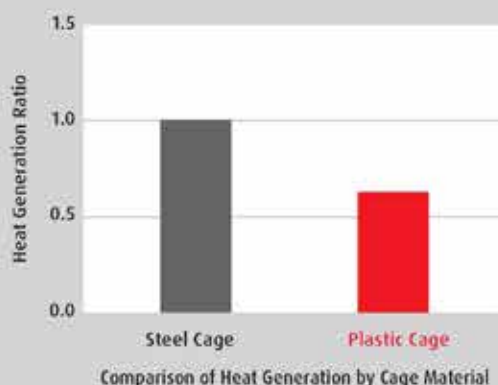
NSK bearings improve the high-speed rotation performance of EV motors by utilizing a plastic cage, specialized grease, and steel balls heat-treated to resist seizure.

Features

1 Plastic Cage for High-Speed Rotation

Today's applications cause bearings to face high temperature and speeds. In response, our plastic cages feature excellent heat resistance. We also examined cage strength through our proven analysis technologies to optimize the shape of the cage.

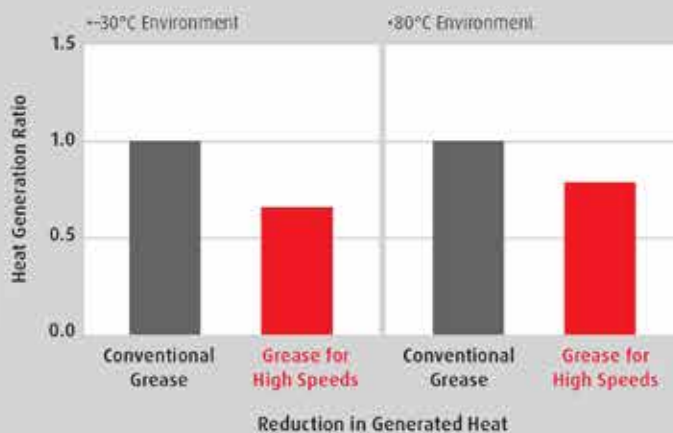
Tested bearings: $\phi 20 \times \phi 47 \times 14$
Rotational speed: 3,000 min⁻¹



2 Grease for High-Speed Rotation

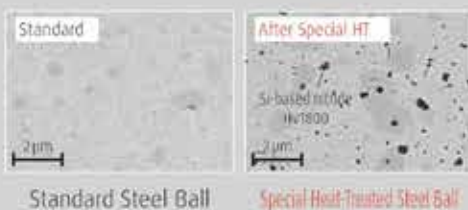
By matching the thickener to the grease, we reduced bearing heat generation across a wide temperature range.

Tested bearings: $\phi 35 \times \phi 62 \times 14$
Rotational speed: 3,000 min⁻¹

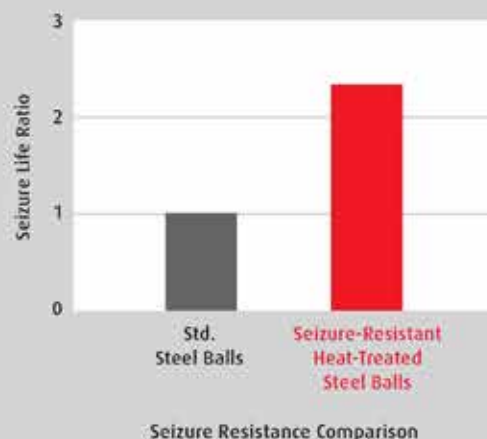


3 Seizure-Resistant Heat-Treated Steel Balls for High-Speed Rotation

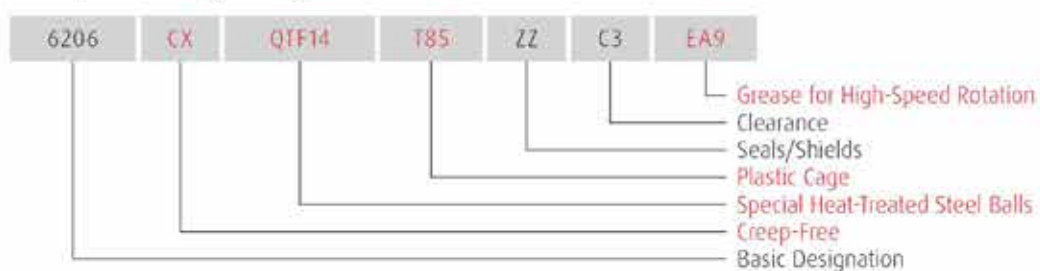
Steel balls with a hard nitride formed on the surface improve seizure resistance.



Difference in Ball Surface Structure



Example Bearing Designation



Designation	Boundary Dimensions (mm)			Limiting Speeds (min ⁻¹)		Seizure-Resistant HT Ball Spec
	Bore Dia.	Outside Dia.	Width	n	n' (Seizure-Resistant HT Ball Spec.)	
6005	25	47	12	19000	20000	QTF14
6205		52	15	16000	18000	QTF14
6006	30	55	13	16000	18000	QTF14
6206		62	16	14000	15000	QTF14
6007	35	62	14	14000	15000	QTF14
6207		72	17	12000	13000	QTF14
6008	40	68	15	13000	14000	QTF14
6208		80	18	11000	—	—
6009	45	75	16	12000	13000	QTF14
6209		85	19	10000	11000	QTF14
6010	50	80	16	11000	12000	QTF14
6210		90	20	9000	10000	QTF14
6011	55	90	18	9500	10000	QTF14

• Plastic cages for EV motors use T85 (Nylon 4,6).

• Please contact NSK regarding reduction gear bearings.



Bearings With Plastic Cages

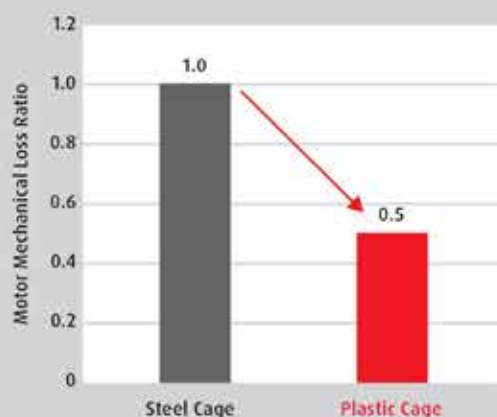
Plastic cages are lighter than steel cages, have excellent self-lubricating properties, and have a low coefficient of friction. For this reason, they generate little heat and are excellent under high speed rotation. In addition, since they don't need as much grease, they effectively reduce bearing torque and contamination.

Features

Motor Energy Savings

Plastic cages reduce mechanical loss in motors by up to 50% compared to steel cages.

Motor: 5 kW 2P 200 V 50 Hz
Temperature: 25 °C



Longer Motor Maintenance Intervals

Plastic cages greatly extend bearing life under high-speed operating conditions.

Tested bearings: $\phi 35 \times \phi 15 \times 11$
Rotational Speed: 20 000 min⁻¹
Temperature: 120 °C

Bearings with Steel Cages

Bearings with Plastic Cages



Usable in Magnetic Environments

Steel cages are affected by magnetic forces, resulting in abnormal friction that shortens the seizure life. Plastic cages don't face this issue and can be used easily and with longer life in magnetic environments, such as with servomotors.

Tested bearings: $\phi 12 \times \phi 21 \times 5$
Misalignment: 0.3 deg
Rotational speed: 1 800 min⁻¹
Preload: 20 N
Environment temperature: 40 °C
Test period: 2 weeks
Magnetic strength: 3 500 Gs

Before Field Test



After Test



Steel Cage

Before Field Test

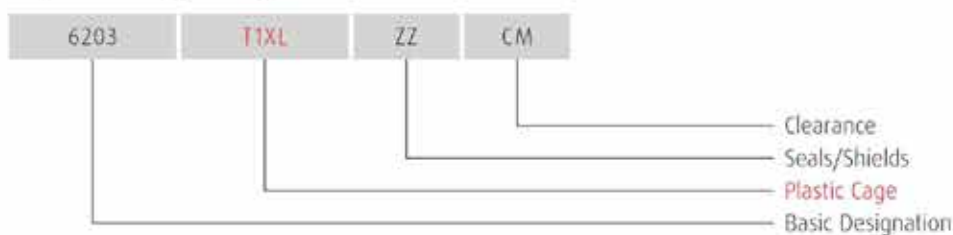


After Test



Plastic Cage

Example Bearing Designation



Designation	Plastic Cage	Boundary Dimensions (mm)		
		Bore Dia.	Outside Dia.	Width
6000	T1X	10	26	8
6200	T1XL		30	9
6300*	T1X		35	11
6001	T1XL	12	28	8
6201	T1XL		32	10
6301	T1X		37	12
6002	T1XL	15	32	9
6202	T1XL		35	11
6302	T1X		42	13
6003	T1XL	17	35	10
6203	T1XL		40	12
6303	T1X		47	14
6004	T1X	20	42	12
6204	T1XL		47	14
6304	T1XL		52	15

Designation	Plastic Cage	Boundary Dimensions (mm)		
		Bore Dia.	Outside Dia.	Width
6005	T1XL	25	47	12
6205	T1XL		52	15
6305	T1X		62	17
6006	T1X	30	55	13
6206	T1X		62	16
6306	T1X		72	19
6007	T1X	35	62	14
6207	T1X		72	17
6307	T1X		80	21
6008	T1X	40	68	15
6208	T1XA		80	18
6308	T1XA		90	23

*Indicates a plastic cage that is not mass produced. Please contact NSK for details.
 • Plastic cages for industrial motors use T1X, T1XL, and T1XA (Nylon 6,6).
 • The maximum operating temperature of polyamide cages is normally 120 °C or less.



Ceramic Ball Bearings

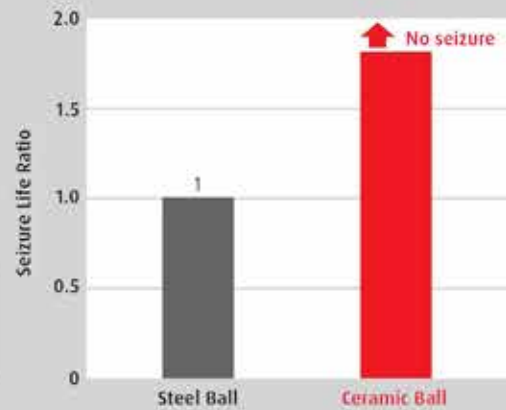
Lightweight ceramic materials have excellent insulation, heat resistance, durability, and low thermal expansion. Using ceramic balls extends seizure life dramatically and prevents electric current from passing through the bearing, stopping electric erosion.

