

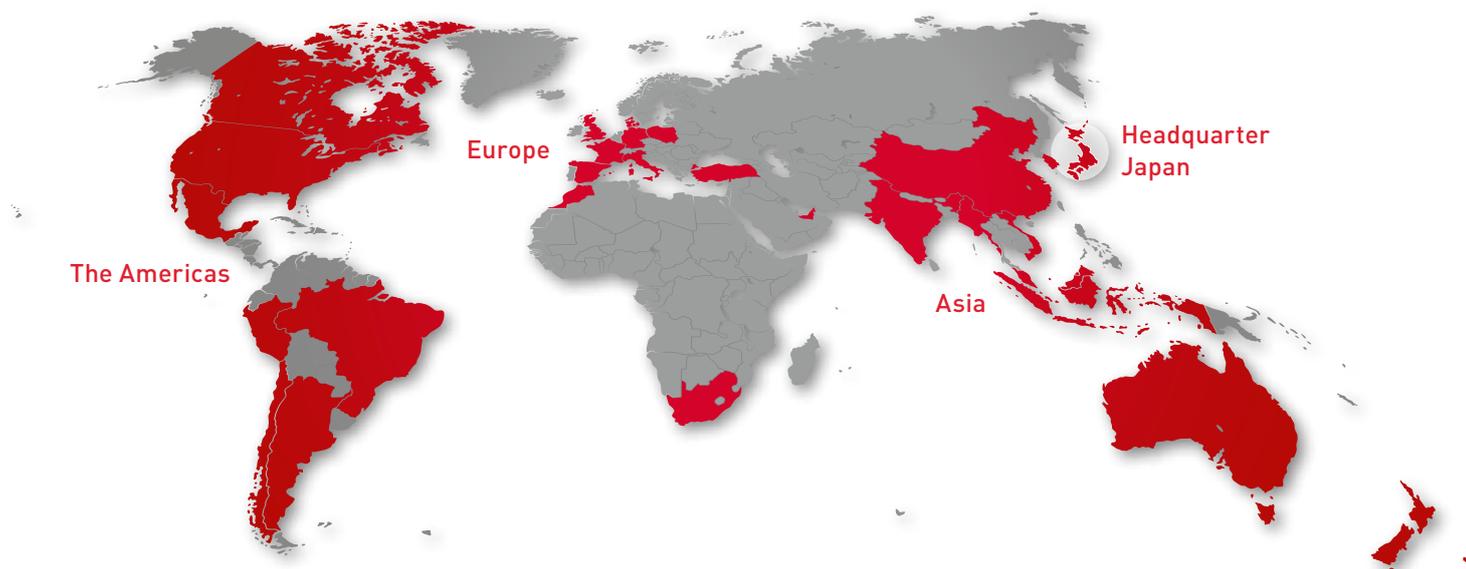
SUPER PRECISION BEARINGS FOR MACHINE TOOL APPLICATIONS



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SETTING THE FUTURE IN MOTION

We are among the leading manufacturers for rolling bearings, linear technology components and steering systems worldwide. 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 our worldwide research and production facilities are linked together in a global 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.

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OUR MOST IMPORTANT PRODUCT: OUR CUSTOMERS' SATISFACTION

One thing keeps us moving: 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.

More about NSK on www.nsk europe.com



SUPER PRECISION BEARINGS – PRODUCT RANGE

Several types of Super Precision Bearings are available from NSK. These include the ROBUST series of high performance bearings, special series of bearings for unique and specialised applications, and the standard series bearings.



Standard Series

Angular Contact Ball Bearings - High-Precision

Basic Super Precision Bearings - manufactured to conform to ISO standards

- 70xx, 72xx, 79xx series
- Contact angles: 15° (C), 25° (A5), 30° (A)
- Cage design: phenolic (TR) or polyamide (TYN), depending on application requirements
- Ball material: steel, ceramic (SN24)



Special Series

Angular Contact Ball Bearings - High-Precision, Sealed

Pre-greased and sealed to reduce handling problems. Suitable for the maintenance of machine tool spindles

- Basic Super Precision Angular Contact Ball Bearings
- Angular Contact Ball Bearings - ROBUST Series, high-speed
- Bore size range: \varnothing 30–100 mm in ISO series 10 and 19 (70xx and 79xx)



BNR & BER – ROBUST Series

Angular Contact Ball Bearings - Ultra High-Speed

High performance bearings developed for high-speed operations with low temperature rise. Suitable for ultra high precision machining applications, and ultra high-speed applications

- Contact angles: 18° (BNR), 25° (BER)
- Ball material: steel (E & S type), ceramic (H and X type)
- Cage design: phenolic (T), polyamide (TYN), PPS (TSR), depending on application requirements
- ROBUST series also can be used for ultra high speed applications of over 3 million $d_m n$.



