NTN

Mining Equipment Product Guidebook

CAT.No.8602-5/E

Mining Equipment Product Guidebook

NTN Corporation

CAT.No.8602-5/E 25.09.00 SK/SK

Mining Equipment Products



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The Mining Process

NTN Contributes to the Stable Operation of Mining Equipment

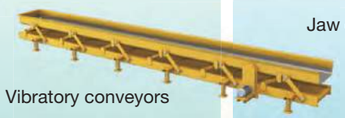
Coal is excavated from mines and transported by loaders and dump trucks, to be subsequently crushed by an array of mining machinery. The bearings used in this machinery are often operating under extreme conditions such as heavy loads, dust, water, etc.. **NTN** provides a premium product, designed to handle the rigors of mining, often resulting in longer operating life and extended maintenance cycles.

Excavating

Draglines

Transport

Hoppers



Vibratory conveyors

Crushing

Jaw crushers

Sifting

Vibrating screens

Crushing

Impact crushers

Grinding

Hoppers, conveyors

Cone crushers

Shipping

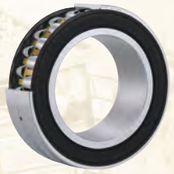
Hoppers, conveyors

Bulk carriers, shipping

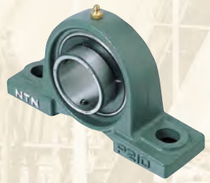
ULTAGE™ series spherical roller bearings [Type EA, Type EM]

ULTAGE™ series spherical roller bearings with High-strength cage [EMA Type]

ULTAGE™ series sealed spherical roller bearings [WA Type]



ULTAGE™ series sealed spherical roller bearings [EMLLX Type]



Bearing units

Triple-lip sealed bearings for bearing units

Plummer blocks

Tapered roller bearings

Constant velocity joints

SL type cylindrical roller bearings for sheaves

ULTAGE™

ULTAGE™ series Spherical Roller Bearings
【Type EA, Type EM】

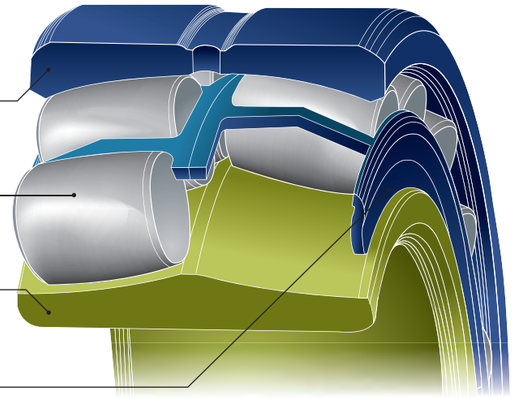
ULTAGE™ series spherical roller bearings are the products developed to meet the demands of "long operating life", "higher speed", and "Improved handling" that are required for various industrial machinery.

Rating Life Up to **3.7 times longer** (compared to conventional **NTN** products)

Allowable Speed Up to **20 % higher** (compared to conventional **NTN** products)

Features [Type EA]

Outer Ring	● Optimal curvature ● With oil inlets and oil groove
Rollers	● Large rollers ● Maximum number of rollers
Inner Ring	● Optimal curvature ● No rib
Cage	● Window type pressed-steel cage ● Cage back surface guides



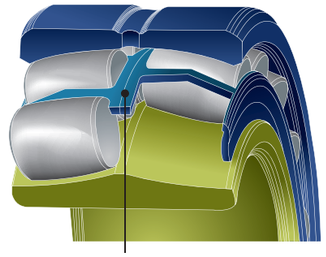
Long Operating Life
- Industry leading load rating (adoption of large diameter roller)
- Extended maintenance intervals
- Downsizing and lightweight
- Heat resistant temperature of 200 °C

Higher Speed
- Industry leading allowable speed
- Optimized pressed-steel cage design for Type EA

Improved Handling
- Improved cage design that allows lubricating oil to enter more easliy
- Improved grease coating properties of cage, ring, and rollers

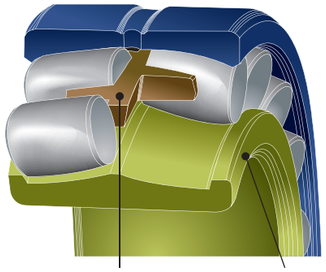
ULTAGE™ **"ULTAGE™"** (a name created from combination of **"ultimate"**, signifying refinement, and **"stage"**, signifying **NTN**'s intention that this series of products be employed in diverse applications) is the general name for **NTN**'s new generation of bearings that are noted for their industry leading performance.

● Type EA



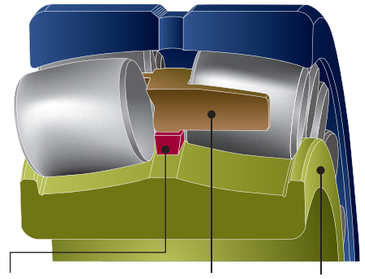
Window Type Pressed-Steel Cage

● Type EM



One-Piece Machined Cage　Inner Ring Rib

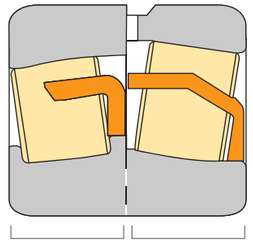
● Type EM (Large Size)



Guide Ring　One-Piece Machined Cage　Inner Ring Rib

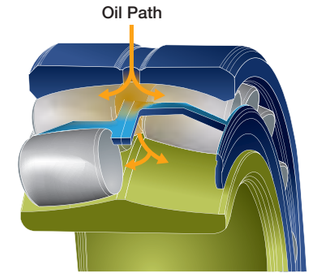
For applications that expose bearings to severe vibration and impact, we recommend Type EM bearings, which incorporate a high-tension brass cage machined from a single piece. (Type EM differs from Type EA in the shape of the inner ring.)

Comparison of Roller Diameter



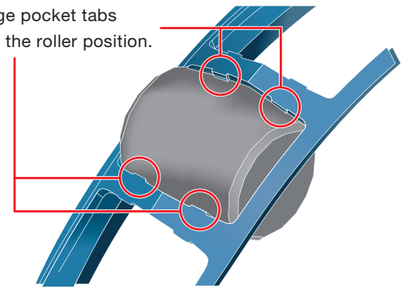
conventional **NTN** product　**Type EA**

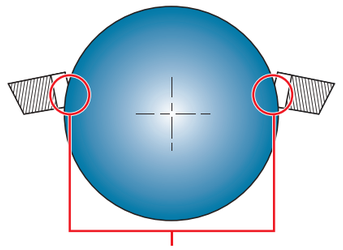
Oil Path



Details of Window Type Pressed-Steel Cage Pockets

Four cage pocket tabs stabilize the roller position.





Chamfered cage pocket tabs for better handling

[Allowable Misalignment]
- 0.05 C_r < Dynamic Equivalent Radial Load: 1/115
- Dynamic Equivalent Radial Load ≤ 0.05 C_r : 1/30

✻ If the installed misalignment is greater than recommended, there is a risk of roller/cage protrusion and impact to surrounding components.

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ULTAGE™ series Spherical Roller Bearings【Type EA, Type EM】

Long Operating Life

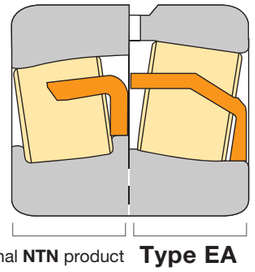
Increasing the roller diameter, maximizing the number of rollers, and industry leading load ratings have led to higher load capacities and longer operating lives. Maintenance intervals can be extended.

1) Rating Life: Up to 3.7 times longer
(compared to conventional **NTN** products)

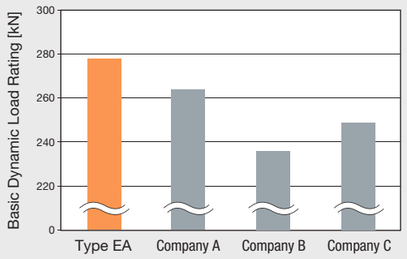
2) Basic Dynamic Load Rating: Up to 50 % greater
(compared to conventional **NTN** products)

3) Basic Static Load Rating: Up to 35 % greater
(compared to conventional **NTN** products)

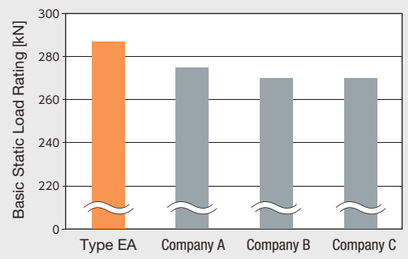
✻ conventional **NTN** product : Type B



● Comparison of basic dynamic load rating (C_r) catalog values with other company products
22216 (ϕ80 × ϕ140 × 33)



● Comparison of basic static load rating (C_{0r}) catalog values with other company products
22216 (ϕ80 × ϕ140 × 33)



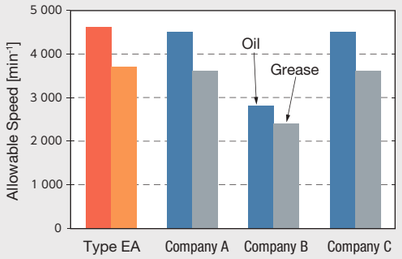
Higher Speed

Use of an improved window type pressed-steel cage allows for higher speeds.

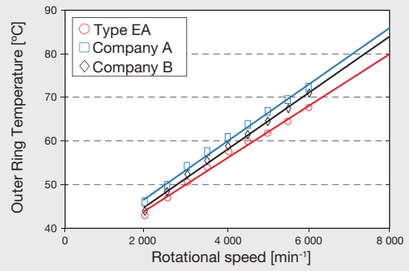
Allowable Speed: Up to 20 % higher (compared to conventional **NTN** products)

The results of comparative testing of bearing temperature rise under circulating oiling conditions show that this bearing suppresses temperature rise at a lower torque compared to other manufacturers' bearings.

● Comparison of permitted rotational speed catalog values with other company products
22216 (ϕ80 × ϕ140 × 33)



● Temperature rise test results (circulating lubrication)
22216 (ϕ80 × ϕ140 × 33)



Improved Handling

Use of a uniquely-shaped window type pressed-steel cage makes assembly/ disassembly and grease application easier.

Rollers do not readily come loose from the cage and making bearing assembly/ disassembly easier.

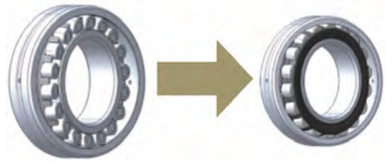
Easier application of grease to the roller surface.

Reduced Size and Weight

The increased load capacity allows the selection of a smaller sized bearing with similar capacity to that of the conventional design. Allowing for a reduction in size and weight, while maintaining the same calculated life.

Comparison example

Model Number	Basic Dynamic Load Rating	Basic Static Load Rating	Boundary Dimensions	Mass	Life Ratio
	kN		mm	kg	
22220B	350	415	ϕ100×ϕ180×46	4.95	1
22218EA	384	398	ϕ90×ϕ160×40	3.34	1.36
			△ 12 %	△ 33 %	1.36 times



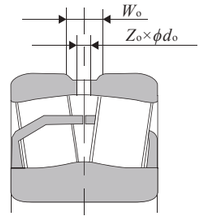
Approx. 12 %
reduction in outside diameter

33 %
reduction in mass ratio

36 %
longer calculated life

Standard Adoption of Oil Inlet and Oil Groove

ULTAGE™ series comes standard with oil inlet and oil groove.



Nominal Bearing Outside Diameter D mm		Number of oil inlets Z_o	
Or Higher	Less than	D1[1]	W33[2]
—	320	4	3
320	600	8	3

1) D1: With oil inlet/oil groove
2) W33: With oil inlet/oil groove (Manufacturing in Europe)

Shape of outer ring outside diameter

W_o and d_o differ according to the model number.
Refer to product tables for details.

⚠ Do not use lubrication inlets for positioning pins.

ULTAGE™

ULTAGE™ series Spherical Roller Bearings with High-strength Cage【EMA Type】

ULTAGE™ series spherical roller bearings with high-strength cage **【EMA Type】** are used under harsh conditions (eccentric rotation, impact load, etc.), and were developed to meet the demands of "long operating life", "vibration resistance", and "low temperature rise" that are required for various industrial machinery.