Features

"Maintenance-Free" Motors

Compared to steel ball bearings, ceramic ball bearings have a significantly longer seizure life.

Tested bearings: $\phi 8 \times \phi 22 \times 7$
Lubrication: Light oil 10 mg
Rotational speed: 1 800 min⁻¹
Temperature: 100 °C

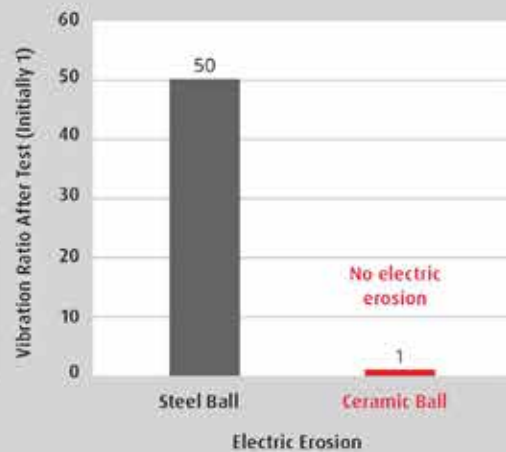


No Electric Erosion

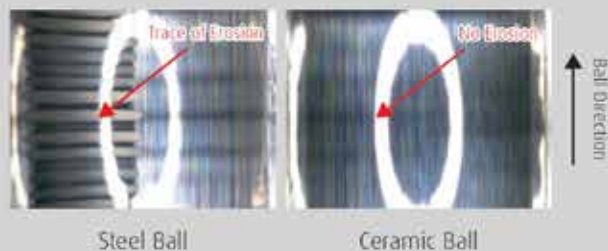
By insulating the rolling elements, electric currents can not pass through the bearing, preventing electric erosion.

• Electric Erosion Reproduction Test

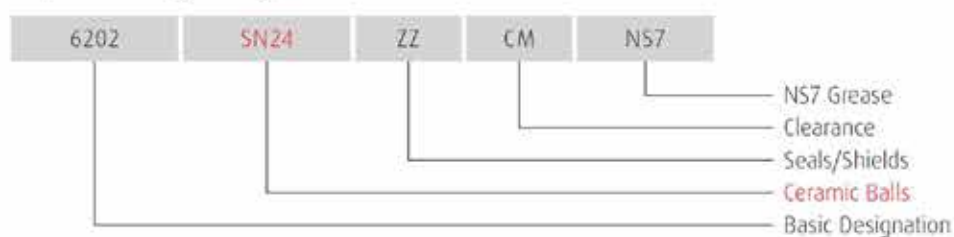
Tested Bearings: $\phi 8 \times \phi 22 \times 7$
with grease lubrication
Rotational Speed: 1 500 min⁻¹
Applied voltage: Steel ball 3 V
Ceramic ball 50 V



• Race Surface After Test



Example Bearing Designation



Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
608	8	22	7
6000	10	26	8
6200		30	9
6001	12	28	8
6201		32	10
6002	15	32	9
6202		35	11
6302		42	13
6003	17	35	10
6203		40	12
6004	20	42	12
6204		47	14
6205	25	52	15
6305		62	17

Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6206	30	62	16
6306		72	19
6207	35	72	17
6307		80	21
6208	40	80	18
6308		90	23
6209	45	85	19
6309		100	25
6010	50	80	16
6310		110	27
6211	55	100	21
6311		120	29
6012	60	95	18
6214	70	125	24



Creep-Free Bearings

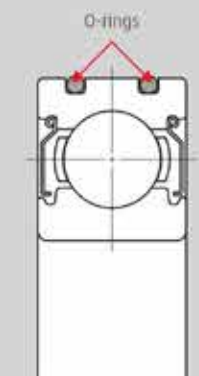
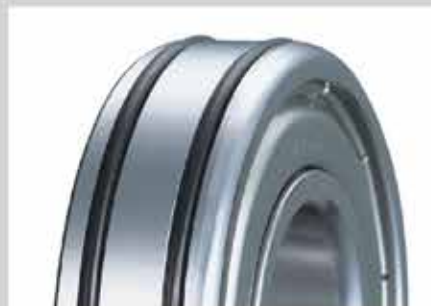
Creep may occur in EV motors used under high speed or in large motors with large unbalanced loads. NSK's Creep-Free Bearings dramatically reduce the occurrence of creep by restricting the amount of clearance between the outer ring and housing. Since boundary dimensions are identical to standard bearings, the housing does not need to be reworked when replacing the bearings, and assembly is easy.

Features

Special Structure to Prevent Creep

Creep-Free Bearings come with two O-rings mounted in the outer ring and help prevent creep by restricting the amount of clearance between the outer ring and housing.

No special machining is required; bearings can be used with the same housing as standard bearings.

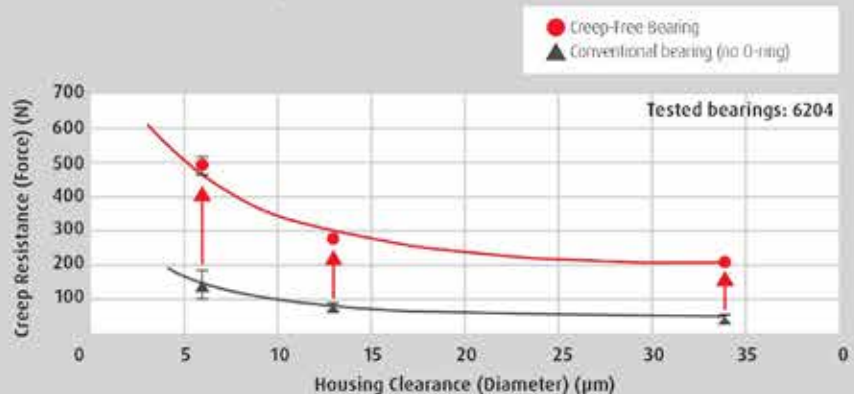


Structure of a Creep-Free Bearing

Usable Under High Speeds and Unbalanced Loads

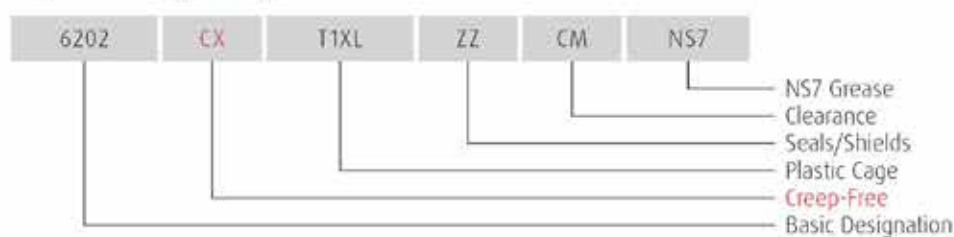
In creep limit load tests, the more the housing clearance is reduced, the more creep can be prevented.

Creep-Free Bearings are up to four times more resistant to creep than conventional bearings.



DATA

Example Bearing Designation



Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6000	10	26	8
6200		30	9
6300		35	11
6001	12	28	8
6201		32	10
6301		37	12
6002	15	32	9
6202		35	11
6302		42	13
6003	17	35	10
6203		40	12
6303		47	14
6004	20	42	12
6204		47	14
6304		52	15
6005	25	47	12
6205		52	15
6305		62	17
6006	30	55	13
6206		62	16
6306		72	19
6007	35	62	14
6207		72	17
6307		80	21
6008	40	68	15
6208		80	18
6308		90	23

Designation	Boundary Dimensions (mm)		
	Bore Dia.	Outside Dia.	Width
6009	45	75	16
6209		85	19
6309		100	25
6010	50	80	16
6210		90	20
6310		110	27
6011	55	90	18
6211		100	21
6311		120	29
6012	60	95	18
6212		110	22
6312		130	31
6013	65	100	18
6213		120	23
6313		140	33
6014	70	110	20
6214		125	24
6314		150	35
6015	75	115	20
6215		130	25
6016	80	125	22
6216		140	26
6017	85	130	22
6217		150	28
6018	90	140	24
6019	95	145	24
6020	100	150	24

- If oil or grease is applied to the outside surface of the bearing, use a mineral oil or a synthetic hydrocarbon oil (such as NSK EA2).
- The O-rings are made of nitrile rubber (operating temperature range: -30 to 120 °C) as standard. Please contact NSK for use under special environments, such as at high temperatures.



NSKHPS High-Performance Standard Series Deep Groove Ball Bearings -For High Efficiency Motors & General Motors

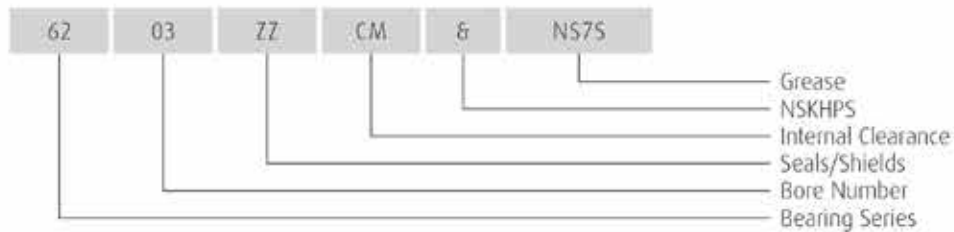
As motors become smaller and lighter, bearings must also become more compact, reliable, and capable of carrying heavy loads. NSK responds to these trends with NSKHPS: our new standard line of high-performance bearings.

Compared to conventional bearings, NSKHPS Series deep groove ball bearings have 15% longer life and 15% higher limiting speed.

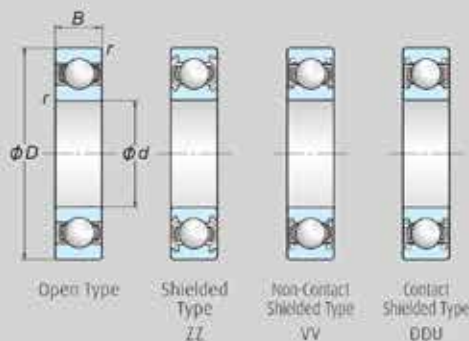
Our current NSKHPS Series has an extensive lineup based on the most commonly used bearing series.