ROBUSTSHOT Series

Angular Contact Ball Bearings - Ultra High-Speed

Direct oil-air lubrication in order to achieve highest speeds

- Direct air-oil Lubrication via a through-hole in the outer ring
- Contact angles: 18° (BNR), 25° (BER)
- Lubrication groove with O-rings in the outer ring
- Hybrid bearings - steel rings, ceramic balls



BSR Series

Angular Contact Ball Bearings - Ultra High-Precision

High performance bearings developed specifically for internal grinding or high-speed motor applications under spring preload

- Bore size range: $\varnothing 6$ –25 mm, contact angle: 15°
- Ball material: steel (S type), ceramic (H and X type)
- Non separable type
- Universal combinations (DU and SU)



ROBUST Standard Series

Cylindrical Roller Bearings - Ultra High-Speed, Single Row

Designed for ultra high-speed applications such as machining centre spindles

- Cage material: brass (MR)⁽¹⁾, PEEK resin (TP)
- Roller material: steel, SHX

⁽¹⁾ MR cage is used in the standard series



Standard & High Rigidity Series

Cylindrical Roller Bearings - High-Speed, Double Row

Designed to deliver high rigidity in high-speed applications such as lathe spindles

- Cage material: brass (MB), PPS resin (TB)
- Standard specification E44: Outer ring oil holes and groove



ROBUST Series: BAR & BTR

Angular Contact Thrust Ball Bearings - High-Speed

High rigidity thrust bearings for lathe applications

- Contact angles: 30° (BAR), 40° (BTR)
- Ball material: steel (S & E type), ceramic (H type)

SUPER PRECISION BEARINGS – PRODUCT RANGE



Special Series

Deep Groove Ball Bearing, High Precision

Suitable for high-speed and high precision motors

- Cage material: ball guided polyamide cage (T1X,TYA), inner ring guided phenolic cage (T), selection depends on the application
- Suitable for silent or low vibration operation



BSN & BSF Series

Ball Screw Support Bearings - BSBD Series, NSKHPS

The double row configuration, enables the bearings to support large axial forces in both directions

- BSN series without flange, BSF series with flange
- Paired types also available
- Contact lip seal - provides good sealing at high speeds



Special Series
for Injection Molding Machines

Angular Contact Thrust Bearings, High-Duty

The high load capacity design delivers five times the life expectancy compared to ball screw support bearings for machine tool applications of a similar size. The number of rows can also be reduced

- Easier handling than tapered roller bearings or thrust spherical roller bearings as a result of non-separable configuration
- Optimum ball bearing design results in lower rotational torque
- Can be universally matched to any required rigidity specification or life cycle



Special Series
for Machine Tool Applications

Angular Contact Thrust Ball Bearings

High rigidity thrust bearings designed specifically for ball screw support applications in machine tools

- Contact angle: 60°
- Can be universally matched to any required rigidity specification or life cycle
- A pre-greased line using special grease is also available
- Can be supplied with contact seals and waterproof grease

SUPER PRECISION BEARINGS – NOMENCLATURES

Angular Contact Ball Bearings - Standard Serie

7	0	10	A5	SN24	TR	V1V	SU	EL	P3	+Y3	MTS	X
1	2	3	4	5	6	7	8	9	10	11	12	13

- 1** 7 Angular Contact Ball Bearing - High Accuracy
- 2** Dimension 9 = 19 Series, 0 = 10 Series, 2 = 02 Series
- 3** Bore Code 00 = 10mm, 01 = 12mm
02 = 15mm, 03 = 17mm
4 and above: Bore diameter = Bore number x 5 (mm)
- 4** Contact Angle C = 15°, A5 = 25°, A = 30°
- 5** Material No symbol: steel ball
SN24: ceramic ball