Rating Life Up to **1.3 times longer** (compared to conventional **NTN** products)

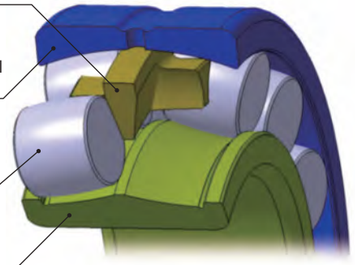
Cage Strength Up to **55 % stronger** (compared to conventional **NTN** products)

Cage
- One-piece machined cage with staggered pockets
- Outer ring guide

Outer ring
- Optimal curvature
- With oil inlets and oil groove

Rollers
- Larger rollers
- Maximum number of rollers

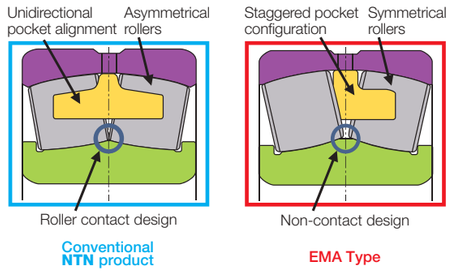
Inner ring
- Optimal curvature
- No center rib



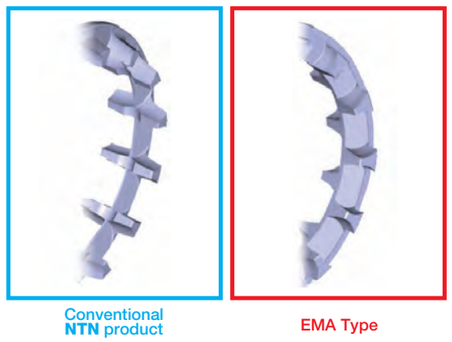
Long Operating Life
- Industry leading load rating (adoption of large diameter roller)
- Extended maintenance intervals
- Downsizing and lightweight
- Heat resistant temperature of 200 °C

Vibration Resistance
- High strenght cage
- Outer ring guided cage more resistant to vibration and eccentric rotation
- Special specification available for vibration screens

Low Temperature Rise
- Industry leading allowble speed
- Optimized intermal bearing design including curvature



Sectional views of bearings



3D image of cage

Allowable Misalignment

- 0.05 C_r < dynamic equivalent radial load : 1/115
- Dynamic equivalent radial load ≤ 0.05 C_r : 1/30

✻ If the installed misalignment is greater than recommended, there is a risk of roller/cage protrusion and impact to surrounding components.

Features

● Long Operating Life

Increasing the roller diameter, maximizing the number of rollers, and industry leading load ratings have led to higher load capacities and longer operating lives.

Rating life : **Up to 1.3 times longer** (compared to conventional **NTN** products)
Basic dynamic load rating : **Up to 9 % greater** (compared to conventional **NTN** products)

● Vibration Resistance

By modifying the shape and incorporating staggered pockets, the cage has improved in both strength and vibration resistance.

Cage strength : **Up to 55 % stronger** (compared to conventional **NTN** products)

● Low Temperature Rise

Through the optimization of internal specifications, heat generation rates have been reduced.

Bearing temperature rise : **Up to 10 % reduction** (compared to conventional **NTN** products)

● 200 ˚C Heat Resistant Specification

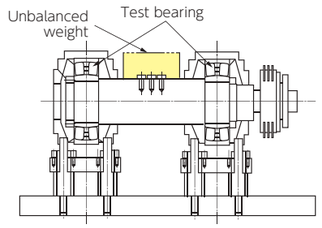
Special heat treatment used as standard provides excellent dimensional stability at up to 200 ºC, contributing to a long operating life.

✻ Conventional **NTN** product : UA Type

Temperature Rise Test Results

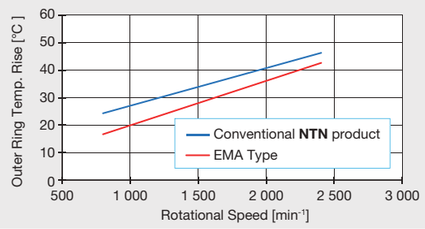
[Test Conditions]

Bearing : 22316UA, 22316EMA
Vibration acceleration : 10 G
Rotational speed : 800 to 2 400 min^{-1}
Lubrication method : ISO VG150 oil lubrication



Structure of testing machine

[Test Results]



Outer Ring Temperature Rise

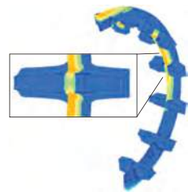
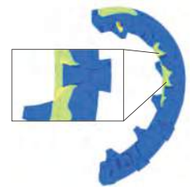
Cage Strength Analysis Results

[Analysis Conditions]

Bearing : 22316UA, 22316EMA
Vibration acceleration : 100 G

✻ The cage strength analysis is a comparison of stresses generated in the cage when vibrational acceleration of 100 G is applied to the bearing as an impact load.

[Analysis Results]

Bearing	Analysis data	Cage strength[1)]
Conventional **NTN** product		1
EMA Type		1.55

1) The cage strength value is obtained by assigning a nominal value of 1 to conventional **NTN** products.

Product Table on P41

ULTAGE™

ULTAGE™ series
Sealed Spherical Roller Bearings【WA Type】

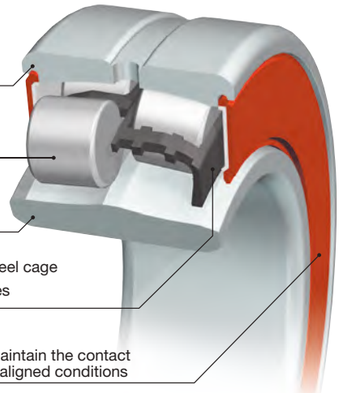
ULTAGE™ series sealed spherical roller bearings [WA Type] were developed to meet the demands of “long operating life”, “Improved reliability”, and “improved handling” that are required for various industrial machinery.

Long Operating Life
- Industry leading load rating (adoption of large diameter roller)
- Extended maintenance intervals
- Downsizing and lightweight

Improved Reliability
- Seals prevent from intrusion of foreign matters
- Prolonged lubrication interval

Improved Handling
- Structure designed to readily accept lubricant
- Pre-lubricated with long life grease

Rating Life
Up to 3.7 times longer
(compared to conventional **NTN** products)

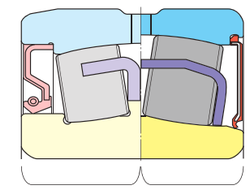


Outer Ring	● Optimal curvature ● With oil inlets and oil groove
Rollers	● Large rollers ● Maximum number of rollers
Inner Ring	● Optimal curvature ● No rib
Cage	● Window type pressed-steel cage ● Cage back surface guides
Seal	● Contact seal ● Unique lip structure to maintain the contact pressure even under misaligned conditions

Features

● Long Operating Life
Increasing the roller diameter, maximizing the number of rollers, and industry leading load ratings have led to higher load capacities and longer operating lives. Internal specifications are the same as the EA type.

● Improved Reliability
The standard seal design is a "contact-type" dust-resistant seal designed to minimize the volume of the seal within the bearing.
1) Foreign matter intrusion is prevented by the adoption of the specially designed contact type rubber seal.
2) Consistent dust resistance is achieved without changing the contact surface pressure of the seal with respect to the regardless of bearing alignment.

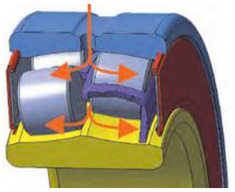


W Type (conventional **NTN** products) — **WA Type**

● Improved Handling
This bearing is filled with an ample amount of long-life grease to avoid the need for cleaning or filling the bearing with grease before assembly into the application.

● Standard Adoption of Oil Inlet and Oil Groove
The bearing is able to be re-greased due to the oil inlet and oil groove that are standard in the outer ring.

Grease flow



● Can be mounted in Standard Plummer Blocks
Although wider than standard spherical roller bearings, they can be mounted in standard type SN5 and SN2 series models.
Note that a standard positioning ring cannot be used when using the bearing on the fixed side. A positioning ring with special width dimensions is required.
Contact **NTN** Engineering for details.

Allowable Misalignment	Allowable Temperature Range	Allowable Speed	Lubricant Grease
● 1/115	● Bearing temperature: -20 to 110 °C	● When lubricating: dn value ≤ 60 x10^3 ● When not lubricating: dn value ≤ 80 x10^3 [dn = d (bearing bore diameter [mm]) × n (rotational speed [min^{-1}])]	● Grease brand: Alvania EP Grease 2 (8A) ● Amount of grease: 15 to 25 % of free space

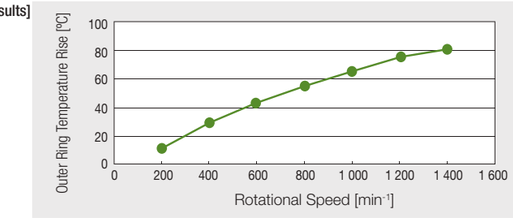
Performance Test Results

● Temperature Rise and Rotational Torque Test

[Test Conditions]

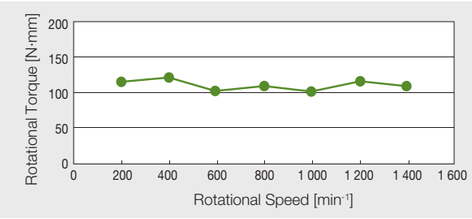
Bearing	: WA22218EALLSD1
Load	: Radial load 294 N
Rotational speed	: 200 to 1 400 min^{-1}
Lubrication	: Alvania EP Grease 2 (8A)
Amount of grease	: 20 % of free space

[Test Results]



Outer Ring Temperature Rise

[Test Results]



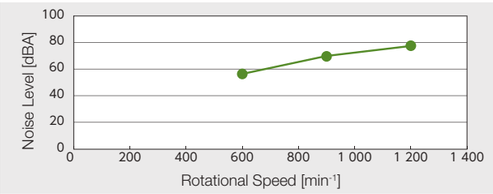
Bearing Rotational Torque

● Noise Test

[Test Conditions]

Bearing	: WA22218EALLSD1
Load	: Radial load 980 N
Rotational speed	: 600, 900, 1 200 min^{-1}
Lubrication	: Alvania EP Grease 2 (8A)
Amount of grease	: 20 % of free space

[Test Results]

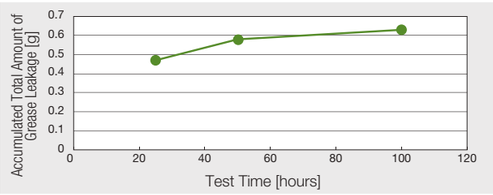


● Grease Leakage Test

[Test Conditions]

Bearing	: WA22218EALLSD1
Load	: Radial load 1 960 N
Rotational speed	: 1 000 min^{-1}
Lubrication	: Alvania EP Grease 2 (8A)
Amount of grease	: 20 % of free space
Test time	: 100 hours

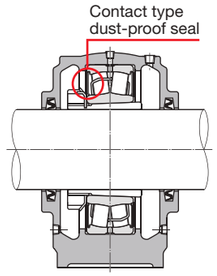
[Test Results]



● Dust Test

[Test Conditions]

Bearing	: 22216 (WA Type) 22216 (Open Type)
Load	: Radial load 196 N
Rotational speed	: 500 min^{-1}
Lubrication	: Grease
Dust	: Coke dust (20 wt% mixed with housing internal grease)
Test time	: 760 hours (approx. 1 month)



WA Type

No deterioration caused by ingress of coke dust

Open Type

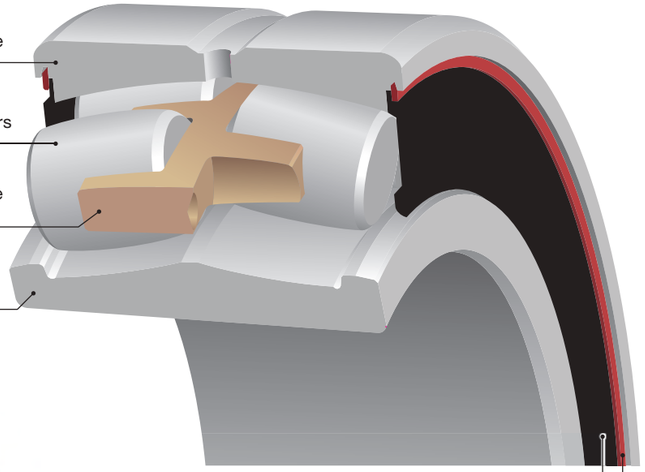
Deterioration caused by ingress of coke dust

Product Table on P43

ULTAGE™

ULTAGE™ series
Sealed Spherical Roller Bearings【EMLLX Type】

ULTAGE™ Series Sealed Spherical Roller Bearings [EMLLX Type] are the products to meet the demands of "long operating life", "improved reliability", and "improved handling" that are required for various industrial machinery.