DATA

Example Bearing Designation



62	Bearing Series	60, 62, 63: Single-Row Deep Groove Ball Bearings
03	Bore Number	Bore number indicates bore diameter. 00:10mm; 01:12mm; 02:15mm; 03:17mm 04 or Larger: Bore Number × 5 (mm)
ZZ	Seals/Shields	ZZ: Shield on Both Side DDU: Contact Rubber Seal on Both Side VV: Non-Contact Rubber Sealed on Both Side
CM	Internal Clearance	Omitted: CN Clearance* C3: Clearance Greater than CN C4: Clearance Greater than C3 CM: For Electric Motors*
&	NSKHPS	&: NSKHPS Bearings
NS7S	Grease	NS7: NS Hi-Lube



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

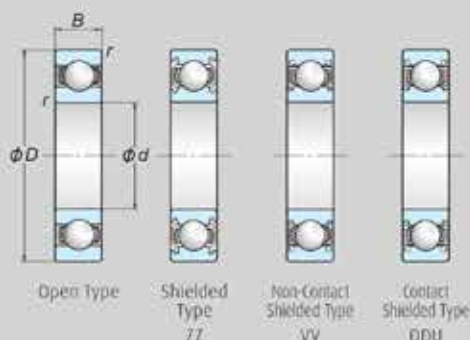
$\frac{f_0 F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$P_0 = 0.6 F_r + 0.5 F_a$$

When $F_r > 0.6 F_r + 0.5 F_a$, use $P_0 = F_r$

Designation				Boundary Dimensions (mm)				Basic Load Ratings (kN)		Factor	Limiting Speeds (min ⁻¹)			
											Grease		Oil	
Open	Shielded	Sealed	NSKHPS	d	D	B	r (mm)	C _r	C _{or}	f ₀	Open	DDU	Open	
											ZZ VV			
6200	ZZ	VV	DDU	8	10	30	9	0.6	5 350	2 390	13.2	28 000	18 000	34 000
6300	ZZ	VV	DDU	8		35	11	0.6	8 500	3 450	11.2	26 000	17 000	30 000
6001	ZZ	VV	DDU	8	12	28	8	0.3	5 350	2 370	13.0	32 000	18 000	38 000
6201	ZZ	VV	DDU	8		32	10	0.6	7 150	3 050	12.3	26 000	17 000	32 000
6301	ZZ	VV	DDU	8		37	12	1.0	10 200	4 200	11.1	24 000	16 000	28 000
6002	ZZ	VV	DDU	8	15	32	9	0.3	5 850	2 830	13.9	26 000	15 000	32 000
6202	ZZ	VV	DDU	8		35	11	0.6	8 000	3 750	13.2	22 000	14 000	28 000
6302	ZZ	VV	DDU	8		42	13	1.0	12 000	5 450	12.3	19 000	13 000	24 000
6003	ZZ	VV	DDU	8	17	35	10	0.3	6 300	3 250	14.4	24 000	13 000	28 000
6203	ZZ	VV	DDU	8		40	12	0.6	10 100	4 800	13.2	20 000	12 000	24 000
6303	ZZ	VV	DDU	8		47	14	1.0	14 300	6 650	12.4	17 000	11 000	20 000
6004	ZZ	VV	DDU	8	20	42	12	0.6	9 850	5 000	13.8	20 000	11 000	24 000
6204	ZZ	VV	DDU	8		47	14	1.0	13 400	6 600	13.1	17 000	11 000	20 000
6304	ZZ	VV	DDU	8		52	15	1.1	16 700	7 900	12.4	16 000	10 000	19 000
6005	ZZ	VV	DDU	8	25	47	12	0.6	10 600	5 850	14.5	18 000	9 500	22 000
6205	ZZ	VV	DDU	8		52	15	1.0	14 700	7 850	13.9	15 000	9 000	18 000
6305	ZZ	VV	DDU	8		62	17	1.1	21 600	11 200	13.2	13 000	8 000	16 000
6006	ZZ	VV	DDU	8	30	55	13	1.0	13 900	8 300	14.7	15 000	8 000	18 000
6206	ZZ	VV	DDU	8		62	16	1.0	20 400	11 300	13.8	12 000	7 500	15 000
6306	ZZ	VV	DDU	8		72	19	1.1	28 000	15 000	13.3	11 000	6 700	13 000
6007	ZZ	VV	DDU	8	35	62	14	1.0	16 800	10 300	14.8	13 000	6 700	15 000
6207	ZZ	VV	DDU	8		72	17	1.1	27 000	15 300	13.8	11 000	6 300	13 000
6307	ZZ	VV	DDU	8		80	21	1.5	35 000	19 200	13.2	10 000	6 000	12 000
6008	ZZ	VV	DDU	8	40	68	15	1.0	17 600	11 500	15.3	12 000	6 000	14 000
6208	ZZ	VV	DDU	8		80	18	1.1	30 500	17 900	14.0	9 500	5 600	12 000
6308	ZZ	VV	DDU	8		90	23	1.5	43 000	24 000	13.2	9 000	5 300	11 000
6009	ZZ	VV	DDU	8	45	75	16	1.0	22 000	15 200	15.3	10 000	5 300	12 000
6209	ZZ	VV	DDU	8		85	19	1.1	33 000	20 400	14.4	9 000	5 300	11 000
6309	ZZ	VV	DDU	8		100	25	1.5	55 500	32 000	13.1	7 500	4 800	9 500
6010	ZZ	VV	DDU	8	50	80	16	1.0	22 900	16 600	15.6	9 500	4 800	11 000
6210	ZZ	VV	DDU	8		90	20	1.1	37 000	23 200	14.4	8 000	4 800	10 000
6310	ZZ	VV	DDU	8		110	27	2.0	65 000	38 500	13.2	7 100	4 300	8 500



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{or}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$P_0 = 0.6 F_r + 0.5 F_a$$

When $F_r > 0.6 F_r + 0.5 F_a$, use $P_0 = F_r$

Desgination					Boundary Dimensions (mm)				Basic Load Ratings (kN)		Factor	Limiting Speeds (min ⁻¹)		
												Grease		Oil
Open	Shielded	Sealed	NSKHP5	d	D	B	r (min.)	C _r	C _{0r}	f ₀		Open	DDU	Open
											ZZ	VV		
6011	ZZ	VV	DDU	8	55	90	18	1.1	29 700	21 200	15.3	8 500	4 500	10 000
6211	ZZ	VV	DDU	8		100	21	1.5	45 500	29 300	14.3	7 500	4 300	9 000
6311	ZZ	VV	DDU	8		120	29	2.0	75 000	44 500	13.1	6 700	4 000	8 000
6012	ZZ	VV	DDU	8	60	95	18	1.1	31 000	23 200	15.6	8 000	4 000	9 500
6212	ZZ	VV	DDU	8		110	22	1.5	55 000	36 000	14.3	6 700	3 800	8 000
6312	ZZ	VV	DDU	8		130	31	2.1	86 000	52 000	13.1	6 000	3 600	7 100
6013	ZZ	VV	DDU	8	65	100	18	1.1	32 000	25 200	15.8	7 500	4 000	9 000
6213	ZZ	VV	DDU	8		120	23	1.5	60 000	40 000	14.4	6 300	3 600	7 500
6313	ZZ	VV	DDU	8		140	33	2.1	97 500	60 000	13.2	5 600	3 400	6 700
6014	ZZ	VV	DDU	8	70	110	20	1.1	40 000	31 000	15.6	7 100	3 600	8 500
6214	ZZ	VV	DDU	8		125	24	1.5	65 500	44 000	14.5	6 000	3 400	7 100
6314	ZZ	VV	DDU	8		150	35	2.1	109 000	68 000	13.2	5 300	3 200	6 300
6015	ZZ	VV	DDU	8	75	115	20	1.1	41 500	33 500	15.8	6 700	3 400	8 000
6215	ZZ	VV	DDU	8		130	25	1.5	69 500	49 500	14.7	5 600	3 200	6 700
6315	ZZ	VV	DDU	8		160	37	2.1	119 000	77 000	13.2	4 800	2 800	6 000
6016	ZZ	VV	DDU	8	80	125	22	1.1	50 000	40 000	15.6	6 300	3 200	7 100
6216	ZZ	VV	DDU	8		140	26	2.0	76 500	53 000	14.6	5 300	3 000	6 300
6316	ZZ	VV	DDU	8		170	39	2.1	129 000	86 500	13.3	4 500	2 800	5 600
6017	ZZ	VV	DDU	8	85	130	22	1.1	52 000	43 000	15.8	6 000	3 000	7 100
6217	ZZ	VV	DDU	8		150	28	2.0	88 000	62 000	14.5	4 800	2 800	6 000
6317	ZZ	VV	DDU	8		180	41	3.0	139 000	97 000	13.3	4 300	2 600	5 000
6018	ZZ	VV	DDU	8	90	140	24	1.5	61 000	50 000	15.6	5 600	2 800	6 300
6218	ZZ	VV	DDU	8		160	30	2.0	101 000	71 500	14.5	4 500	2 600	5 600
6318	ZZ	VV	DDU	8		190	43	3.0	150 000	107 000	13.3	4 000	2 400	4 800
6019	ZZ	VV	DDU	8	95	145	24	1.5	63 500	54 000	15.8	5 300	2 600	6 000
6219	ZZ	VV	DDU	8		170	32	2.1	114 000	82 000	14.4	4 300	2 600	5 000
6319	ZZ	VV	DDU	8		200	45	3.0	160 000	119 000	13.3	3 400	2 400	4 300
6020	ZZ	VV	DDU	8	100	150	24	1.5	63 000	54 000	15.9	5 000	2 600	6 000
6220	ZZ	VV	DDU	8		180	34	2.1	128 000	93 000	14.4	4 000	2 400	4 800
6021	ZZ	VV	DDU	8	105	160	26	2.0	76 000	66 000	15.8	4 500	2 400	5 600
6221	ZZ	VV	DDU	8		190	36	2.1	140 000	105 000	14.4	3 800	2 200	4 500
6022	ZZ	VV	DDU	8	110	170	28	2.0	89 000	73 000	15.5	4 500	2 200	5 300
6024	ZZ	VV	DDU	8		120	180	28	2.0	92 500	80 000	15.7	4 000	2 200



NSKHPS High-Performance Standard Series Cylindrical Roller Bearings -For General Motors

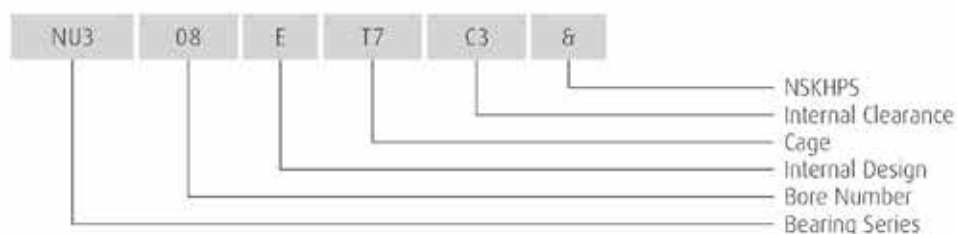
As motors become smaller and lighter, bearings must also become more compact, reliable, and capable of carrying heavy loads. NSK responds to these trends with NSKHPS: our new standard line of high-performance bearings.