	Symbol	Material	Guiding	Features	Limiting Speed (dmn value)	Available for
	TYN	Polyamide resin	Ball guided	Excellent wear and noise characteristics, especially effective with grease lubrication	Oil: 1.4 million Grease: 1.2 million	• Standard Series • NSKROBUST Series (not available for 19 Series sealed type)
	T	Phenolic resin	Outer ring guided	Stable cage rotation in high-speed operation	2.8 million	TR: Standard Series T(X): NSKROBUST Series TA: BSR series (sealed type)
	TSR	PPS resin	Outer ring guided	Reduction of non-repeatable run-out (NRR0). Low temperature rise in ultra high-speed operation due to unique design with enhanced oil drain	3.0 million	• NSKROBUST Series

- 7** Seal / Oil hole No symbol: Open type
V1V : Non-contact rubber seal
E34D: Direct lubrication oil holes

Universal combination	Arrangement example
SU Single row	
DU 2 row	 DB  DF  DT
DUD 3 row	 DBD  DFD  DTD
QU 4 row	 DBB  DFF  DTT  DBT  DFT

- 9** Preload EL Extra Light Preload
L Light Preload
M Medium Preload
H Heavy Preload
CP Special Preload
CA Special Clearance
- 10** Accuracy Class P2 ISO Class 2
P3 Dimensional ISO Class 4, rotation ISO Class 2
P4 ISO Class 4
P4Y ISO class 4 with special OD and ID tolerance
- 11** +Y3 O-rings on bearing outside surface (only at direct lubrication)
- 12** Grease MTE= MTE Grease, MTS = MTS Grease, NB5 = NBU15 Grease, YL2 = Lubcon L252 Grease
- 13** Grease quantity X = 15%, K = 20%, L = 30% of internal space

SUPER PRECISION BEARINGS – NOMENCLATURES

Angular Contact Ball Bearings - „Robust Serie“ for High Speed Applications

50	BNR	10	H	T	E34D	SU	EL	P3	+Y3	MTS	X
1	2	3	4	5	6	7	8	9	10	11	12

- 1** Nominal bore diameter = bore dimension in mm
- 2** Contact angle BER = 25°, BNR = 18°, BSR = 15°
- 3** Dimension 19 = 19 Series, 10 = 10 Series...
- 4** Material
- | Type | Material | |
|------------------|---|---|
| | Inner and outer ring | Balls |
| S | Bearing steel (SUJ2) | Bearing steel (SUJ2) |
| E | Bearing steel (SUJ2) | Ultra long life rolling elements (EQTF) |
| H | Bearing steel (SUJ2) | Ceramic (Si ₃ N ₄) |
| X | Heat resistant steel for high-speed operation (SHX) | Ceramic (Si ₃ N ₄) |
| XE (Spinshot™II) | Heat resistant steel for high-speed operation (SHX) | Ceramic (Si ₃ N ₄) |
- 5** Cage see „Standard Series“ page 7
- 6** Seal / Oil hole No symbol: Open type
V1V : Non-contact rubber seal
E34D: Direct Lubrication oil holes „Robust Shot“
- 7** Arrangement see „Standard Series“ page 7
- 8** Preload
- | | |
|----|---------------------|
| EL | Extra Light Preload |
| L | Light Preload |
| M | Medium Preload |
| H | Heavy Preload |
| CP | Special Preload |
| CA | Special Clearance |
- 9** Accuracy Class
- | | |
|-----|---|
| P2 | ISO Class 2 |
| P3 | Dimensional ISO Class 4, rotation ISO Class 2 |
| P4 | ISO Class 4 |
| P4Y | ISO class 4 with special OD and ID tolerance |
- 10** +Y3 O-rings on bearing outside surface (only „Robust Shot“)
- 11** Grease MTE= MTE Grease, MTS = MTS Grease, NB5 = NBU15 Grease
- 12** Grease quantity X = 15%, K = 20%, L = 30% of internal space

Cylindrical Roller Bearings - Single Row „ROBUST Series“

N	10	11	RS	—	TP	KR	CC0	P4
1	2	3	4	5	6	7	8	9

1 N Single-row CRB (Inner Ring Guided Rollers)

2 Dimension 10 = 10 Series

3 Bore Code Bore diameter = Bore number x 5 (mm)

4	Material	Type	Material	
			Inner/Outer ring	Rollers
		RS	Bearing steel (SUJ2)	Bearing steel (SUJ2)
		RX	Heat resistant steel for highspeed operation (SHX)	Heat resistant steel for highspeed operation (SHX)