Outer Ring	● Optimal curvature ● With oil inlets and oil groove
Rollers	● Larger rollers ● Maximum number of rollers
Cage	● One-piece machined cage
Inner Ring	● Optimal curvature ● No center rib
Seal	● Removable contact seal on both sides ● Unique lip structure to maintain contact pressure even with bearing misalignment ● Material: Nitrile rubber
Retaining Ring	● Can be installed and removed without a special tool

Long Operating Life
- Industry leading load rating (adoption of large diameter roller)
- Extended maintenance intervals
- Downsizing and lightweight

Improved Reliability
- Seals prevent intrusion of foreign matters
- Prolonged relubrication interval

Improved Handling
- Uses removable seals
- Complies with ISO dimensions

Allowable Misalignment
- 1/115

Allowable Temperature Range
- Bearing temperature: -20 to 110 °C

Allowable Speed
- dn value ≤ 60 x10^3
  [$dn = d$ (bearing bore diameter [mm]) × n (rotational speed [min^{-1}])]

Lubricant Grease
- Grease brand: Alvania EP Grease 2 (8A)
- Amount of grease: 25 to 35 % of free space

Specifications

● Fully Compatible with Open Bearings
The dimensions are the same as open bearings complying with ISO dimensions, so they can replace open bearings without changing the dimensions of the surrounding parts. The allowable misalignment angle of 0.5°is also the same between sealed and open spherical roller bearings (see **Fig. 1**).

● Use of Removable Seals
Seals can be removed as they are held in place with a retaining ring (see **Fig. 2**).
- When installing the bearing, the radial internal clearance can be accurately measured with a feeler gauge, and adjusted (see **Fig. 3**).
- The retaining rings can be installed without the us e of a special tool, and removed by inserting a flathead screwdriver into the retaining ring notch (see **Fig. 4**).

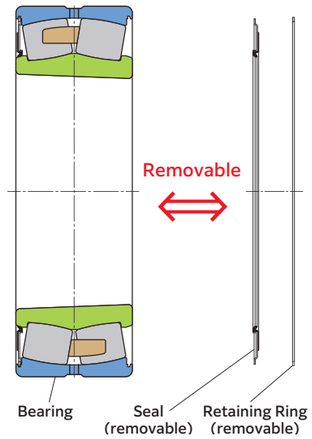
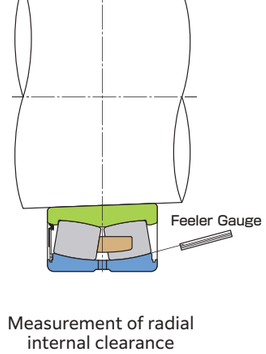


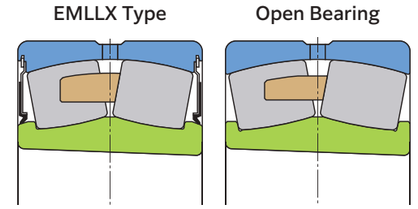
Fig. 2



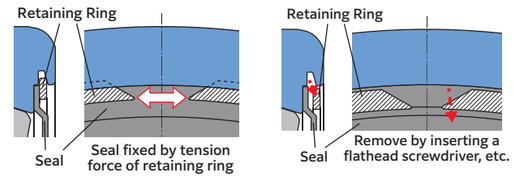
Measurement of radial internal clearance
Fig. 3

● Adoption of Special Thin Seals
- Ensures uniform contact pressure of the seal lip during selfalignment of the bearing, prevention of ingress of foreign matter, and stable sealing.
- Provides sealed spherical roller bearings with the world's largest load capacity.

● Lubrication Specification in Accordance with Requirements
- Either grease-filled type or grease-free type can be selected.



EMLLX type and open bearings have the same dimensions
Fig. 1



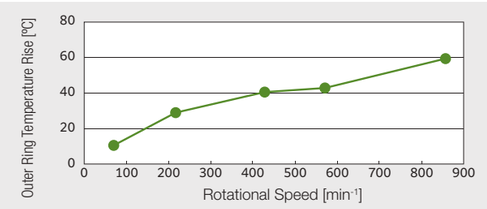
Seal fixing　　Seal removal
Fig. 4

Temperature Rise Test Results

[Test Conditions]

Bearing	: 22228EMLLXKD1
Load	: radial load 47.2 kN
Rotational speed	: 70 to 857 min^{-1}
Lubrication	: Alvania EP Grease 2 (8A)
Amount of grease	: 30 % of free space
Test time	: 12 h at each rotational speed

[Test Results]

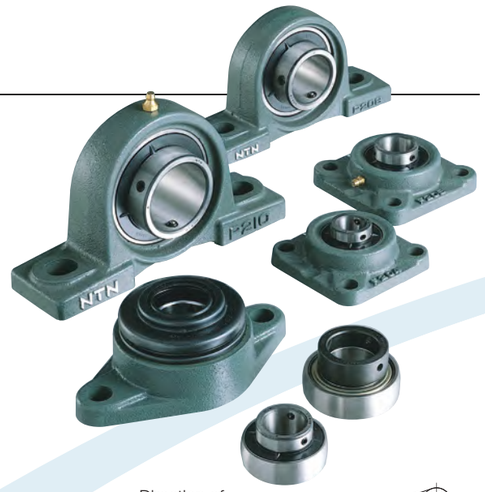


Outer Ring Temperature Rise

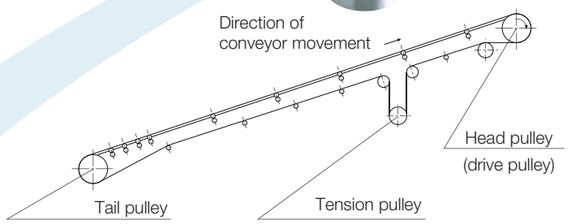
Product Table on P45

Bearing Units

- Available with dust covers.
- Easy to install/remove.
- Choose from unit with re-lubrication fitting or without.

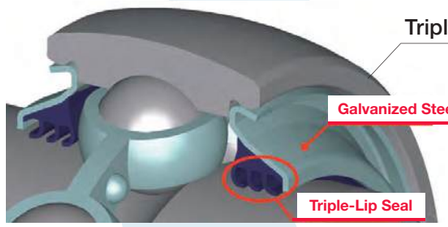


Bulk material conveyors



Triple-Lip Sealed Bearings for Bearing Units

- **The use of a seal with a triple-lip structure makes them extremely resistant to dust and water.**
- **Available as a low-torque type (LLJ) and high-torque type (LLS).**

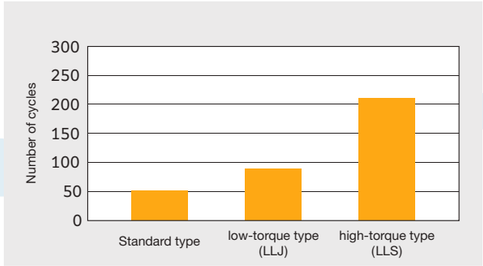


●Waterproof Performance Test Results

[Test Conditions]

Bearing	: UC205D1 standard type, low-torque type(LLJ) , high-torque type(LLS)
Rotational speed	: 800 min^{-1}
Load	: no load (light belt tension)
Test mode	: intermittent operation (6 hours operation / 6 hours stop = 1 cycle)
Test machine	: **NTN** muddy water test machine
Muddy water specifications	: dust JIS Z 8901 Kanto Loam Class 8 dust water mixture ratio 1:10 (ratio by weight)
Quantity of muddy water	: 1/4 to 1/3 of outer ring immersed
Termination conditions	: Muddy water leakage from bearing, bearing seizure, 0.6 G vibration when operating

[Test Results]



●Allowable temperature range and Allowable speed

Temperature range for triple-lip sealed bearings: –15 to 100 °C
Low-torque type(LLJ) allowable speed: dn value ≤ 36×10^3
High-torque type(LLS) allowable speed: dn value ≤ 21×10^3
[dn = bearing bore diameter d (mm) × rotational speed n (min^{-1})]

Product Table on P41

Plummer Blocks

- **Impact and vibration resistance (excellent damping capacity), suited to heavy loads.**
- **Grease and oil are both available for lubrication.**

●Plummer Block Seal Types

Rubber Seal

Rubber seals are typically used for grease lubrication, and their allowable peripheral speed, as a guideline, ranges from 5 to 6 m/s.

Felt Seal

Felt seals are limited to grease lubrication only use. Felt seals are not suitable for dusty or moist environments, and their allowable peripheral speed, as a guideline, is 4 m/s.

S grease Seal

The S grease seal (synthetic rubber seal with spring) excels in sealing performance and is well suited for grease or oil lubrication (custom specifications can be used with plummer blocks). Recommended peripheral speeds are within a range of 10 to 12 m/s, and special attention is required for the surface roughness and hardness of the shaft in contact with the seal contact area.

Labyrinth Seal

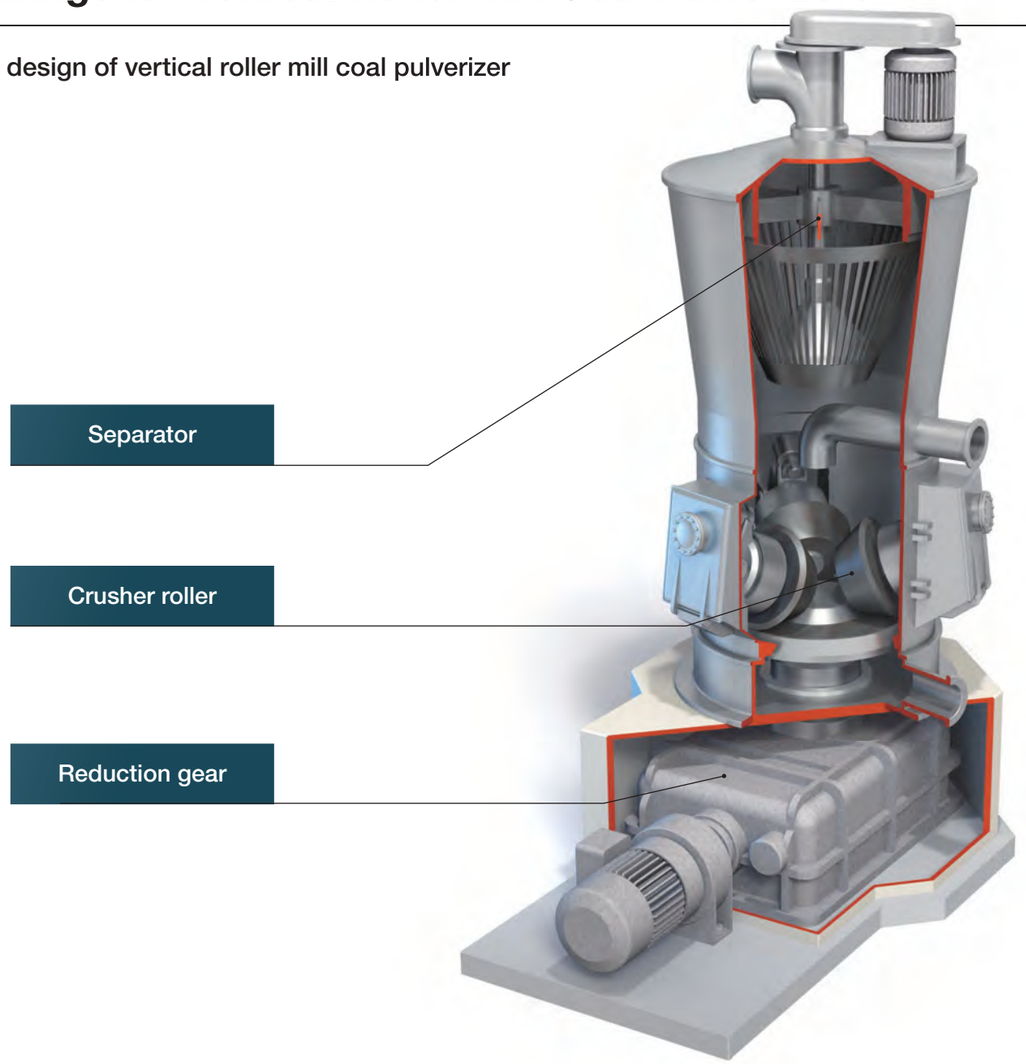
A sealing type that uses a labyrinth ring. A labyrinth seal is used in clearance fit to a shaft (h9) together with an O-ring so that it can be installed easily and can follow expansion/compression of the shaft.