Compared to conventional bearings, the NSKHPS Series of cylindrical roller bearings has up to 60% longer life and 15% higher limiting speed.

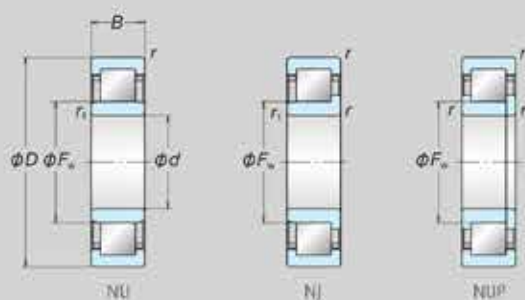
Our current NSKHPS Series has an extensive lineup based on the most commonly used bearing series.

DATA

Example Bearing Designation



NU3	Bearing Series	NU2, NU22, NU3, NU23 NJ2, NJ22, NJ3, NJ23 : Cylindrical Roller Bearings NUP2, NUP22, NUP3, NUP23
08	Bore Number	Bore number indicates bore diameter. Bore Number × 5 (mm)
E	Internal Design	E: High Load Capacity
T7	Cage	W: Pressed-Steel Cage M: Machined-Brass Cage T: Polyamide-Resin Cage T7: L-PPS Resin Cage
C3	Internal Clearance	Omitted: CN Clearance C3: Clearance Greater than CN C4: Clearance Greater than C3
&	NSKHPS	&: NSKHPS Bearings



Designation*						Boundary Dimensions (mm)					Basic Load Ratings (kN)		Limiting Speeds (min ⁻¹)		Permissible Axial Movement S (mm)	
Basic Number & Internal Design Code	Cage				NSK HPS	d	D	B	r _(min.)	r ₁ (min.)	Fw	C _r	C _{0r}	Grease		Oil
	W	M	T	T7												
NU205E	*	*	*	*	⊗	25	52	15	1	0.6	31.5	33 500	27 700	12 000	14 000	1.2
NU2205E		*	*	*	⊗		52	18	1	0.6	31.5	40 000	34 500	12 000	14 000	1.2
NU305E	*	*	*	*	⊗		62	17	1.1	1.1	34	48 000	37 500	10 000	12 000	1.2
NU2305E		*	*	*	⊗		62	24	1.1	1.1	34	65 500	56 000	9 000	11 000	1.2
NU206E	*	*	*	*	⊗	30	62	16	1	0.6	37.5	45 000	37 500	9 500	12 000	1.2
NU2206E		*	*	*	⊗		62	20	1	0.6	37.5	56 500	50 000	9 500	12 000	1.2
NU306E	*	*	*	*	⊗		72	19	1.1	1.1	40.5	61 000	50 000	8 500	10 000	1.2
NU2306E		*	*	*	⊗		72	27	1.1	1.1	40.5	86 000	77 500	8 000	9 500	1.2
NU207E	*	*	*	*	⊗	35	72	17	1.1	0.6	44	58 000	50 000	8 500	10 000	1.2
NU2207E		*	*	*	⊗		72	23	1.1	0.6	44	71 000	65 500	8 500	10 000	2.2
NU307E	*	*	*	*	⊗		80	21	1.5	1.1	46.2	76 500	65 500	7 500	9 500	1.2
NU2307E		*	*	*	⊗		80	31	1.5	1.1	46.2	107 000	101 000	6 700	8 500	1.2
NU208E	*	*	*	*	⊗	40	80	18	1.1	1.1	49.5	64 000	55 500	7 500	9 000	1.2
NU2208E		*	*	*	⊗		80	23	1.1	1.1	49.5	83 000	77 500	7 500	9 000	1.2
NU308E	*	*	*	*	⊗		90	23	1.5	1.5	52	95 500	81 500	6 700	8 000	1.2
NU2308E		*	*	*	⊗		90	33	1.5	1.5	52	131 000	122 000	6 000	7 500	1.2
NU209E	*	*	*	*	⊗	45	85	19	1.1	1.1	54.5	72 500	66 500	6 700	8 000	1.2
NU2209E		*	*	*	⊗		85	23	1.1	1.1	54.5	87 500	84 500	6 700	8 500	1.2
NU309E	*	*	*	*	⊗		100	25	1.5	1.5	58.5	112 000	98 500	6 000	7 500	1.4
NU2309E		*	*	*	⊗		100	36	1.5	1.5	58.5	158 000	153 000	5 300	6 700	1.4
NU210E	*	*	*	*	⊗	50	90	20	1.1	1.1	59.5	79 500	76 500	6 300	7 500	1.7
NU2210E		*	*	*	⊗		90	23	1.1	1.1	59.5	96 000	97 000	6 300	8 000	1.2
NU310E	*	*	*	*	⊗		110	27	2	2	65	127 000	113 000	5 000	6 000	1.4
NU2310E		*	*	*	⊗		110	40	2	2	65	187 000	187 000	5 000	6 300	1.9
NU211E	*	*	*	*	⊗	55	100	21	1.5	1.1	66	99 000	98 500	5 600	7 100	1.2
NU2211E		*	*	*	⊗		100	25	1.5	1.1	66	117 000	122 000	5 600	7 100	1.2
NU311E	*	*	*	*	⊗		120	29	2	2	70.5	158 000	143 000	4 500	5 600	1.4
NU2311E		*	*	*	⊗		120	43	2	2	70.5	231 000	233 000	4 500	5 600	1.4

* - Available cage ★ NJ and NUP type bearings are also available. Please consult NSK for details.

Designation*						Boundary Dimensions (mm)					Basic Load Ratings (kN)		Limiting Speeds (min ⁻¹)		Permissible Axial Movement S (mm)	
Basic Number & Internal Design Code	Cage				NSK HPS	d	D	B	r (min.)	r ₁ (min.)	Fw	C _r	C _{0r}	Grease		Oil
	W	M	T	T7												
NU212E	*	*	*	*	⋈	60	110	22	1.5	1.5	72	112 000	107 000	5 300	6 300	1.2
NU2212E		*	*	*	⋈		110	28	1.5	1.5	72	151 000	157 000	5 300	6 300	1.2
NU312E		*	*	*	⋈		130	31	2.1	2.1	77	169 000	157 000	4 800	5 600	1.5
NU2312E		*	*	*	⋈		130	46	2.1	2.1	77	251 000	262 000	4 300	5 300	1.5
NU213E	*	*	*	*	⋈	65	120	23	1.5	1.5	78.5	124 000	119 000	4 800	5 600	1.4
NU2213E		*	*	*	⋈		120	31	1.5	1.5	78.5	171 000	181 000	4 800	6 000	1.4
NU313E		*	*	*	⋈		140	33	2.1	2.1	82.5	204 000	191 000	4 300	5 300	1.5
NU2313E		*	*	*	⋈		140	48	2.1	2.1	82.5	263 000	265 000	3 800	4 800	1.5
NU214E		*	*	*	⋈	70	125	24	1.5	1.5	83.5	136 000	137 000	5 000	6 300	1.4
NU2214E		*	*	*	⋈		125	31	1.5	1.5	83.5	179 000	194 000	4 500	5 600	1.4
NU314E		*	*	*	⋈		150	35	2.1	2.1	89	231 000	222 000	4 000	5 000	1.5
NU2314E		*	*	*	⋈		150	51	2.1	2.1	89	310 000	325 000	3 600	4 500	1.5
NU215E		*	*	*	⋈	75	130	25	1.5	1.5	88.5	150 000	156 000	4 800	6 000	1.4
NU2215E		*	*	*	⋈		130	31	1.5	1.5	88.5	186 000	207 000	4 300	5 300	1.4
NU315E		*	*	*	⋈		160	37	2.1	2.1	95	271 000	263 000	3 800	4 800	1.4
NU2315E		*	*	*	⋈		160	55	2.1	2.1	95	370 000	395 000	3 400	4 300	1.4
NU216E		*	*	*	⋈	80	140	26	2	2	95.3	160 000	167 000	4 500	5 300	1.4
NU2216E		*	*	*	⋈		140	33	2	2	95.3	214 000	243 000	4 000	5 000	1.4
NU316E		*	*	*	⋈		170	39	2.1	2.1	101	289 000	282 000	3 600	4 300	1.5
NU2316E		*	*	*	⋈		170	58	2.1	2.1	101	400 000	430 000	3 200	4 000	1.5
NU217E		*	*	*	⋈	85	150	28	2	2	100.5	192 000	199 000	4 300	5 000	1.3
NU2217E		*	*	*	⋈		150	36	2	2	100.5	250 000	279 000	3 800	4 500	1.3
NU317E		*			⋈		180	41	3	3	108	360 000	330 000	3 400	4 000	2.0
NU2317E		*			⋈		180	60	3	3	108	485 000	485 000	3 000	3 800	1.6
NU218E		*	*	*	⋈	90	160	30	2	2	107	205 000	217 000	4 000	4 800	1.4
NU2218E		*	*	*	⋈		160	40	2	2	107	274 000	315 000	3 600	4 300	1.9
NU318E		*			⋈		190	43	3	3	113.5	390 000	355 000	3 200	3 800	1.5
NU2318E		*			⋈		190	64	3	3	113.5	535 000	535 000	2 800	3 400	3.1
NU219E		*	*		⋈	95	170	32	2.1	2.1	112.5	249 000	265 000	3 800	4 500	1.4
NU2219E		*	*		⋈		170	43	2.1	2.1	112.5	325 000	370 000	3 400	4 000	1.4
NU319E		*			⋈		200	45	3	3	121.5	410 000	385 000	3 000	3 600	1.5
NU2319E		*			⋈		200	67	3	3	121.5	565 000	585 000	2 600	3 400	1.6
NU220E		*			⋈	100	180	34	2.1	2.1	119	305 000	305 000	3 600	4 300	1.4
NU2220E		*			⋈		180	46	2.1	2.1	119	410 000	445 000	3 200	3 800	1.4
NU320E		*			⋈		215	47	3	3	127.5	465 000	425 000	2 800	3 400	1.8
NU2320E		*			⋈		215	73	3	3	127.5	700 000	715 000	2 400	3 000	1.8
NU221E		*			⋈	105	190	36	2.1	2.1	125	320 000	310 000	3 400	4 000	1.4
NU321E		*			⋈		225	49	3	3	133	525 000	480 000	2 600	3 200	1.8
NU222E		*			⋈	110	200	38	2.1	2.1	132.5	360 000	365 000	3 200	3 800	1.4
NU2222E		*			⋈		200	53	2.1	2.1	132.5	470 000	515 000	2 800	3 400	1.4
NU322E		*			⋈		240	50	3	3	143	555 000	525 000	2 600	3 000	3.8
NU2322E		*			⋈		240	80	3	3	143	830 000	880 000	2 200	2 800	3.3

* - Available cage ★ NJ and NUP type bearings are also available. Please consult NSK for details.