5 Internal design No symbol = Standard

6 Cage TP = Outer ring guided PEEK cage
MR = Roller guided brass cage

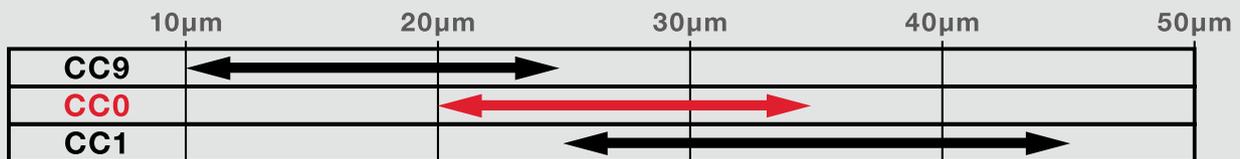
7 Bore No symbol = Cylindrical bore
KR = Tapered Bore 1:12

8 Radial Clearance CC0 = Standard clearance for tapered bore (smaller clearance)
CC1 = Standard clearance for cylindrical bore (higher clearance)

9 Accuracy Class P4 ISO Class 4
P4Y ISO class 4 with special OD and ID tolerance

Internal Radial Clearance Classes

Three classes of internal radial clearance for tapered bore bearings are commonly in use: CC9, CC0 and CC1. It depends on the operating conditions which class is most suitable. NSK has chosen to use CC0, a well-balanced clearance, as its standard internal radial clearance class because of its advantages in terms of ease of mounting and spindle accuracy.



Internal clearance example (bearing: NN3020TBKR)

NSK's recommended clearance

- CC0

With the upper limit of CC1 and the lower limit of CC9 omitted, this class offers medium radial clearance. Its range is also smaller than that of CC1. As it is the easiest-to-use for customers who target this range, it is the recommended clearance offered for CRB with tapered bore.

SUPER PRECISION BEARINGS – NOMENCLATURES

Cylindrical Roller Bearings - Double Row „High Rigidity Series“

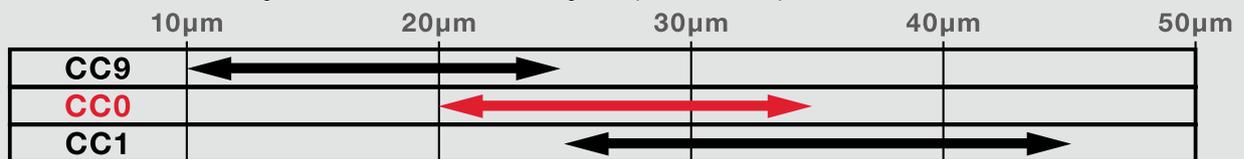
NN	30	17	—	TB	KR	E44	CC0	P4
----	----	----	---	----	----	-----	-----	----

1 2 3 4 5 6 7 8 9

1	NN	Double-row CRB (Inner Ring Guided Rollers)
2	Dimension	30 = 30 Series 39 = 39 Series
3	Bore Code	Bore diameter = Bore number x 5 (mm)
4	Internal design	
5	Cage	TB = Roller guided PPS cage MB = Roller guided brass cage No symbol = Ring guided brass cage
6	Bore	No symbol = Cylindrical bore KR (K) = Tapered Bore 1:12
7	Lubrication Holes	No symbol = no lubrication holes E44 = Outer ring with oil groove and lubrication holes
8	Radial Clearance	CC0 = Standard clearance for tapered bore CC1 = Standard clearance for cylindrical bore CC9 = Smaller clearance compared to normal
9	Accuracy Class	P4 ISO Class 4

Internal Radial Clearance Classes

Three classes of internal radial clearance for tapered bore bearings are commonly in use: CC9, CC0 and CC1. It depends on the operating conditions which class is most suitable. NSK has chosen to use CC0, a well-balanced clearance, as its standard internal radial clearance class because of its advantages in terms of ease of mounting and spindle accuracy.