Specially-coated housing are also available

Pulley bearing in extreme contamination conditions
(Plummer block)

Bearings for Vertical Roller Mill Coal Pulverizers

Typical design of vertical roller mill coal pulverizer



Typical Specifications for Bearings in Crusher Rollers and Separators

Unit : mm

Bearing Position	Arrangement	Example 1 (Bore Dia. × Outside Dia. × Width)	Example 2 (Bore Dia. × Outside Dia. × Width)	Example 3 (Bore Dia. × Outside Dia. × Width)
Crusher roller	Fixed side	Spherical roller bearings (ϕ280 × ϕ500 × 176)	Spherical roller bearings (ϕ400 × ϕ720 × 256)	Spherical roller bearings (ϕ360 × ϕ650 × 232)
	Floating side	Cylindrical roller bearings (ϕ280 × ϕ500 × 165.1)	Cylindrical roller bearings (ϕ400 × ϕ720 × 256)	Cylindrical roller bearings (ϕ360 × ϕ650 × 232)
Separator	Fixed side	Tapered roller bearings (ϕ635 × ϕ850 × 105)	Tapered roller bearings (ϕ835 × ϕ1 090 × 115)	Tapered roller bearings (ϕ835 × ϕ1 090 × 115)
	Floating side	Cylindrical roller bearings (ϕ630 × ϕ850 × 100)	Cylindrical roller bearings (ϕ830 × ϕ1 040 × 115)	Cylindrical roller bearings (ϕ830 × ϕ1 040 × 115)

Typical Specifications for Bearings in 3 Step Reduction Gearbox

Unit : mm

Bearing Position	Example 1 (Bore Dia. × Outside Dia. × Width)	Example 2 (Bore Dia. × Outside Dia. × Width)
Input shaft	Tapered roller bearings (ϕ80 × ϕ170 × 42.5)	Tapered roller bearings (ϕ90 × ϕ190 × 46.5)
	Tapered roller bearings (ϕ90 × ϕ160 × 42.5)	Tapered roller bearings (ϕ100 × ϕ215 × 77.5)
2nd step	Spherical roller bearings (ϕ100 × ϕ215 × 73)	Spherical roller bearings (ϕ120 × ϕ260 × 86)
	Spherical roller bearings (ϕ100 × ϕ215 × 73)	Cylindrical roller bearing (ϕ120 × ϕ260 × 86)
Output shaft	Spherical roller bearings (ϕ130 × ϕ280 × 93)	Spherical roller bearings (ϕ140 × ϕ300 × 102)
	Spherical roller bearings (ϕ150 × ϕ320 × 108)	Spherical roller bearings (ϕ160 × ϕ340 × 114)
Thrust shaft	Thrust cylindrical roller bearings (ϕ360 × ϕ560 × 120)	Thrust cylindrical roller bearings (ϕ440 × ϕ740 × 150)

Typical Specifications for Bearings in Planetary Gearbox

Unit : mm

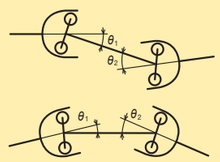
Bearing Position	Example 1 (Bore Dia. × Outside Dia. × Width)	Example 2 (Bore Dia. × Outside Dia. × Width)	Example 3 (Bore Dia. × Outside Dia. × Width)	Example 4 (Bore Dia. × Outside Dia. × Width)
Pinion (motor side)	Double row tapered roller bearings (ϕ180 × ϕ380 × 158)	Double row tapered roller bearings (ϕ170 × ϕ360 × 160)	Double row tapered roller bearings (ϕ210 × ϕ480 × 230)	Double row tapered roller bearings (ϕ190 × ϕ350 × 135)
Pinion (gear side)	Spherical roller bearings (ϕ200 × ϕ340 × 140)	Spherical roller bearings (ϕ190 × ϕ320 × 128)	Spherical roller bearings (ϕ220 × ϕ370 × 150)	Spherical roller bearings (ϕ200 × ϕ340 × 140)
Bevel gear flange	Double row tapered roller bearings (ϕ240 × ϕ360 × 115)	Tapered roller bearings (ϕ220 × ϕ340 × 76)	Tapered roller bearings (ϕ220 × ϕ340 × 76)	Tapered roller bearings (ϕ220 × ϕ340 × 76)
Coupling gear	Spherical roller bearings (ϕ400 × ϕ540 × 106)	Spherical roller bearings (ϕ360 × ϕ480 × 90)	Spherical roller bearings (ϕ400 × ϕ540 × 106)	Spherical roller bearings (ϕ400 × ϕ540 × 106)
Planetary gear	Spherical roller bearings (ϕ240 × ϕ400 × 128)	Spherical roller bearings (ϕ200 × ϕ340 × 140)	Spherical roller bearings (ϕ220 × ϕ370 × 150)	Spherical roller bearings (ϕ440 × ϕ720 × 280)
Output shaft	Slide bearing (metal)	Cylindrical roller bearings (ϕ460 × ϕ680 × 100)	Slide bearing (metal)	Slide bearing (metal)
Thrust	Thrust cylindrical roller bearings (ϕ1 110 × ϕ1 750 × 220)	Thrust cylindrical roller bearings (ϕ1 105 × ϕ1 600 × 175)	Thrust cylindrical roller bearings (ϕ1 510 × ϕ2 100 × 240)	Thrust cylindrical roller bearings (ϕ945 × ϕ1 520 × 220)

Constant Velocity Joints

Superior performance of constant velocity joints

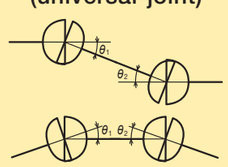
No lubrication required	Boot-sealed to enable operation for prolonged periods without lubricating.
Low vibration/noise efficient rotation	They ensure high quality manufacturing due to their low vibration/noise and efficient rotation (constant velocity rotation) compared to other couplings.
Ambient environment	They are boot-sealed. Therefore, there is no loss of grease and clean environments can be maintained.
Easy handling	They are easy to handle because, unlike cross-joints, they require no left-right angle/phase matching or centering during installation.
Safety	Constant velocity joints are covered by a boot. Therefore, they are safe to handle without risk of trapping fingers in cross-joint yokes.

Constant velocity joints



Can be used as a single joint
Does not need to be positioned for constant velocity, even if $\theta_1 \neq \theta_2$

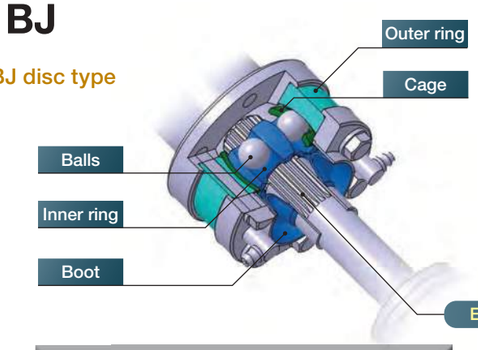
Cross-joint (universal-joint)



Two joints used as a single system
Must be positioned correctly for constant velocity so that $\theta_1 = \theta_2$

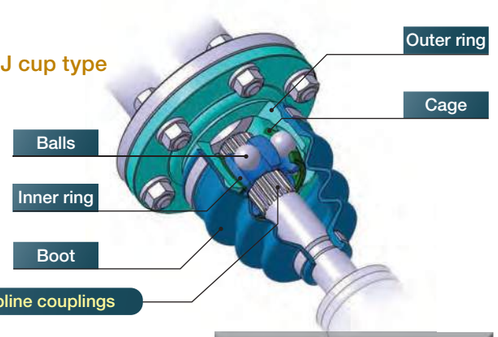
BJ

● BJ disc type



● Excellent high-speed rotation performance
● Max. allowable angle : 14 to 18°

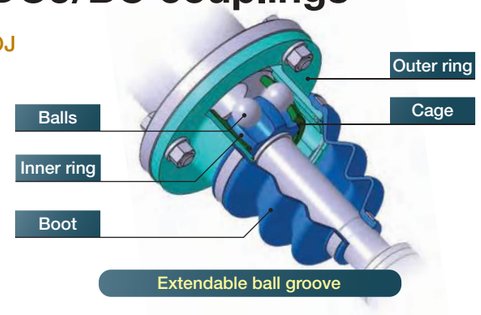
● BJ cup type



● Max. allowable angle : 25°
● Excellent seal performance

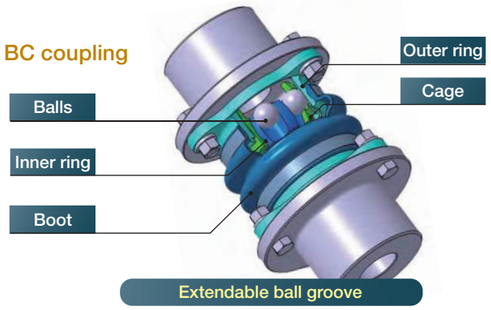
DOJ/BC couplings

● DOJ



● Extendable inside the joint while under torque load
● Max. allowable angle : 68 to 200 sizes: 20°
225 to 625 sizes : 8 to 10°

● BC coupling



● No need to center/easy to install
● Max. allowable angle : 5°
● Extendable inside main body

BC coupling

BC couplings manufactured by **NTN** can be used in replacement of general couplings.[1)]
Take a closer look at the easy installation typically/can removal characteristics, degree of angular deflection, and eccentricity that these BC couplings can provide.

Chain coupling | Gear coupling | Disc coupling | Rubber coupling

By substituting with BC couplings...

Replacement

BC coupling

No centering required
Improve work efficiency, reduce maintenance

No lubrication required
Boot-sealed to enable operation for prolonged periods without lubricating.

Absorb vibration

Comparison of coupling types (50 mm bore diameter)

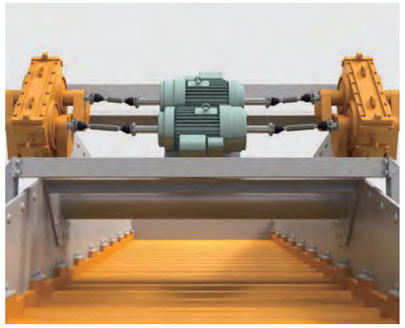
Coupling Function	Chain Coupling	Gear Coupling	Disc Coupling	Rubber Coupling	**NTN** BC Couplings
Allowable deflection angle (°)	1.0	1.5	1.0	0.3	5.0
Allowable eccentricity (mm)	0.4	1.0	0.2	0.2	5.0
Allowable torque (N•m)	932	932	775	490	932
Permissible distance between shafts (mm)	12	8	12	3	103
Outside diameter (mm)	130	140	143	120	134
Mass (kg)	6.2	7.5	6.9	6.7	8.5
Independent installation and removal	Not permissible	Not permissible	Not permissible	Not permissible	Permissible
Maintenance	Time required for centering				No centering or re-lubrication required

1) Replacement may not be possible depending on conditions. Check the conditions and location of use. Contact **NTN** for technical support.