Technical Data

1. Bearing Sound and Vibration

Diagnosis with Sound and Vibration

Classification of sounds and vibrations

Sounds and vibrations accompany the rotation of rolling bearings. The frequency and amplitude of such sounds and vibrations vary depending on the type of bearing, mounting conditions, operational conditions, etc. The sounds and vibrations of a rolling bearing can be classified under the following four main categories and each category can be further classified into several subcategories, as described in Table 1 below. However, boundaries between groups are not definite. Even if some types of sounds or vibrations are inherent in the bearings, the volume might be related

to the manufacturing process. Conversely, some types of sounds or vibrations, even if caused by manufacturing, cannot be eliminated under normal conditions. By recording the sounds and vibrations of a rotating machine and analyzing them, the cause may be inferred. As shown by the figures on the next page, a mechanically normal bearing shows a stable waveform. However, a bearing with damage such as a scratch shows a waveform with wide swings indicating large-amplitude sounds at regular intervals (refer to Figs.1 and 2).

Table 1 Classification of Sounds and Vibrations in a Rolling Bearing

	Sound Type		Vibration		Features
Structural	Race noise		Free vibration of raceway ring		Continuous noise: basic unavoidable noise that all bearings generate
	Roller/ball click noise		Free vibration of raceway ring, free vibration of cage		Regular noise at a certain interval: found in large bearings and horizontal shafts, radial loads and low rpm
	Squeal noise		Free vibration of raceway ring		Intermittent or continuous: generally found in large cylindrical roller bearings and under radial load, grease lubrication, and particular speeds
	Cage noise	"CK" sound	Free vibration of cage		Regular noise at a set interval: generated by all bearing types
		"CG" sound	Vibration of cage		Intermittent or continuous: lubrication with certain greases
		Tapping sound	Free vibration of cage		Set interval: slightly irregular under radial load and during initial stage
Rumbling		Vibration from passage of rolling element		Continuous: found in all bearing types under radial load	
Manufacturing	Chatter noise		Vibration due to waviness	Inner ring	Continuous noise
				Outer ring	
				Rolling element	Continuous with rollers, occasional with balls
Handling	Flaw noise		Vibration due to flaw	Inner ring	Regular noise at a set interval
				Outer ring	
				Rolling element	
Contamination noise		Vibration due to contamination		Irregular	
Other	Seal noise		Free vibration of a seal		Contact seal
	Lubricant noise		—		Irregular
	Rumbling	Runout	f_c	Continuous	
			f_e	Continuous	
			$f_e/2f_c$	Continuous	

n : Positive integer (1, 2, 3,...) Z : Number of rolling elements f_{ow} : Natural frequency of ring in radial bending mode (Hz)
 f_{oe} : Natural frequency in the mode of angular vibration in inertia of outer ring-spring system (Hz)
 f_c : Rotation frequency of inner ring (Hz) f_e : Orbital revolution frequency of rolling elements (Hz)



Fig. 1 Sound waveform of a normal bearing



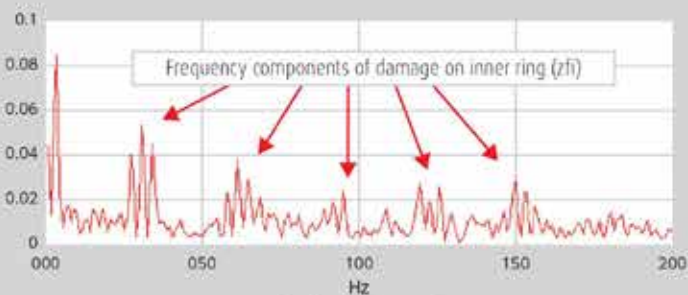
Fig. 2 Sound waveform of a scratched bearing

When the inner ring raceway surface is damaged

Bore diameter: 100 mm

Recording and analysis method: Envelope analysis sounds recorded by microphone for a test machine.

Number of rotations: 50 min



Example of analysis result

Generated Frequency (Frequency Analysis)			Source	Countermeasures
FFT of Original Wave		FFT After Envelope (Basic No.)		
Radial (Angular) Direction	Axial Direction			
f_{RIN}, f_{MI}	f_{AIN}, f_{AM}	—	Selective resonance from waviness (rolling friction)	Improve rigidity around bearings, provide appropriate radial clearance, use high-viscosity lubricant and high-quality bearings
f_{RIN}, f_{MI}	f_{AIN}, f_{AM}	Zf_c	Collision of rolling elements with inner ring or cage	Reduce radial clearance, apply preload, use high-viscosity oil
$(\approx f_{R2N}, f_{R3N})$	—	?	Self-induced vibration caused by sliding friction at rolling surface	Reduce radial clearance, apply preload, change grease, replace with bearings with countermeasures
Natural frequency of cage		f_c	Collision of cage with rolling elements or rings	Apply preload, use high-viscosity lubricant, reduce mounting error
Natural frequency of cage		?	Self-induced vibration caused by friction at cage guide surface	Change grease brand, replace with cage with countermeasures
Natural frequency of cage		Zf_c	Collision of cage and rolling element caused by grease resistance	Reduce radial clearance, apply preload, use low-viscosity lubricant
Zf_c	—	—	Displacement of inner ring due to rolling element passage	Reduce radial clearance, apply preload
$nZf_i \pm f_c (nZ \pm 1 \text{ peaks})$	$nZf_i (nZ \text{ peaks})$	—	Inner ring raceway waviness, irregularity of shaft exterior	Use high-quality bearings, improve shaft accuracy
$nZf_c (nZ \pm 1 \text{ peaks})$	$nZf_c (nZ \text{ peaks})$	—	Outer ring raceway waviness, irregular housing bore	Use high-quality bearings, improve housing bore accuracy
$2nf_b \pm f_c (2n \text{ peaks})$	$2nf_b (2n \text{ peaks})$	—	Rolling element waviness	Use high-quality bearings
f_{RIN}, f_{MI}	f_{AIN}, f_{AM}	Zf_i	Nicks, dents, rust, flaking on inner ring raceway	Replace bearing and take care when handling
		Zf_c	Nicks, dents, rust, flaking on inner ring raceway	Replace bearing and take care when handling
		Zf_b	Nicks, dents, rust, flaking on rolling elements	Replace bearing and take care when handling
f_{RIN}, f_{MI}	f_{AIN}, f_{AM}	Irregular	Entry of dirt or debris	Wash the bearing, improve sealing
Natural frequency of seal		(f_r)	Self-induced vibration due to friction at seal contact area	Change the seal, change the grease
?	?	Irregular	Lubricant or lubricant bubbles crushed between rolling elements and raceways	Change the grease
f_r	—	—	Irregular inner ring cross-section	Use high-quality bearings
f_c	—	—	Ball variation in bearing, rolling elements non-equidistant	Use high-quality bearings
$f_r - 2f_c$	—	—	Non-linear vibration due to rigid variation by ball variation	Use high-quality bearings

f_{RIN} : Ring natural frequency in axial bending mode (Hz)

f_{AM} : Natural frequency in the mode of axial vibration in mass of an outer ring spring system (Hz)

f_r : $f_r = f_c - f_c$ (Hz) f_b : Rotation frequency of rolling element around its center (Hz)

2. Grease for Motors

Grease Properties Table

Name	Thickener	Base Oil	Dropping Point (°C)	Worked Penetration	Operating Temperature (°C)	Base Oil Viscosity (mm ² /s) (40°C)
NS7	Lithium soap	Ester + Diester	192	250	-40 to +130	24.1
ENS	Urea	Polyolester	>260	264	-40 to +160	30.5
EA7	Urea	Poly- α -olefin	>260	243	-40 to +160	46
EA9	Urea	Poly- α -olefin	>260	314	-40 to +140	47
LGU	Urea	Poly- α -olefin	>260	201	-40 to +120	95.8
KPM	PTFE	Perfluoro-polyether	None	290	-20 to +200	420

3. Grease Life Equations

Grease Life of Sealed Ball Bearings

When grease is packed into single-row deep groove ball bearings, the grease life may be estimated using Equation (1), Equation (2), or Fig. 3.

(General-purpose grease (1))

$$\log t = 6.54 - 2.6 \frac{n}{N_{max}} - \left(0.025 - 0.012 \frac{n}{N_{max}} \right) T \quad (1)$$

(Wide-range grease (2))

$$\log t = 6.12 - 1.4 \frac{n}{N_{max}} - \left(0.018 - 0.006 \frac{n}{N_{max}} \right) T \quad (2)$$

where: t : Average grease life (h)

n : Speed (min⁻¹)

N_{max} : Limiting speed with grease lubrication (min⁻¹)

(values for ZZ and VV types are listed in the bearing tables)

T : Operating temperature (°C)

Equation (1), Equation (2), and Fig. 3 apply under the following conditions:

(a) Speed n

$$0.25 \leq \frac{n}{N_{max}} \leq 1$$

$$\text{when } \frac{n}{N_{max}} < 0.25, \text{ assume } \frac{n}{N_{max}} = 0.25$$

(b) Operating Temperature T

For general-purpose grease (1) $-70^\circ\text{C} \leq T \leq 110^\circ\text{C}$

For wide-range grease (2) $-70^\circ\text{C} \leq T \leq 130^\circ\text{C}$

When $T < -70^\circ\text{C}$, assume $T = -70^\circ\text{C}$

(c) Bearing Loads

The bearing loads should be about 1/10 or less the basic load rating C_0 .