NSK's recommended clearance

- CC0

With the upper limit of CC1 and the lower limit of CC9 omitted, this class offers medium radial clearance. Its range is also smaller than that of CC1. As it is the easiest-to-use for customers who target this range, it is the recommended clearance offered for CRB with tapered bore.

Ball Screw Support Bearings - BSBD - Series

BS	F	30	80	DDU	H	P2B	DT
----	---	----	----	-----	---	-----	----

1 2 3 4 5 6 7 8

- | | | |
|---|----------------|--|
| 1 | BS | Ball Screw Support Bearing |
| 2 | Type | F = Flange Type
N = No Flange Type |
| 3 | Bore | Nominal bore diameter = Bore dimension in mm |
| 4 | Outer Diameter | Nominal outer diameter = Dimension in mm |
| 5 | Seal Type | DDU contact seal |
| 6 | Preload | H Preload |
| 7 | Accuracy Class | Running accuracy ISO Class 2
Other NSK Spec |
| 8 | Arrangement | No symbol = One double row angular contact ball bearing
DT = Paired double row angular contact ball bearing |

SUPER PRECISION BEARINGS – NOMENCLATURES

Ball Screw Support Bearings - TAC - Series

30	TAC	62	C	—	SU	H	PN7C
----	-----	----	---	---	----	---	------

1 2 3 4 5 6 7 8

1 30 Nominal bore diameter = Bore dimension in mm

2 Type Angular Contact Thrust Type

3 Outer Diameter Nominal outer diameter = Dimension in mm

4 Internal Design Contact Angle 60°

5 Seal Type No symbol = Open type
 DDG = Contact rubber seal
 V1V = Non-contact rubber seal

6 Arrangement

Universal combination		Arrangement example		
SU	Single row			
DU	2 row	 DB	 DF	 DT
DUD	3 row	 DBD	 DFD	 DTD
QU	4 row	 DBB	 DFB	 DTB
		 DBT	 DFT	 DTT

7 Preload H = Heavy preload

8 Accuracy Class PN7C = NES Class 7C (Axial runout equivalent to P2)

Thrust Angular Contact ball bearing - High Speed Angular Thrust Bearing

100	BAR	10	S	TYN	DB	L	P4A
-----	-----	----	---	-----	----	---	-----

1 2 3 4 5 6 7 8

1 Nominal bore diameter = Bore dimension in mm

2 Contact angle BAR = 30°
BTR = 40°

3 Dimension 19 = 19 Series
10 = 10 Series

4	Material	Material	
		Type	Inner and outer ring
		S	Bearing steel (SUJ2)
		E	Bearing steel (SUJ2)
		Balls	Ultra long life rolling elements (EQTF)
		H	Bearing steel (SUJ2)
			Ceramic (Si ₃ N ₄)

5 Cage TYN = Ball guided polyamide cage
MY = Ball guided brass cage
No symbol = Outer ring guided brass cage

6 Arrangementmt DB = Back to back arrangement open type

7 Preload EL Extra light preload
L Light preload

8 Accuracy Class P2A = Outer diameter are NSK specific, all others ISO Class 2
P4A = Outer diameter are NSK specific, all others ISO Class 4

Thrust Angular Contact ball bearing - TAC F Series

100	TAC	20F	M	E44	DB	EL	P4A
-----	-----	-----	---	-----	----	----	-----

1 2 3 4 5 6 7 8

1 100 Nominal bore diameter = bore dimension in mm

2 Type Angular Contact Thrust Ball Bearing

3 Dimension 20F = For combination NN30 Series
29F = For combination NN39 and NN49 Series

4 Cage M = Brass cage

5 Lubrication Holes No symbol = no lubrication holes
E44 = Outer ring with oil groove and lubrication holes

6 Arrangementmt DB = Back to back arrangement

7 Preload EL = Extra light preload
L = Light preload

8 Accuracy Class P4A = Outer diameter are NSK specific, all others ISO Class 4
P5A = Outer diameter are NSK specific, all others ISO Class 5

SUPER PRECISION BEARINGS INTERCHANGE GUIDE

Interchange Guide for Precision Angular Contact Bearings (Example of 25 degrees contact angle)