Typical Specifications for Constant Velocity Joints in Mining Equipment

Use Machinery	CVJ Position	Part Number
Vibrating screens (oscillators) Representative example 1	Drive rolls	**BJ100ACC9 ··**
Vibrating screens (oscillators) Representative example 2	Drive rolls	**BJ100ACC9 ··**
	No. 5 intermediate rolls	**BJ100ACC9 ··**
Vibrating screens (oscillators) Representative example 3	Drive rolls	**BJ125ACC9 ··**
	No. 5 intermediate rolls	**BJ125ACC9 ··**
	No. 6 intermediate rolls	**BJ125ACC9 ··**
	No. 7 intermediate rolls	**BJ125ACC9 ··**
Shuttle cars	Wheel drive units	**BJ200ACB0 ··**
Rod mills	Drive transmission units	**DOJ550F0 ··**

Note : Part number suffixes are serial numbers.



Example 1 of use for Vibrating screens (oscillators)

Example 2 of use for Vibrating screens (oscillators)

SL Type Cylindrical Roller Bearings for Sheaves

Optimal bearings for ultra-low speed, heavy loads, and impact loads.

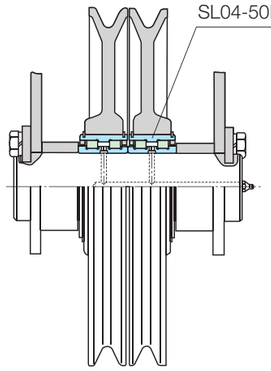
Features

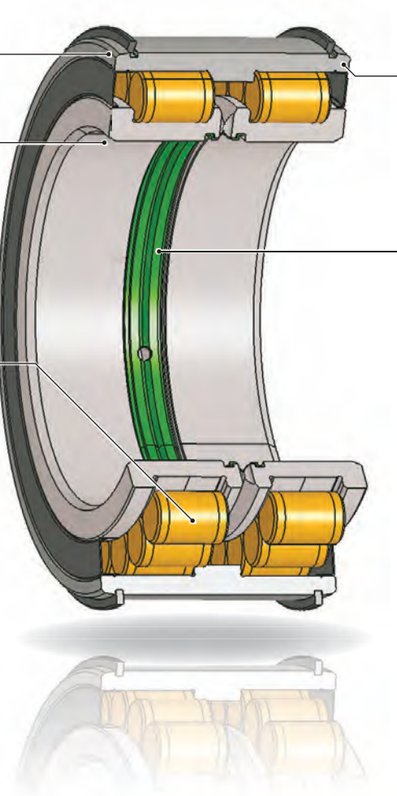
Thin section design

- Smaller
- Lighter

Full complement roller bearings

- Maximum number of rollers



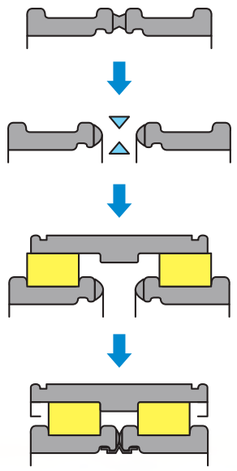


Thrust load handling capability

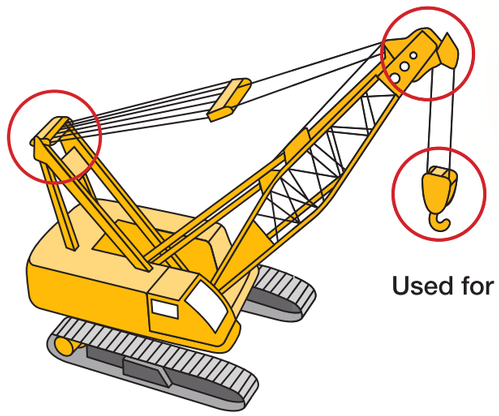
- Optimal rib design
- Improved roller precision

Non-separable type

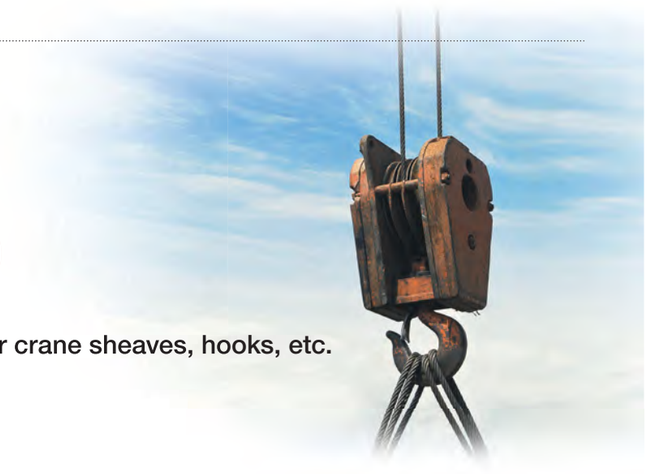
- Separable by special construction method
- Lockable after roller installation



Installation example



Used for crane sheaves, hooks, etc.



Product Table on P49

Bearings with Solid Grease

Extended replacement intervals due to reduced grease leakage and resistance to emulsification with water.

Features

- Resistant to grease leakage due to centrifugal forces.
- Prevents contamination of ambient environment.
- Long operating life due to resistance against emulsification and leakage.

Bearing Specifications

Main ingredients and premissible operating temperature range

Solid Grease (product code)	Resin	Lubricant	Permissible Operating Temperature Range
General-purpose Solid Grease (LP03)	Ultra-high molecular weight polyethylene	Li–mineral oil grease	–20 to 80 °C[1)] [max. 60 °C at regular operation conditions]

1) If the temperature exceeds the permissible operating temperature range, contact **NTN** for more information.

Production range

Bearings with general-purpose solid grease (LP03)

○: Standard △: Special ×: Not available

Bearing type	Lubricant Packing Method		Bearing Size (Outside Diameter)
	Spot-pack	Full-pack	
Deep groove ball bearings	○[1)]	△	Up to 350 mm
Miniature and small size ball bearings	○[1)]	×	(Bearing bore diameter from 6 to 9 mm)
Self-aligning ball bearings	×	○[1)]	Up to 250 mm
Spherical roller bearings	×	○[1)]	Up to 250 mm
Bearing units	○[1)]	△	Up to 300 mm
Needle roller bearings	×	○[2)]	

1) Deep groove ball bearings are equipped with spot-pack and ZZ shields as standard. Certain bearing type and bearing designations listed as standard specification are not available. Contact **NTN** for more information.
2) Available dimensions of the needle roller bearings differ for each bearing type. Contact **NTN** for more information.
Note : Standard bearings are not manufactured from corrosion resistant materials. However, stainless steel bearings are available.

Allowable speed

Bearings with general-purpose solid grease (LP03)

Bearing type	Load Condition	Allowable Speed (dn value)[1)]	
		Spot-pack	Full-pack
Deep groove ball bearings	Radial load	200×10^3	50×10^3
Miniature and small size ball bearings	Radial load	200×10^3	–
Self-aligning ball bearings	Radial load	–	30×10^3
Spherical roller bearings	Radial load	–	30×10^3
	$\frac{\text{Axial load}}{\text{Radial load}} \le 0.3$	–	20×10^3
Bearing units	Radial load	120×10^3	30×10^3
Needle roller bearings	Radial load	–	$30\times10^{3\,2)}$

1) dn = bearing bore diameter d (mm) × rotational speed n (min^{-1})
2) $F_W \cdot n$ = roller inscribed circle diameter F_W (mm)× rotational speed n (min^{-1})

Necessary minimum load

In case of full-pack, in order for the rolling elements to rotate without sliding, 1 % of the basic dynamic load rating is required. Contact **NTN** for more information.

Spot-pack

Deep groove ball bearings

Bearing units

Full-pack

Needle roller bearings

Spherical roller bearings

Spalling (Flaking, Delamination)

Phenomena	Primary Causes	Primary Preventative Measures
The raceway surface peels away in scale-like flakes. After the spalling develops, the remaining surface is markedly uneven/rough.	Although this fatigue phenomenon is caused by rolling motion, this phenomenon may occur prematurely if abnormally excessive loads are applied, poor bearing handling, poor shaft and/or housing precision, and or installation errors, etc. Intrusion of foreign material and corrosion are also contributing factors.	(1) Investigate the existence of factors applying abnormal loads. (2) Reevaluate the conditions of use and, depending on the conditions, use bearings with a greater load capacity. (3) Improve the lubrication method by increasing the viscosity of the lubricant to form a good lubricant film. (4) Prevent installation damage

Photo A-1

- Deep groove ball bearing
- Spalling (flaking, delamination) has occurred on both raceways and the balls
- Caused by excessive load

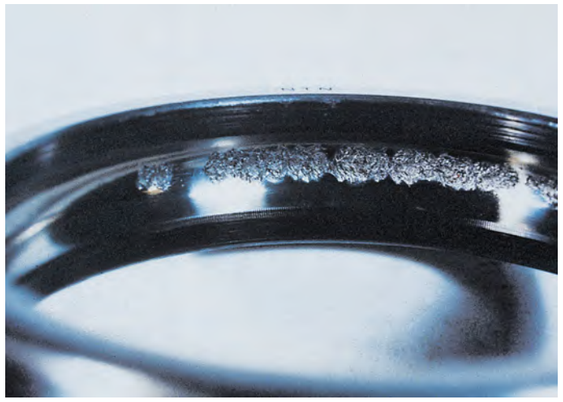


Photo A-2

- Outer ring of angular contact ball bearing
- Spalling (flaking, delamination) of the raceway ball path
- Caused by poor bearing handling

Photo A-3

- Inner ring of deep groove ball bearing
- Spalling (flaking, delamination) has occurred on one side of the raceway surface
- Caused by excessive axial load

Photo A-4

- Inner ring of spherical roller bearing
- Spalling (flaking, delamination) has occurred only on one side of the raceway surface
- Caused by excessive axial load

Bearing Inspection and Maintenance

Performing periodic inspections and maintenance of the bearings makes it possible to maximize bearing performance, and also detect any early-stage bearing anomalies. Therefore, inspections and maintenance can increase productivity and economic efficiency by preventing bearing failures before they occur.

The inspection items written on the right are generally accepted methods for performing bearing maintenance and aftercare. Depending on the importance of the system or machinery being used, implementing inspection and maintenance by determining the inspection items and periodic inspection cycles is an important aspect of bearing maintenance and management.

1. **Inspect the bearings while the machine is operating**
   Check the temperature, sound, and vibration of the bearings. Examine the characteristics of the lubricant and determine the cycle for refilling or replacing the lubricant.
2. **Visually monitor the bearings**
   Carefully monitor any visible phenomena that appear when carrying out periodic inspections and after the bearings have been used. If there are visible signs of damage, take measures to prevent recurrence.

✻ Representative examples regarding bearing damage and preventative measures are illustrated below. Refer to the related catalog “Care and Maintenance of Bearings (CAT. No. 3017/E)” for more details.

Photo A-5

- Tapered roller bearing
- Spalling (flaking, delamination) has occurred on 1/4 of the inner ring raceway; the rollers and outer ring are discolored light brown
- Caused by excessive preload

Photo A-6

- Outer ring of double row angular contact ball bearing
- Spalling (flaking, delamination) has occurred on 1/4 of the outer ring raceway surface circumference
- Caused by improper installation

Photo A-7

- Thrust ball bearing
- Spalling (flaking, delamination) has occurred on the bearing shaft washer (bearing washer fitted on the side of the shaft) and rolling elements
- Caused by poor lubrication

Photo A-8

- Outer ring of double row tapered roller bearing
- Spalling (flaking, delamination) has occurred on the raceway surface
- Caused by electrical damage (electric current passing thru bearing)

Indentation

Phenomena	Primary Causes	Primary Preventative Measures
Indentations (Brinell indentations) on the raceway surface caused by compaction of solid foreign materials and impact.	Intrusion of solid foreign materials Metal fragment entrapments Dropping, impact damage due to poor bearing handling	(1) Prevent intrusion of foreign material. (2) If caused by metal fragments, investigate the existence of spalling (flaking, delamination) also occurring in other bearings. (3) Provide better filtration for lubrication system. (4) Improve bearing handling, method of assembly.