Notes (1) Mineral-oil based greases (e.g. lithium-soap based grease) often used around -10 to 110°C .

Notes (2) Synthetic-oil based greases used over a wide temperature range around -40 to 130°C .

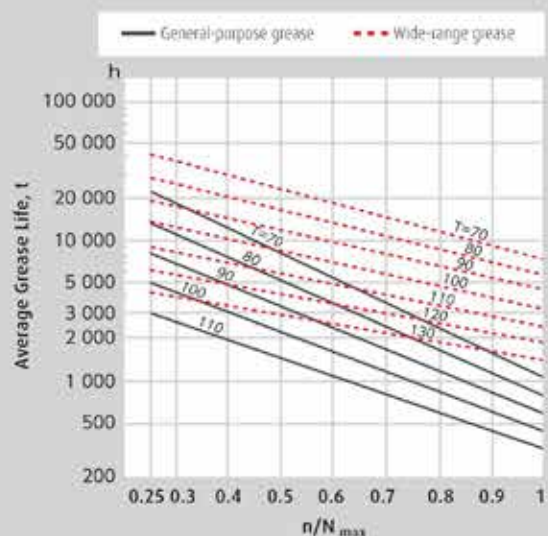


Fig. 3 Grease Life of Sealed Ball Bearings

4. Radial Internal Clearance

Radial Internal Clearances in Deep Groove Ball Bearings

Units: μm

Nominal Bore Diameter d (mm)		Clearance									
		C2		CN		C3		C4		C5	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
10 only		0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	25	85	75	140	125	195	175	265
225	250	2	40	30	95	85	160	145	225	205	300
250	280	2	45	35	105	90	170	155	245	225	340
280	315	2	55	40	115	100	190	175	270	245	370
315	355	3	60	45	125	110	210	195	300	275	410
355	400	3	70	55	145	130	240	225	340	315	460
400	450	3	80	60	170	150	270	250	380	350	510
450	500	3	90	70	190	170	300	280	420	390	570
500	560	10	100	80	210	190	330	310	470	440	630
560	630	10	110	90	230	210	360	340	520	490	690
630	710	20	130	110	260	240	400	380	570	540	760
710	800	20	140	120	290	270	450	430	630	600	840

Remarks To obtain the measured values, use the clearance correction values in the table below. For the C2 clearance class, the smaller value should be used for bearings with minimum clearance and the larger value for bearings near the maximum clearance range.

Units: μm

Nominal Bore Dia. d (mm)		Measuring Load (N) (kgf)		Radial Clearance Correction Amount				
over	incl.			C2	CN	C3	C4	C5
10 (incl.)	18	24.5	2.5	3 to 4	4	4	4	4
18	50	49	5	4 to 5	5	6	6	6
50	280	147	15	6 to 8	8	9	9	9

Remark For values exceeding 280 mm, please contact NSK.

Radial Internal Clearances in Bearings for Electric Motors

Deep Groove Ball Bearings for Electric Motors

Units: μm

Nominal Bore Dia. d (mm)		Clearance CM		Remarks	
over	incl.	min.	max.	Shaft	Housing Bore
10 (incl.)	18	4	11	js5 (j5)	
18	30	5	12		
30	50	9	17		
50	80	12	22		
80	100	18	30		
100	120	18	30		
120	160	24	38		
				k5	H6, 7 (*) or js6, 7 (j6, j7) (*)
				m5	

Notes (*) Applicable to outer rings that require movement in the axial direction.

(†) Applicable to outer rings that do not require movement in the axial direction.

Remark The radial internal clearance increase caused by the measuring load is equal to the correction amount for CN clearance listed in the table above.

Cylindrical Roller Bearings for Electric Motors

Units: μm

Nominal Bore Dia. d (mm)		Clearance				Remarks	
		Interchangeable CT		Non-interchangeable CM		Recommended Fit	
over	incl.	min.	max.	min.	max.	Shaft	Housing Bore
24	40	15	35	15	30	k5	
40	50	20	40	20	35		
50	65	25	45	25	40		
65	80	30	50	30	45		
80	100	35	60	35	55		
100	120	35	65	35	60		
120	140	40	70	40	65		
140	160	50	85	50	80		
160	180	60	95	60	90		
180	200	65	105	65	100	n6	
						js6, js7 (j6, j7) (*) or k6, k7 (*)	

Notes (*) Applicable to outer rings that require movement in the axial direction.

(†) Applicable to outer rings that do not require movement in the axial direction.

5. Example Bearing Damage in Motors

Seizure

Damage	Possible Causes	Countermeasures
When sudden overheating occurs during rotation, the bearing becomes discolored. If operation continues, the raceway rings, rolling elements, and cage will soften, melt, and deform as damage accumulates.	<ul style="list-style-type: none"> -Poor lubrication -Excessive load (excessive preload) -Excessive rotational speed -Excessively small internal clearance -Entry of water and debris -Poor precision of shaft and housing, excessive shaft bending 	<ul style="list-style-type: none"> • Review the lubricant and lubrication method • Re-investigate the suitability of the bearing type selected • Review the preload, bearing clearance, and fitting • Improve the sealing mechanism • Check the precision of the shaft and housing • Improve the mounting method



Photo 1

Part: Inner ring of an angular contact ball bearing

Symptom: Raceway discoloration, melting at ball pitch intervals

Cause: Excessive preload



Photo 2

Part: Outer ring in Photo 1

Symptom: Raceway discoloration, melting at ball pitch intervals

Cause: Excessive preload



Photo 3

Part: Balls and cage of Photo 1

Symptom: Cage damaged by melting, balls discolored and covered by some melt

Cause: Excessive preload



Photo 4

Part: Inside a deep groove ball bearing

Symptom: Grease nearly depleted, carbonization

Cause: Poor lubrication



Photo 5

Part: Inside a deep groove ball bearing

Symptom: Cage damage, grease depleted, carbonization

Cause: Poor lubrication



Photo 6

Part: Cylindrical roller bearing

Symptom: Seizure of roller at ring raceway surface

Cause: Excessively small internal clearance generated heat from motion of the inner ring and rollers under high speed and light load

Creep

Damage	Possible Causes	Countermeasures
<p>A phenomenon in bearings where relative slippage occurs at the fitting surfaces.</p> <p>Creep causes a shiny appearance, occasionally with scoring or wear.</p>	<ul style="list-style-type: none"> -Insufficient interference or loose fit -Insufficient sleeve tightening 	<ul style="list-style-type: none"> • Check interference and prevent rotation • Correct the sleeve tightening • Review precision of the shaft and housing • Apply axial preload • Tighten the raceway ring side face • Apply adhesive to the fitting surface • Apply a film of assembly paste to the fitting surface



Photo 7

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



Photo 8

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

Electrical Erosion

Damage	Possible Causes	Countermeasures
When electric current passes through a bearing, arcing and burning occur throughout the thin oil film at points of contact between the race and rolling elements. The points of contact are melted locally to form "fluting" or groove-like corrugations which can be seen by the naked eye. Magnification of these grooves reveals crater-like depressions that indicate melting by arcing.	-Electric potential difference between inner and outer rings. -High-frequency electric potential difference generated by instruments or substrates used near a bearing.	• Design electric circuits that prevent current flow through the bearings • Insulate the bearing



Photo 9
Part: Inner ring of a cylindrical roller bearing
Symptom: Belt pattern of electrical erosion accompanied by pits on the raceway surface



Photo 10
Part: Balls of a deep groove ball bearing
Symptom: A dark color covering the entire ball surface

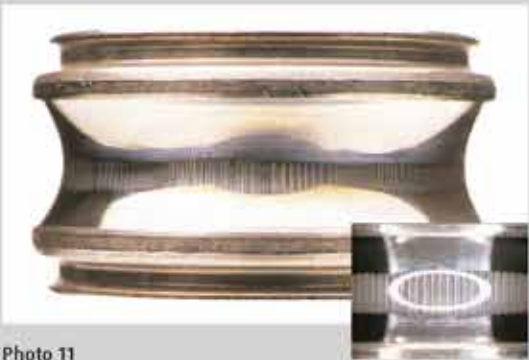


Photo 11
Part: Inner ring of a deep groove ball bearing
Symptom: Fluting on the raceway surface (high frequency)

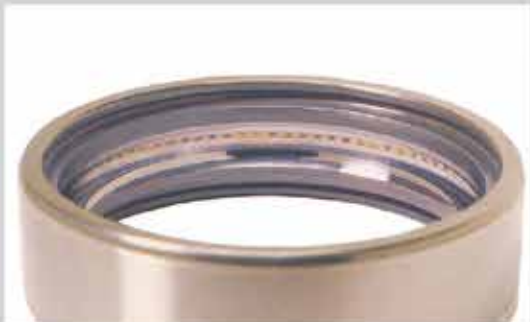


Photo 12
Part: Outer ring of a deep groove ball bearing
Symptom: Fluting on the raceway surface (high frequency)

Motor Bearings Specification Request

Please contact your nearest NSK branch with the following:

◆ Basic Parameters

Motor Parameters	Application			
	Rotational Speed			
	Output		Max. : _____ kw ; Normal: _____ kw	
	Position		<input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical <input type="checkbox"/> Inclined (inclination angle): _____ °	
	Ambient Temp.		Range _____ to _____ °C ; Normal: _____ °C	
	Cooling Method		<input type="checkbox"/> Water <input type="checkbox"/> Oil <input type="checkbox"/> Air ; <input type="checkbox"/> Other: _____	
Bearing Parameters			Drive Side Bearing	Non Drive Side Bearing
	Designation			
	Dimensions		Bore dia. ϕ _____ × Outside dia. ϕ _____ × Width _____ mm	Bore dia. ϕ _____ × Outside dia. ϕ _____ × Width _____ mm
	Lubrication Type		<input type="checkbox"/> Grease (Brand: _____) ; <input type="checkbox"/> Oil (Brand: _____)	
	Seal/Shield Type		<input type="checkbox"/> Open <input type="checkbox"/> Shielded (ZZ) <input type="checkbox"/> Sealed (VV/DDU/DDW)	
	Load		Axial Fa: _____ N ; Radial Fr : _____ N	
			Rotor weight: _____ kg ; Side magnetic force: _____ N	
	Bearing Temp.		Min. : _____ °C ; Max. : _____ °C ; Normal : _____ °C	
Required Life		_____ Hours (or) _____ Years		
Fitting Parameters	Fitting	Housing	_____ to _____ mm	_____ to _____ mm
		Shaft	_____ to _____ mm	_____ to _____ mm
	Shaft Hollow Dia.		ϕ _____ mm (0 for non-hollow shafts)	ϕ _____ mm (0 for non-hollow shafts)
	Shaft Material			
	Housing Material			
	Bearing Preload		<input type="checkbox"/> None ; <input type="checkbox"/> With preload : Type (<input type="checkbox"/> Spring / <input type="checkbox"/> Shim / <input type="checkbox"/> Other _____) : Location (<input type="checkbox"/> Drive side / <input type="checkbox"/> Non drive side)	

◆ To help analyze the bearing load, please provide a layout and dimensions.