Standard design	ISO series	NSK	SKF	SNFA	Fafnir	FAG
	19	79xxA5(V1V)	719xxACD	SEBxxxxx3	3xx93xxWI	B719xxE.(2RSD)
	10	70xxA5(V1V)	70xxACD	SEBxxxxx3	3xx91xxWI	B70xxE.(2RSD)
	02	72xxA5	72xxACD	EBxxxxx3	3xx21xxWI	B72xxE.(2RSD)
	19	79xxA5SN24(V1V)	791xxACD/HC	SEBxx/NSxxx3	3xxC93xxWI	HCB719xxE.(2RSD)
	10	70xxA5SN24(V1V)	70xxACD/HC	EXxx/NSxxx3	3xxC91xxWI	HCB70xxE.(2RSD)
High speed design	ISO series	NSK	SKF	SNFA	Fafnir	FAG
	19	xxBER19(V1V)S	719xxACE	VEBxxxxx3	3xx93xxHX(VV)	HS(S)719xxE
	10	xxBER19(V1V)S	70xxACE	VEExx(/S)xxx3	3xx91xxHX(VV)	HS(S)70xxE
	19	xxBER19(V1V)H	719xxACE/HC	VEBxx/NSxxx3	3xxC93xxHX(VV)	HC(S)719xxE
	10	xxBER10(V1V)H	70xxACE/HC	VEExx(/S)/NSxxx3	3xxC91xxHX(VV)	HC(S)70xxE
	19	xxBER19(V1V)X	-	VEBxxXNxxx3	-	XC(S)719xxE
	10	xxBER10(V1V)X	-	VEExx(/S)/XNxxx3	-	XC(S)70xxE

Interchange Guide for Ball Screw Support Bearings

Series	NSK	INA	SKF	TIMKEN
No flange single	BSNxxxxDDUHP2B	ZLKNxxxx-(2Z/2RS)	BEAM0xxxx-(2RZ/2RS)	MMN5xxBSxxPP DM
Flange single	BSFxxxxDDUHP2B	ZLKFxxxx-(2Z/2RS)	BEAS0xxxx-(2RZ/2RS)	MMF5xxBSxxPP DM
No flange pair	BSNxxxxDDUHP2BDT	ZLKNxxxx-(2Z/2RS)-2AP	-	MMN5xxBSxxPP QM
Flange Pair	BSFxxxxDDUHP2BDT	ZLKFxxxx-(2Z/2RS)-2AP	-	MMF5xxBSxxPP QM

Interchange Guide for Precision Thrust Bearings

Thrust bearings for spindle applications – contact angle	NSK	SKF	SNFA	Fafnir	FAG
30 degrees	xxBAR	BTMxx A/DB	-	-	-
40 degrees	xxBTR	BTMxx B/DB	-	-	-
60 degrees	xxTAC	2344xx	-	-	2344xx

Interchange Guide for Precision Ball Screw Support Bearings

Series	NSK	SKF	SNFA	Fafnir	FAG
Non-ISO-metric (30 bore, 62 OD, 15 w)	30TAC62B	BSD3062C	BS3062	MM30BS62	BSB030062
ISO-metric (30 bore, 62 OD, 16 w)	BSB2030	BSA206C	BS230	-	760230
INCH (23.838 bore, 62 OD, 15.875 w)	BSB093	BDAB634201C	-	MM9308WI2H	-

Caption

Symbols in **(brackets)** show seal designation when available. Items in **red** are the manufacturers' identifiers of particular parameters.

- Steel balls
- Ceramic balls
- Steel balls sealed
- Ceramic balls sealed
- Special material rings/
Ceramic balls (sealed)
- Steel rollers
& rings
- Ceramic rollers &
Special steel rings
- Special steel
rollers & rings

[*] Normal steel rings
This interchange should be used as a guideline only, as manufacturers' designations may change without notice.

Interchange Guide for Precision Cylindrical Roller Bearings

	NSK	SKF	FAG
Standard design construction			
	NN39xx(KR)	-	-
	NN30xx(KR)	NN30xx(K)	NN30xx(K)
High speed design construction			
	NUU49xx(KR)	NUU49xx(K)	NUU49xx(K)
	N10xx(KR)	N10xx(K)	N10xx(K)
High speed design construction			
	N10xxRS(KR)	-	-
	N10xxRXH(KR)	N10xxHC5(K)[*]	HCN10xx(K)[*]
High speed design construction			
	N10xxRX(KR)	-	-

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