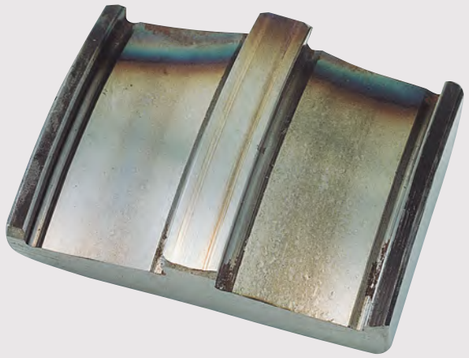


Photo B-1

- Inner ring of spherical roller bearing (cut section)
- Indentation has occurred on one side of the raceway surface
- Caused by the compaction of solid foreign material

Photo B-2

- Rollers of spherical roller bearing
- Indentation has occurred on the raceway surface
- Caused by the compaction of solid foreign material

Photo B-3

- Rollers of tapered roller bearing
- Indentation has occurred on the raceway surface (temper coloration at both ends)
- Caused by intrusion of foreign material in the lubricant

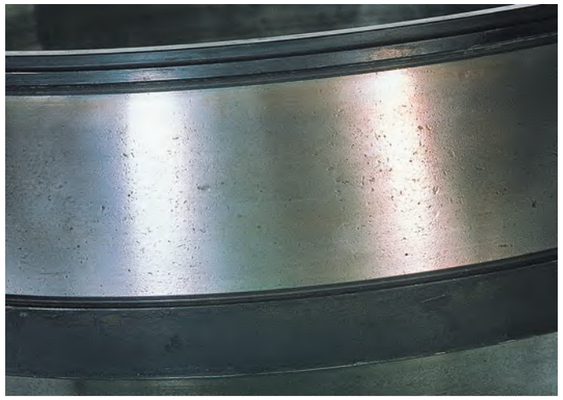


Photo B-4

- Inner ring of tapered roller bearing
- Indentation has occurred on the raceway surface
- Caused by the compaction of solid foreign material

Bearing Seizure

Phenomena	Main Causes	Main Preventative Measures
Bearing has seized due to overheating and will not rotate. Discoloration, softening and welding of raceway, rolling element, and rib surfaces.	Poor heat dissipation Insufficient lubricant and/or lubricant is not suitable Bearing clearances are too small Excessive load (or preload) Roller skew, incorrect installation tolerances	(1) Improve heat dissipation. (2) Review lubricant type and volume. (3) Prevent misalignment. (4) Reinvestigate the bearing clearances and preload. (5) Reinvestigate the conditions of use.

Photo C-1

- Inner ring of double row tapered roller bearing
- Discoloration, softening of inner ring due to seizure, and wear has occurred in a stepped pattern matching the roller pitch
- Caused by poor lubrication

Photo C-2

- Rollers of double row tapered roller bearing
- Discoloration, scoring, and welding due to seizure has occurred on the surfaces and ends of the rollers and inner ring set shown in Photo C-1.

Photo C-3

- Outer ring of spherical roller bearing
- Wear has occurred in a stepped pattern due to seizure of the raceway surface
- Caused by poor lubrication

Photo C-4

- Inner ring of tapered roller bearing
- Raceway surface large diameter side and large rib surface have seized
- Caused by poor lubrication

Cracking

Phenomena	Main Causes	Main Preventative Measures
Fracture, cracking, hairline and friction cracking, etc.	Excessive load Excessive impact Heating and sudden cooling due to creep Excessive interference fit Extensive spalling (flaking, delamination)	(1) Investigate causes of abnormal loading and rectify/improve. (2) Prevent creep. (3) Reinvestigate the fit interference.

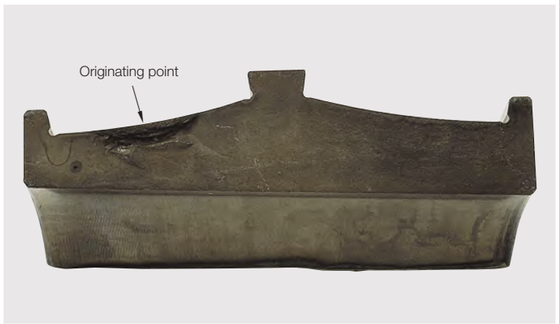


Photo D-1

- Inner ring of spherical roller bearing (fracture surface)
- Originating point is the center of the left side raceway
- Caused by excessive interference fit

Photo D-2

- Outer ring of four row cylindrical roller bearing
- Fracture in the circumferential direction of the raceway surface
- Cracking originating point is excessive spalling (flaking, delamination)

Chipping

Phenomena	Primary Causes	Primary Preventative Measures
Partial chipping	Compaction of solid foreign material Impact, excessive loading Poor bearing handling	(1) Investigate causes of impact, excessive loading and rectify/improve. (2) Improve bearing handling. (3) Improve seal performance.

Photo E-1

- Cylindrical roller bearing
- Chipping of inner/outer ring guide rib
- Caused by excessive impact load

Photo E-2

- Inner ring of tapered roller bearing
- Chipping of large rib
- Caused by impact due to poor assembly

False Brinelling, Fretting Corrosion

Phenomena	Main Causes	Main Preventative Measures
Red rust color from abrasion particles due to wear appear on the contact surfaces forming surface depressions. Depressions form at the pitch of the rolling elements on the raceway surface, which is also called false brinelling.	If vibrating loads applied to contacting elements result in small amplitude oscillation, lubricant is driven out from contact areas, and parts become significantly worn. The bearing oscillation angle is too small. Insufficient lubricant (lubricant-free state) Load fluctuation Vibration during transportation	(1) Before transporting, preload the inner/outer ring separating packaging to prevent separation. (2) In case of an oscillating motion, use a higher consistency oil or grease. (3) Reinvestigate the lubricant type. (4) Secure the shaft and housing. (5) Re-evaluate the bearing shaft and housing fits.
When it occurs on the fitted surface, it is called fretting corrosion.	Vibration, shaft deflection, installation error, insufficient fit interference	

Photo F-1

- Inner ring of cylindrical roller bearing
- False brinelling has occurred around the total circumference of the raceway surface
- Caused by vibration

Photo F-2

- Outer ring of cylindrical roller bearing
- Fretting corrosion has occurred along the outside diameter

Creep

Phenomena	Main Causes	Main Preventative Measures
The fitting surfaces on which creep occurs becomes polished, almost mirror like or cloudy surfaces. This may also be accompanied by scoring.	Insufficient interference between inner ring and shaft when subjected to inner ring rotating loads. Same for outer ring when subjected to outer ring rotating loads. If the housing is made of a light alloy such as aluminum, fit may be insufficient due to the difference of thermal expansion.	(1) Reinvestigate the fit interference. (2) Improve the machining precision of the shaft and housing.

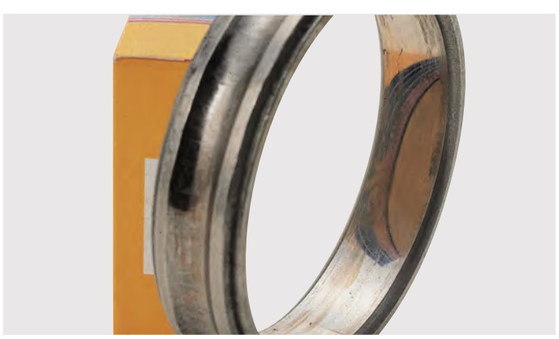


Photo G-1

- Inner ring of deep groove ball bearing
- Mirror like surface has occurred on the bore diameter surface dus to creep

Photo G-2

- Inner ring of tapered roller bearing
- Scoring caused by creep has occurred in the center section of the bore surface

Product Tables

Explanation of dimension table

Fatigue Load Limit (C_u)

The fatigue load limit is the applied load on a bearing that results in just reaching the fatigue stress limit at the maximum loaded raceway contact. This depends on the bearing type, internal specifications, quality, and material strength. In ISO 281:2007, 1.5 GPa is recommended as the fatigue stress limit corresponding to C_u for bearings made of commonly used high quality material and good manufacturing quality. Values for the fatigue load limit with respect to the **NTN** bearing designations are provided in the dimensional table. The life modification factor, a_{ISO} , should be evaluated considering the fatigue load limit. For details see catalog “Ball and Roller Bearings (CAT.No.2203/E) section 3.4 Modified rating life”.

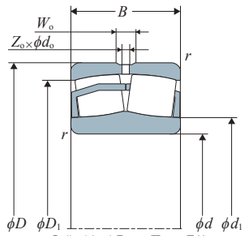
ULTAGE

ULTAGE™ series Spherical Roller Bearings [Type EA, Type EM]

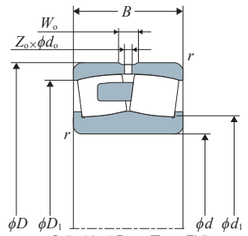
Bearing Designation

222	16	EA	K	D1	C3

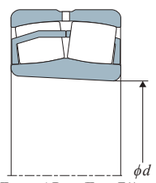
- C3 — Internal clearance code
- D1 — Oil inlet/groove code: D1 : with oil inlet/groove; W33 : with oil inlet/groove (Manufacturing in Europe)
- K — Bore configuration code: no code : cylindrical; K : tapered
- EA — Bearing type code: EA : window type pressed-steel cage; EM : one-piece machined high-tension brass cage
- 16 — Bore diameter code
- 222 — Bearing series (type code + width series code + diameter series code.)



Cylindrical Bore (Type EA)



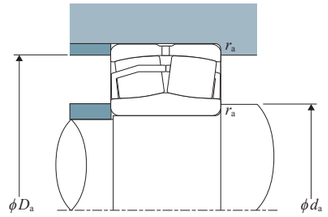
Cylindrical Bore (Type EM)



Tapered Bore (Type EA)