Motor Layout	Related Dimensions Distance From Bearing Center: _____ mm Distance From Load Center to Front Bearing Center: _____ mm Distance From Load Center to Rear Bearing Center: _____ mm
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Catalogues

“Self-Lube Bearings”

+ BALL BEARING UNITS



www.nsk-literature.com/en/ball-bearing-units

Catalogues

“Plummer Blocks
and Accessories”

PLUMMER BLOCKS AND ACCESSORIES – SNN SERIES AND SD SERIES



Product-Brochure

“Rolling Bearings”

+ ROLLING BEARINGS



Success Stories



Industrial Fan Units



Centrifugal Pump



Optical Sorter

Success Story

Industry: Power Generation

Application: Industrial Fan Units

Cost Savings: € 134,040

Introduction

An energy producer in the UK was experiencing frequent breakdowns due to bearing failure within two industrial fan units. The critical assets were operating 24/7. On average the bearings on each fan unit failed every 3 months. NSK performed an application review. The root cause of failure was attributed to incorrect bearing fixing arrangement. NSK recommended using high capacity Spherical Roller Bearings used within SNN Plummer Blocks. A trial was conducted resulting in zero bearing failures over a 12 months period, with significant improvements in performance and reduced maintenance and associated downtime costs, with 4 times greater life.

Key Facts

- Total Air Fan: direct drive overhung fan supported by two Spherical Roller Bearings in Plummer Blocks
- Frequent bearing failure taking 3 engineers 10 hours each time to repair, incurring high costs per breakdown
- Incorrect bearing arrangement (fixing wrong bearing)
- NSK Solution: High capacity Spherical Roller Bearings within SNN Plummer blocks and split nitrile seals along with recommendations on correct bearing location
- Four times longer bearing life with significant downtime reduction, improved efficiency and equipment reliability



↑ Industrial Fan Unit

Value Proposals

- NSK engineering conducted an Application Review including a failed bearing examination from the drive and non-drive end bearings of one Fan Unit
- NSK recommended High Capacity Spherical Roller Bearings within SNN Plummer Blocks and split nitrile seals along with recommendations on correct bearing location. Furthermore High Capacity Spherical Roller Bearings were chosen as the internal design is more reliable for direct coupled overhung industrial fan units, due to inner ring ribs providing better roller guidance
- Trial conducted, with NSK Engineering overseeing the installation and implementation of NSK recommendations with zero breakdowns in a 12 month period
- The customer benefited from increased productivity, substantial loss of production savings and reduced maintenance down time

Success Story

Industry: Power Generation

Application: Centrifugal Pump

Cost Savings: € 28,970

Introduction

Key Facts

- Energy producer – water recirculation centrifugal pumps
- Frequently failures due to poor lubrication
- NSK Solution: DDU Sealed Deep Groove Ball Bearings
- A trial was performed on 3 out of 20 pumps without any failures for more than 6 months
- After changing to the NSK solution on all pumps no failure occurred within a period 12 months
- Significant cost savings due to failure-free running but also due to reduced material and maintenance cost



↑ Centrifugal Pump

Value Proposals

- Repeated failures on the pumps were recognised. The customer requested the local distributor to check the possibility to improve the lifetime of the bearings.
- NSK and the local distributor performed a bearing analysis on site and concluded that the failure occurred due to lack of lubrication. Considering the age of the equipment and the poor condition of the seals, a design modification to avoid the oil leaks was not considered.
- Instead NSK proposed to use Deep Groove Ball Bearings with DDU seals and a high temperature grease.
- A trial was performed on 3 pumps and the bearings have been monitored for 6 months without any failures.
- After changing to NSK Deep Groove Ball Bearings with DDU seals and a high temperature grease on all pumps no failure occurred within a period of 12 months period.

Success Story

Industry: Material Handling

Application: Optical Sorter

Cost Savings: 51,174 euros

Introduction

A customer in the recycling industry was experiencing regular failures of a mounted bearing unit on a conveyor of an optical sorting machine. In the three months since the installation of the machine, a total of 5 bearing failures had been recorded. An NSK applications engineer examined the application and determined that vibration and lubrication issues were causing the bearing to fail prematurely. NSK recommended using SNN Plummer Blocks combined with NSKHPS Spherical Roller Bearings.

Key Facts

- Optical sorting machine
- Special mounted units failing prematurely
- Vibration causing grub screws to loosen and shaft to spin on bearing inner ring
- No lubrication escape path causing excessive heat generation
- NSK solution: SNN plummer blocks with NSKHPS Spherical Roller Bearings
- No bearing failures since NSK solution implemented
- Significant reduction in downtime and maintenance costs



↑ Optical Sorter Conveyor

Value Proposals

- NSK Application Engineering performed an Application Review following a Failed Bearing Analysis
- It was determined that vibration in the application had caused the grub screws to loosen, resulting in the shaft spinning in the bearing inner ring
- It was also noted that the type of mounted unit being used had no grease escape path, causing excessive grease build up resulting in high heat generation
- NSK recommended using HPS Spherical Roller Bearings mounted on adapter sleeves in an SNN plummer block housing. The adapter sleeve locking method means that the bearing cannot become loose on the shaft even with vibration present
- NSK SNN plummer blocks are provided with a grease escape hole as standard, meaning excessive grease build up is avoided
- No failures recorded since the NSK solution was implemented

Innovative Products

Angular Contact Ball Bearings

Angular Contact Ball Bearings – Double Row

Ball Bearings – Prelubricated

Spherical Roller Bearings – NSKHPS Series

Spherical Roller Bearings for Vibrating Screens

Cylindrical Roller Bearings – NSKHPS Series

Self-Lube® Units

Triple-Lip Sealed Inserts

Self-Lube® – HLT Inserts

Plummer Blocks and Accessories - SNN Series

Roller Bearings for large Gearboxes

Angular Contact Ball Bearings - High Performance

NSK's High Performance Angular Contact Ball Bearings for industrial machinery & pumps. Bearings designed for easy handling, long-life, low vibration, & quiet running in application.

Product Features

- Optimised internal design
- High load rating – high tech polymers or brass machined cage
- Ball centred cage
- High dimensional and running accuracy
- Universal facing is standard

Benefits

- Long life
- High temperature capability
- Polyamide up to 150°C
- PPS up to 190°C in continuous operation
- High reliability – internal design improves lubricant flow
- Reduced heat generation ensuring longer life & reliability
- Reduced vibration & noise
- Easy handling & installation due to universal facing

Condition Description

- High Load
- High Temperature
- Low Noise
- Vibration

Industries

- Fans and Blowers
- Industrial Pumps and Compressors



72	10	B	EA	T85	SU	L
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Description

72	Bearing Series
10	Bore number
B	Contact Angle (B: 40°)
EA	Extra Capacity
T85	Cage
SU	Arrangement (SU: Single Universal)
L	Preload

Double Row Angular Contact Ball Bearings

The sealing system of double row angular contact ball bearings prevents the ingress of dirt and ensures an optimum service life. They correspond, in structure and function, to a pair of single-row angular contact ball bearings in a back to back ("O") arrangement.

Product Features

- Shields ZR: sheet steel discs
- Seals RSR: made of nitrile rubber reinforced with an embedded steel disc

Benefits

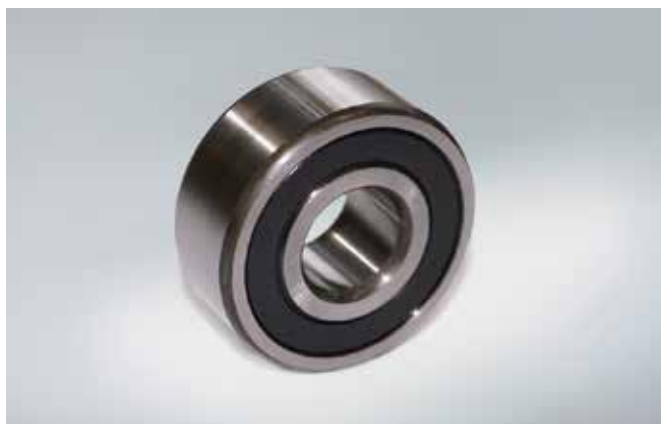
- Contact seals providing excellent protection against the ingress of contamination, reducing wear on the raceways and ball surface, reducing noise, vibration and the risk of lubricant failure
- Designed to accommodate radial and axial forces in both directions
- Capacity to accept moment loading
- Other bearing variants available on request
- Outer and inner ring: diameter, width, threads etc.
- Contour options: crowned, gothic etc.
- Special seals

Condition Description

- Contamination

Industries

- Agriculture



Ball Bearings - Prelubricated BB with EA3 Grease

NSK's Long Life, Low Torque Ball Bearings - EA3 grease is pre-filled in shielded/sealed NSK ball bearings used in a wide range of electric motors to maximise life and protection, but minimise noise and power loss, compared to bearings lubricated with conventional greases.

Product Features

- Excellent oxidation and heat stability
- Excellent rust prevention and water resistance
- Excellent low temperature characteristics
- Low noise.
- NLGI consistency 3
- Negligible effect on rubbers and plastics

Benefits

- Provides long term lubrication even under elevated temperatures
- Energy efficient
- Low torque/minimal power loss even at low starting temperatures
- Minimal leakage and bearing rust in humid conditions
- Excellent resistance to varnish corrosion
- Retention and slumping prevention in vertical applications
- Sealing effect helps prevent carbon dust particle ingress
- Energy efficient

Condition Description

- High Speed
- High Temperature
- Low Noise

Industries

- Domestic Appliances
- Electric Motors
- Industrial Pumps and Compressors
- Power Tools



62 05 ZZ C3 E EA3

Description

62	Basic Type & Series
05	Bore Diameter
ZZ	Features
C3	Internal Clearance
E	Noise Level
EA3	Lubricant

NSKHPS Spherical Roller Bearings

NSKHPS Spherical Roller Bearings are state-of-the-art material technology bearings, suitable for high speeds & loads. They can enable equipment downsizing and are suitable for a wide variety of applications. Available with steel or brass cage.