Number of oil inlets on outer ring

Number of oil Inlets Z_o	
D1	W33
4	3



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

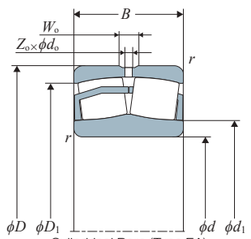
e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Allowable Speed min^{-1}		Bearing Designation[3]		Installation-related Dimensions mm					Constant	Axial Load Factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$[2]	W_o	d_o	C_r	C_{0r}	C_u	Grease Lubrication	Oil Lubrication	Cylindrical Bore	Tapered Bore[1]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore
25	52	18	1	3	1.5	57.3	46.1	3.23	10 400	13 000	**22205EAW33**	**22205EAKW33**	30	30	46	46	1	0.34	2.00	2.98	1.96	0.173	0.169
	52	18	1	3	1.5	57.3	46.1	3.23	10 400	13 000	**22205EMW33**	**22205EMKW33**	30	30	46	46	1	0.34	2.00	2.98	1.96	0.174	0.171
30	62	20	1	4	2	75.7	64.5	4.58	8 800	11 000	**22206EAW33**	**22206EAKW33**	37	36	56	55	1	0.31	2.15	3.20	2.10	0.278	0.272
	62	20	1	4	2	75.7	64.5	4.58	8 800	11 000	**22206EMW33**	**22206EMKW33**	37	36	56	55	1	0.31	2.15	3.20	2.10	0.281	0.275
35	72	23	1.1	5	2	100	92	6.11	7 500	9 400	**22207EAW33**	**22207EAKW33**	45	42	65	63	1.1	0.31	2.21	3.29	2.16	0.438	0.430
	72	23	1.1	5	2	100	92	6.11	7 500	9 400	**22207EMW33**	**22207EMKW33**	45	42	65	63	1.1	0.31	2.21	3.29	2.16	0.442	0.433
40	80	23	1.1	5	2.5	116	105	7.78	6 800	8 500	**22208EAD1**	**22208EAKD1**	50	47	73	71	1.1	0.27	2.47	3.67	2.41	0.528	0.518
	80	23	1.1	5	2.5	110	98	7.29	6 800	8 500	**22208EMD1**	**22208EMKD1**	50	47	73	71	1.1	0.27	2.47	3.67	2.41	0.529	0.519
	90	33	1.5	6	3	169	152	9.36	5 400	6 600	**22308EAD1**	**22308EAKD1**	52	49	81	78	1.5	0.36	1.87	2.79	1.83	1.02	1.00
	90	33	1.5	6	3	169	152	9.36	5 400	6 600	**22308EMD1**	**22308EMKD1**	52	49	81	78	1.5	0.36	1.87	2.79	1.83	1.03	1.01
45	85	23	1.1	6	2.5	121	113	8.76	6 100	7 700	**22209EAD1**	**22209EAKD1**	54	52	78	76	1.1	0.26	2.64	3.93	2.58	0.572	0.561
	85	23	1.1	6	2.5	116	106	8.24	6 100	7 700	**22209EMD1**	**22209EMKD1**	54	52	78	76	1.1	0.26	2.64	3.93	2.58	0.577	0.566
	100	36	1.5	6	3	206	187	11.8	4 600	5 700	**22309EAD1**	**22309EAKD1**	58	54	91	87	1.5	0.36	1.90	2.83	1.86	1.37	1.34
	100	36	1.5	6	3	206	187	11.8	4 600	5 700	**22309EMD1**	**22309EMKD1**	58	54	91	87	1.5	0.36	1.90	2.83	1.86	1.38	1.35
50	90	23	1.1	6	2.5	130	124	10.1	5 700	7 200	**22210EAD1**	**22210EAKD1**	59	57	83	81	1.1	0.24	2.84	4.23	2.78	0.614	0.602
	90	23	1.1	6	2.5	125	117	9.54	5 700	7 200	**22210EMD1**	**22210EMKD1**	59	57	83	81	1.1	0.24	2.84	4.23	2.78	0.616	0.604
	110	40	2	7	3.5	250	232	14.0	4 300	5 300	**22310EAD1**	**22310EAKD1**	63	61	99	95	2	0.36	1.87	2.79	1.83	1.82	1.79
	110	40	2	7	3.5	250	232	14.0	4 300	5 300	**22310EMD1**	**22310EMKD1**	63	61	99	95	2	0.36	1.87	2.79	1.83	1.84	1.80
55	100	25	1.5	6	3	155	148	12.6	5 300	6 700	**22211EAD1**	**22211EAKD1**	66	64	91	90	1.5	0.23	2.95	4.40	2.89	0.830	0.814
	100	25	1.5	6	3	148	140	11.9	5 300	6 700	**22211EMD1**	**22211EMKD1**	66	64	91	90	1.5	0.23	2.95	4.40	2.89	0.827	0.811
	120	43	2	8	3.5	296	274	17.4	3 900	4 800	**22311EAD1**	**22311EAKD1**	68	66	109	104	2	0.36	1.87	2.79	1.83	2.31	2.26
	120	43	2	8	3.5	296	274	17.4	3 900	4 800	**22311EMD1**	**22311EMKD1**	68	66	109	104	2	0.36	1.87	2.79	1.83	2.34	2.29
60	110	28	1.5	7	3	187	181	15.4	4 800	6 000	**22212EAD1**	**22212EAKD1**	71	69	101	99	1.5	0.24	2.84	4.23	2.78	1.14	1.12
	110	28	1.5	7	3	179	171	14.6	4 800	6 000	**22212EMD1**	**22212EMKD1**	71	69	101	99	1.5	0.24	2.84	4.23	2.78	1.15	1.13
	130	46	2.1	9	4	340	319	20.3	3 600	4 600	**22312EAD1**	**22312EAKD1**	75	72	118	113	2.1	0.35	1.95	2.90	1.91	2.86	2.80
	130	46	2.1	9	4	340	319	20.3	3 600	4 600	**22312EMD1**	**22312EMKD1**	75	72	118	113	2.1	0.35	1.95	2.90	1.91	2.91	2.85
65	120	31	1.5	8	3.5	226	224	18.2	4 400	5 500	**22213EAD1**	**22213EAKD1**	78	74	111	107	1.5	0.24	2.79	4.15	2.73	1.52	1.49
	120	31	1.5	8	3.5	217	212	17.2	4 400	5 500	**22213EMD1**	**22213EMKD1**	78	74	111	107	1.5	0.24	2.79	4.15	2.73	1.53	1.50
	140	48	2.1	9	4	369	343	23.4	3 300	4 100	**22313EAD1**	**22313EAKD1**	81	77	128	122	2.1	0.33	2.06	3.06	2.01	3.48	3.41
	140	48	2.1	9	4	369	343	23.4	3 300	4 100	**22313EMD1**	**22313EMKD1**	81	77	128	122	2.1	0.33	2.06	3.06	2.01	3.50	3.43
70	125	31	1.5	7	3.5	235	240	20.1	4 100	5 200	**22214EAD1**	**22214EAKD1**	84	79	116	113	1.5	0.22	3.01	4.48	2.94	1.61	1.58
	125	31	1.5	7	3.5	235	240	20.1	4 100	5 200	**22214EMD1**	**22214EMKD1**	84	79	116	113	1.5	0.22	3.01	4.48	2.94	1.64	1.60
	150	51	2.1	10	5	420	396	26.0	3 000	3 800	**22314EAD1**	**22314EAKD1**	85	82	138	131	2.1	0.34	2.00	2.98	1.96	4.25	4.16
	150	51	2.1	10	5	420	396	26.0	3 000	3 800	**22314EMD1**	**22314EMKD1**	85	82	138	131	2.1	0.34	2.00	2.98	1.96	4.31	4.22
75	130	31	1.5	7	3.5	244	249	21.1	4 000	5 000	**22215EAD1**	**22215EAKD1**	88	84	121	118	1.5	0.22	3.14	4.67	3.07	1.67	1.64
	130	31	1.5	7	3.5	244	249	21.1	4 000	5 000	**22215EMD1**	**22215EMKD1**	88	84	121	118	1.5	0.22	3.14	4.67	3.07	1.71	1.67
	160	55	2.1	10	5	491	467	29.8	2 900	3 600	**22315EAD1**	**22315EAKD1**	91	87	148	139	2.1	0.34	2.00	2.98	1.96	5.18	5.07
	160	55	2.1	10	5	491	467	29.8	2 900	3 600	**22315EMD1**	**22315EMKD1**	91	87	148	139	2.1	0.34	2.00	2.98	1.96	5.27	5.16
80	140	33	2	8	3.5	278	287	24.0	3 700	4 600	**22216EAD1**	**22216EAKD1**	94	91	129	127	2	0.22	3.14	4.67	3.07	2.09	2.05
	140	33	2	8	3.5	267	272	22.8	3 700	4 600	**22216EMD1**	**22216EMKD1**	94	91	129	127	2	0.22	3.14	4.67	3.07	2.11	2.07
	170	58	2.1	10	5	541	522	32.5	2 700	3 400	**22316EAD1**	**22316EAKD1**	98	92	158	148	2.1	0.34	2.00	2.98	1.96	6.12	5.99
	170	58	2.1	10	5	541	522	32.5	2 700	3 400	**22316EMD1**	**22316EMKD1**	98	92	158	148	2.1	0.34	2.00	2.98	1.96	6.28	6.15
85	150	36	2	8	3.5	324	330	27.1	3 400	4 300	**22217EAD1**	**22217EAKD1**	100	96	139	137	2	0.22	3.07	4.57	3.00	2.59	2.54
	150	36	2	8	3.5	324	330	27.1	3 400	4 300	**22217EMD1**	**22217EMKD1**	100	96	139	137	2	0.22	3.07	4.57	3.00	2.67	2.62
	180	60	3	11	5	599	604	36.4	2 600	3 200	**22317EAD1**	**22317EAKD1**	107	99	166	157	3	0.32	2.09	3.11	2.04	7.18	7.04
	180	60	3	11	5	599	604	36.4	2 600	3 200	**22317EMD1**	**22317EMKD1**	107	99	166	157	3	0.32	2.09	3.11	2.04	7.29	7.15

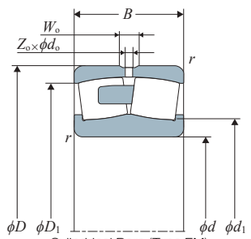
1) "**K**" indicates bearings have tapered bore with a taper ratio of 1:12. 2) Smallest allowable dimension for chamfer dimension "*r*". 3) "**W33**" indicates manufacturing in Europe.

ULTAGE

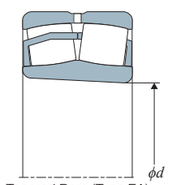
ULTAGE™ series Spherical Roller Bearings [Type EA, Type EM]



Cylindrical Bore (Type EA)



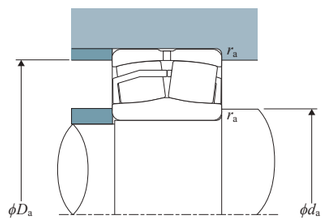
Cylindrical Bore (Type EM)



Tapered Bore (Type EA)