Product Features

- Highest load rating SRB's
- Optimum raceway design & surface finishing
- Brass cage design (CAM) or strengthened steel cage (EA)
- High cleanliness Z-steel
- Temperature stability: up to 200° C
- 40 mm to 260 mm bore size

Benefits

- Up to twice the operating life
- Up to 20% higher limiting speed
- Dynamic load rating: 25% higher
- Lower maintenance cost and improved productivity
- High load rating enables downsizing

Condition Description

- High Load
- High Speed
- High Temperature
- Misalignment

Industries

- Fans and Blowers
- Food and Beverage
- Industrial Pumps and Compressors
- Material Handling
- Medical and Health Care



232	36	CA	M	K	E4	C3	S11	*H*
-----	----	----	---	---	----	----	-----	-----

Description

232	Bearing type and series
36	Bore
CA	Internal Design
M	Cage
K	Design of Rings
E4	Design of Rings
C3	Radial Internal Clearance
S11	Special Specification
H	NSKHPS

Spherical Roller Bearings - Long-life Vibrating Screen SRB

NSK's Long-Life Vibrating Screen Series of Spherical Roller Bearings are engineered specifically to withstand the harsh working environments and frequent vibration of the mining, quarrying and construction industries. (Supersedes the CA series VS bearings).

Product Features

- Precision machined tough one piece brass cage, contoured roller pockets
- Improved surface roughness on rollers & inner & outer ring
- Special heat treatment rollers, prevent cracks from vibrations & shock loads
- Self aligning ability with floating guide ring
- Controlled roller skew
- Internal radial clearance set at 2/3 ISO standard bearings
- Outer dimensions set at 1/2 of ISO standard bearings
- 40mm - 200mm bore diameter

Benefits

- Twice the service life of conventional bearings
- Reduced maintenance costs
- High dynamic & static load ratings - load rating increased by 1.25 times
- Dampened vibration & highly resistant to heavy or shock loads
- High speed performance & low operating temperature rise
- Better roller guidance & smooth running - reduced bearing damage from slippage, surface fatigue, flaking

Condition Description

- High Load
- Misalignment
- Vibration

Industries

- Material Handling
- Oil and Gas
- Paper
- Quarrying, Mining and Construction
- Utilities



223	20	CAM	E4	-VS3(4)
-----	----	-----	----	---------

Description

223	Bearing type and series
20	Bearing Bore
CAM	Cage
E4	Outer Ring with Groove & Oil Holes
-VS3(4)	Vibrating Screens + Special dimensional Tolerance + Radial Int

NSKHPS Cylindrical Roller Bearings

The new range NSKHPS Cylindrical Roller Bearings for Industrial Machinery are offered with four types of cages for various general-purpose applications. The bearing life has increased up to 60% compared to conventional bearings. The NSKHPS bearings contribute to reducing maintenance cost and facilitate the downscaling of related equipment.

Product Features

- Available with 4 different cages:
-
- Pressed Steel Cage
- Machined Brass Cage
- Polyamide Resin Cage
- L-PPS Resin Cage

Benefits

- Increased Bearing Life up to 60%
- Optimised Internal Design
- Reduction of maintenance Cost
- Downsizing of related equipment

Condition Description

- Contamination
- High Temperature

Industries

- Electric Motors
- Fans and Blowers
- Oil and Gas
- Paper
- Power Transmission



NU3	08	E	T7	C3	U537
-----	----	---	----	----	------

Description

NU3	Bearing
08	Bore
E	Internal Design
T7	Cage
C3	Internal Clearance
U537	NSKHPS

Self-Lube® Units

The Self-Lube® units are a versatile range of housings and inserts manufactured to NSK global specification for materials and quality - all cast iron housings supplied with regreasing facility, capable of taking up initial misalignment during assembly. The general housing types are pillow blocks, flange units, take-up units, cartridge units and hanger units. Suitable for a wide range of industry applications.

Product Features

- Range of diverse casting and pressed steel housings (15 alternatives).*
- Inserts - 3 main locking arrangements and 2 inner ring length options.*
- Three main seal options - standard, triple lip & flinger/standard.
- Positively located steel end cap available for units up to 60mm shaft.
- All cast iron housings supplied with regreasing facility. ** For all options see Self-Lube® catalogue*

Benefits

- Simple cost effective bearing arrangement - units can be regreased.
- Can be used on fabricated and general engineering equipment.
- Secure shaft locking for all speed, load and vibration conditions.
- Effective sealing for all conditions and applications.
- Protects from the dangers of rotating shaft ends.

Condition Description

- Arduous Environments
- Contamination
- Corrosive Environment
- High Temperature
- Misalignment

Industries

- Agriculture
- Cement
- Fans and Blowers
- Food and Beverage
- Material Handling



(T)	NP	45	(DEC)	(FS)
-----	----	----	-------	------

Description

(T)	Triple Lip Seal (optional)
NP	Housing
45	Bore
(DEC)	Locking options
(FS)	Seal Options

Triple-Lip Sealed Inserts

NSK's Triple-Lip Sealed Inserts are perfect for applications where bearings are exposed to heavy dust and water contamination.

Product Features

- Nitrile rubber triple lip, bonded to protective pressed steel shield
- Available for both setscrew and eccentric locking collar insert options
- Large size range offered, including imperial options
- Inserts interchangeable with standard items

Benefits

- Longer bearing life through superior seal performance
- Extended relubrication intervals, greatly reducing maintenance costs and increased productivity of machinery
- Simple implementation; ready replacement for existing bearing units
- Mounting on the shaft with balled setscrew, providing much greater resistance to loosening

Condition Description

- Contamination
- Corrosive Environment

Industries

- Chemical and Pharmaceutical
- Food and Beverage
- Material Handling
- Packaging
- Textile and Leather



T	1045	1.1/4	DEC	G	HLT
---	------	-------	-----	---	-----

Description

T	Prefix
1045	Type & Series
1.1/4	Bore size
DEC	Shaft lock type and inner ring length indicator
G	Lubrication facility
HLT	Suffix options

Self-Lube® - HLT Inserts

NSK's Self-Lube® HLT Inserts provide opportunities to reduce maintenance, downtime and replacement costs in operation at extreme temperatures.

Product Features

- Special internal geometry; C5 internal clearance
- High performance Klueber grease
- Durable silicone rubber seals
- Steel cage material
- Interchangeable with standard Self-Lube® inserts

Benefits

- High performance grease and effective lubrication at extreme temperatures, with upper and lower limits of -40°C and +180°C
- Efficient sealing and protection at extreme temperatures (-40°C and +180°C)
- Steel cage and special internal features designed to function at temperature extremes
- Increase radial clearance (C5) between balls and raceways to help prevent radial pre-load

Condition Description

- High Temperature

Industries

- Fans and Blowers
- Food and Beverage
- Material Handling
- Packaging
- Utilities



T	1045	1.1/4	DEC	G	HLT
---	------	-------	-----	---	-----

Description

T	Prefix
1045	Type & Series
1.1/4	Bore size
DEC	Shaft lock type and inner ring length indicator
G	Lubrication facility
HLT	Suffix options

Plummer Blocks and Accessories - SNN Series

NSK modular SNN housing range offers various technical options to match the needs of the most demanding applications. The components are easy to fit, remove and maintain. Equipped with NSK high performance bearings, SNN split housings will support you in achieving your cost reduction plans.

Product Features

- Equipped with 2 Lubrication holes and 1 Draining hole
- Solid corners in the base for locating pins
- Square shape and centre marks
- High grade casting - allows 5 different sealing arrangements:- Double lips seals- V-ring seals- Felt seals- Labyrinth seals- Taconite seals

Benefits

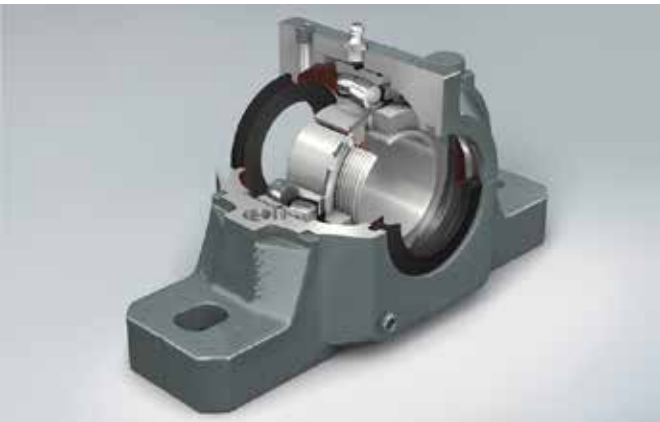
- Easy assembly, easy alignment
- High rigidity (minimises deformation of the bearing seat)
- Comprehensive range of sealing & arrangements to match all needs
- Good heat transfer
- Same housing can be used with both double row self-aligning ball bearings or double row spherical roller bearings
- Low maintenance costs

Condition Description

- Contamination
- Fitting
- High Load
- Lubrication
- Misalignment

Industries

- Cement
- Fans and Blowers
- Power Transmission
- Steel and Metals



SNN	511-609
-----	---------

Description	
SNN	Housing Code
511-609	Size

Roller Bearings for large Gearboxes - large-size TRB & CRB

NSK has developed a range of long-life, large-size taper & cylindrical roller bearings for gearboxes in large industrial machinery such as wind power generators & mining machinery. Its special material & customised heat treatment technology decrease early damage caused by white structure flaking. Under such conditions, the bearings' life can be enhanced seven times in comparison to conventional bearings.

Product Features

- Special material: optimised chemical composition
- Customised heat treatment process
- Available TRB and CRB
- Black oxide coating available on request
- Interchangeable with standard products

Benefits

- High resistance to white structure flaking
- Increased fatigue life compared to standard bearings
- Increased level of residual stress leads to higher material resistance
- High fracture toughness
- High dimensional stability

Condition Description

- Compact Environment
- High Load
- Lubrication

Industries

- Power Generation
- Power Transmission
- Quarrying, Mining and Construction
- Wind Energy



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