Number of oil inlets on outer ring

Number of oil Inlets Z_o
4



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0F_a$

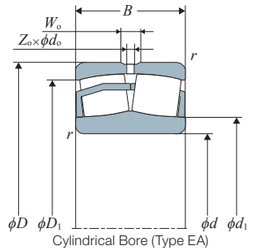
e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Allowable Speed min^{-1}		Bearing Designation		Installation-related Dimensions mm					Constant	Axial Load Factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [2]	W_o	d_o	C_r	C_{0r}	C_u	Grease Lubrication	Oil Lubrication	Cylindrical Bore	Tapered Bore [1]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore
90	160	40	2	10	4.5	384	398	30.2	3 200	4 000	**22218EAD1**	**22218EAKD1**	105	101	149	144	2	0.23	2.90	4.31	2.83	3.34	3.27
	160	40	2	10	4.5	384	398	30.2	3 200	4 000	**22218EMD1**	**22218EMKD1**	105	101	149	144	2	0.23	2.90	4.31	2.83	3.43	3.37
	160	52.4	2	9	4	467	513	30.0	2 600	3 200	**23218EMD1**	**23218EMKD1**	104	101	149	141	2	0.30	2.25	3.34	2.20	4.43	4.31
	190	64	3	12	5	668	652	40.0	2 500	3 000	**22318EAD1**	**22318EAKD1**	110	104	176	166	3	0.33	2.06	3.06	2.01	8.42	8.25
	190	64	3	12	5	668	652	40.0	2 500	3 000	**22318EMD1**	**22318EMKD1**	110	104	176	166	3	0.33	2.06	3.06	2.01	8.53	8.35
95	170	43	2.1	10	4.5	416	417	33.4	3 000	3 800	**22219EAD1**	**22219EAKD1**	110	107	158	153	2.1	0.23	2.95	4.40	2.89	3.98	3.90
	170	43	2.1	10	4.5	416	417	33.4	3 000	3 800	**22219EMD1**	**22219EMKD1**	110	107	158	153	2.1	0.23	2.95	4.40	2.89	4.06	3.98
	200	67	3	12	6	732	751	43.4	2 300	2 800	**22319EAD1**	**22319EAKD1**	120	109	186	174	3	0.32	2.09	3.11	2.04	9.91	9.71
	200	67	3	12	6	732	751	43.4	2 300	2 800	**22319EMD1**	**22319EMKD1**	120	109	186	174	3	0.32	2.09	3.11	2.04	10.0	9.82
100	165	52	2	8	4	464	563	30.7	2 400	3 000	**23120EAD1**	**23120EAKD1**	114	111	154	147	2	0.28	2.39	3.56	2.34	4.37	4.24
	165	52	2	8	4	480	590	32.1	2 400	3 000	**23120EMD1**	**23120EMKD1**	114	111	154	147	2	0.28	2.39	3.56	2.34	4.45	4.32
	180	46	2.1	11	5	472	495	36.9	2 800	3 600	**22220EAD1**	**22220EAKD1**	118	112	168	161	2.1	0.24	2.84	4.23	2.78	4.90	4.80
	180	46	2.1	11	5	472	495	36.9	2 800	3 600	**22220EMD1**	**22220EMKD1**	118	112	168	161	2.1	0.24	2.84	4.23	2.78	5.02	4.93
	180	60.3	2.1	9	4.5	586	661	36.3	2 300	2 900	**23220EMD1**	**23220EMKD1**	118	112	168	159	2.1	0.31	2.18	3.24	2.13	6.51	6.33
	215	73	3	13	6	827	844	50.1	2 100	2 600	**22320EAD1**	**22320EAKD1**	127	114	201	187	3	0.34	1.98	2.94	1.93	12.6	12.3
	215	73	3	13	6	827	844	50.1	2 100	2 600	**22320EMD1**	**22320EMKD1**	127	114	201	187	3	0.34	1.98	2.94	1.93	12.9	12.7
110	170	45	2	8	3.5	417	517	32.1	2 600	3 300	**23022EAD1**	**23022EAKD1**	123	119	161	155	2	0.23	2.95	4.40	2.89	3.66	3.55
	170	45	2	8	3.5	417	517	32.1	2 600	3 300	**23022EMD1**	**23022EMKD1**	123	119	161	155	2	0.23	2.95	4.40	2.89	3.66	3.55
	180	56	2	9	4	547	669	36.2	2 200	2 800	**23122EAD1**	**23122EAKD1**	125	121	169	161	2	0.28	2.43	3.61	2.37	5.66	5.49
	180	56	2	9	4	547	669	36.2	2 200	2 800	**23122EMD1**	**23122EMKD1**	125	121	169	161	2	0.28	2.43	3.61	2.37	5.53	5.36
	180	69	2	8	4	622	769	35.7	2 200	2 700	**24122EMD1**	**24122EMK30D1**	121	121	169	158	2	0.36	1.90	2.83	1.86	6.75	6.65
	200	53	2.1	12	6	602	643	45.0	2 600	3 300	**22222EAD1**	**22222EAKD1**	130	122	188	179	2.1	0.25	2.69	4.00	2.63	7.10	6.95
	200	53	2.1	12	6	602	643	45.0	2 600	3 300	**22222EMD1**	**22222EMKD1**	130	122	188	179	2.1	0.25	2.69	4.00	2.63	7.30	7.15
	200	69.8	2.1	11	5	752	869	43.9	2 100	2 600	**23222EMD1**	**23222EMKD1**	130	122	188	176	2.1	0.32	2.12	3.15	2.07	9.41	9.14
	240	80	3	16	7	975	972	59.0	2 000	2 400	**22322EAD1**	**22322EAKD1**	139	124	226	209	3	0.32	2.09	3.11	2.04	17.0	16.6
	240	80	3	16	7	975	972	59.0	2 000	2 400	**22322EMD1**	**22322EMKD1**	139	124	226	209	3	0.32	2.09	3.11	2.04	17.4	17.1
120	180	46	2	8	3.5	446	577	35.8	2 400	3 100	**23024EAD1**	**23024EAKD1**	134	129	171	165	2	0.22	3.14	4.67	3.07	4.02	3.90
	180	46	2	8	3.5	446	577	35.8	2 400	3 100	**23024EMD1**	**23024EMKD1**	134	129	171	165	2	0.22	3.14	4.67	3.07	4.02	3.90
	180	60	2	8	3.5	526	726	34.4	2 100	2 600	**24024EMD1**	**24024EMK30D1**	132	129	171	161	2	0.29	2.32	3.45	2.26	5.28	5.21
	200	62	2	10	4.5	663	820	43.4	2 000	2 500	**23124EAD1**	**23124EAKD1**	138	131	189	179	2	0.28	2.43	3.61	2.37	7.72	7.49
	200	62	2	10	4.5	663	820	43.4	2 000	2 500	**23124EMD1**	**23124EMKD1**	138	131	189	179	2	0.28	2.43	3.61	2.37	7.77	7.54
	200	80	2	10	4.5	756	991	41.3	1 900	2 500	**24124EMD1**	**24124EMK30D1**	136	131	189	173	2	0.37	1.84	2.74	1.80	10.0	9.87
	215	58	2.1	12	6	688	753	49.9	2 400	3 000	**22224EAD1**	**22224EAKD1**	141	132	203	193	2.1	0.25	2.74	4.08	2.68	8.88	8.68
	215	58	2.1	12	6	688	753	49.9	2 400	3 000	**22224EMD1**	**22224EMKD1**	141	132	203	193	2.1	0.25	2.74	4.08	2.68	9.01	8.82
	215	76	2.1	11	5	857	998	49.8	1 900	2 400	**23224EMD1**	**23224EMKD1**	139	132	203	190	2.1	0.32	2.09	3.11	2.04	11.7	11.3
	260	86	3	18	8	1 170	1 280	68.4	1 800	2 200	**22324EAD1**	**22324EAKD1**	156	134	246	225	3	0.32	2.09	3.11	2.04	22.3	21.9
	260	86	3	18	8	1 170	1 280	68.4	1 800	2 200	**22324EMD1**	**22324EMKD1**	156	134	246	225	3	0.32	2.09	3.11	2.04	22.7	22.2
130	200	52	2	9	4	565	721	44.2	2 200	2 900	**23026EAD1**	**23026EAKD1**	145	139	191	183	2	0.22	3.01	4.48	2.94	5.88	5.71
	200	52	2	9	4	565	721	44.2	2 200	2 900	**23026EMD1**	**23026EMKD1**	145	139	191	183	2	0.22	3.01	4.48	2.94	5.90	5.73
	200	69	2	9	4	682	936	42.2	1 900	2 400	**24026EMD1**	**24026EMK30D1**	143	139	191	178	2	0.31	2.20	3.27	2.15	7.82	7.71
	210	64	2	10	4.5	710	906	47.1	1 900	2 400	**23126EAD1**	**23126EAKD1**	148	141	199	189	2	0.27	2.51	3.74	2.45	8.45	8.19
	210	64	2	10	4.5	710	906	47.1	1 900	2 400	**23126EMD1**	**23126EMKD1**	148	141	199	189	2	0.27	2.51	3.74	2.45	8.51	8.25
	210	80	2	10	4.5	803	1 080	45.0	1 800	2 400	**24126EMD1**	**24126EMK30D1**	146	141	199	183	2	0.34	1.96	2.92	1.92	10.7	10.5
	230	64	3	13	6	808	898	56.6	2 200	2 800	**22226EAD1**	**22226EAKD1**	151	144	216	206	3	0.25	2.69	4.00	2.63	11.0	10.7
	230	64	3	13	6	808	898	56.6	2 200	2 800	**22226EMD1**	**22226EMKD1**	151	144	216	206	3	0.25	2.69	4.00	2.63	11.1	10.9
	230	80	3	12	5	958	1 130	55.4	1 700	2 300	**23226EMD1**	**23226EMKD1**	150	144	216	203	3	0.32	2.12	3.15	2.07	13.8	13.4
	280	93	4	19	9	1 330	1 400	77.8	1 600	2 000	**22326EAD1**	**22326EAKD1**	164	147	263	243	4	0.33	2.06	3.06	2.01	27.2	26.6
	280	93	4	19	9	1 330	1 400	77.8	1 600	2 000	**22326EMD1**	**22326EMKD1**	164	147	263	243	4	0.33	2.06	3.06	2.01	28.0	27.5

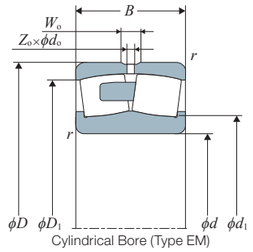
1) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio 1:30. 2) Smallest allowable dimension for chamfer dimension *r*.

ULTAGE

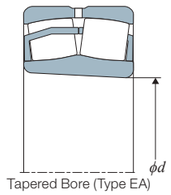
ULTAGE™ series Spherical Roller Bearings [Type EA, Type EM]



Cylindrical Bore (Type EA)



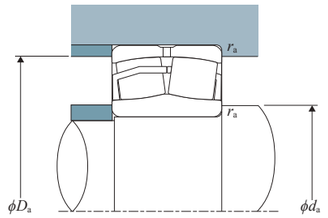
Cylindrical Bore (Type EM)



Tapered Bore (Type EA)

Number of oil inlets on outer ring

Nominal Bearing Outside Diameter D mm		Number of oil inlets Z_o
Or Higher	Less Than	
—	320	4
320	600	8



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Allowable Speed min^{-1}		Bearing Designation		Installation-related Dimensions mm					Constant	Axial Load Factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [2]	W_o	d_o	C_r	C_{0r}	C_u	Grease Lubrication	Oil Lubrication	Cylindrical Bore	Tapered Bore [1]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore
	210	53	2	9	4	597	783	47.5	2 100	2 700	**23028EAD1**	**23028EAKD1**	155	149	201	193	2	0.22	3.14	4.67	3.07	6.32	6.13
	210	53	2	9	4	597	783	47.5	2 100	2 700	**23028EMD1**	**23028EMKD1**	155	149	201	193	2	0.22	3.14	4.67	3.07	6.37	6.18
	210	69	2	9	4	709	990	46.0	1 800	2 200	**24028EMD1**	**24028EMK30D1**	153	149	201	188	2	0.28	2.37	3.53	2.32	8.27	8.15
	225	68	2.1	11	5	802	1 030	53.1	1 800	2 200	**23128EAD1**	**23128EAKD1**	159	152	213	203	2.1	0.26	2.55	3.80	2.50	10.3	9.94
	225	68	2.1	11	5	802	1 030	53.1	1 800	2 200	**23128EMD1**	**23128EMKD1**	159	152	213	203	2.1	0.26	2.55	3.80	2.50	10.3	10.0
140	225	85	2.1	10	4.5	951	1 280	53.3	1 700	2 200	**24128EMD1**	**24128EMK30D1**	156	152	213	198	2.1	0.34	1.98	2.94	1.93	12.9	12.8
	250	68	3	14	7	912	1 010	65.8	2 000	2 500	**22228EAD1**	**22228EAKD1**	163	154	236	224	3	0.25	2.74	4.08	2.68	13.9	13.6
	250	68	3	14	7	912	1 010	65.8	2 000	2 500	**22228EMD1**	**22228EMKD1**	163	154	236	224	3	0.25	2.74	4.08	2.68	14.2	13.9
	250	88	3	13	6	1 140	1 370	64.2	1 600	2 100	**23228EMD1**	**23228EMKD1**	162	154	236	220	3	0.33	2.06	3.06	2.01	18.2	17.7
	300	102	4	19	9	1 540	1 720	88.8	1 500	1 900	**22328EAD1**	**22328EAKD1**	181	157	283	261	4	0.33	2.03	3.02	1.98	34.4	33.7
	300	102	4	19	9	1 540	1 720	88.8	1 500	1 900	**22328EMD1**	**22328EMKD1**	181	157	283	261	4	0.33	2.03	3.02	1.98	35.4	34.7
	225	56	2.1	10	4.5	660	893	52.9	2 000	2 500	**23030EAD1**	**23030EAKD1**	167	161	214	207	2.1	0.21	3.20	4.77	3.13	7.68	7.45
	225	56	2.1	10	4.5	660	893	52.9	2 000	2 500	**23030EMD1**	**23030EMKD1**	167	161	214	207	2.1	0.21	3.20	4.77	3.13	7.73	7.50
	225	75	2.1	10	4.5	789	1 140	51.2	1 700	2 100	**24030EMD1**	**24030EMK30D1**	165	161	214	202	2.1	0.29	2.32	3.45	2.26	10.4	10.3
	250	80	2.1	13	6	1 060	1 350	65.1	1 600	2 000	**23130EAD1**	**23130EAKD1**	171	162	238	223	2.1	0.29	2.35	3.50	2.30	15.7	15.2
150	250	80	2.1	13	6	1 060	1 350	65.1	1 600	2 000	**23130EMD1**	**23130EMKD1**	171	162	238	223	2.1	0.29	2.35	3.50	2.30	15.8	15.3
	250	100	2.1	12	6	1 180	1 590	62.8	1 600	2 000	**24130EMD1**	**24130EMK30D1**	168	162	238	216	2.1	0.36	1.85	2.76	1.81	19.7	19.4
	270	73	3	15	7	1 080	1 220	74.4	1 800	2 300	**22230EAD1**	**22230EAKD1**	177	164	256	242	3	0.25	2.74	4.08	2.68	17.6	17.3
	270	73	3	15	7	1 080	1 220	74.4	1 800	2 300	**22230EMD1**	**22230EMKD1**	177	164	256	242	3	0.25	2.74	4.08	2.68	18.0	17.7
	270	96	3	14	6	1 340	1 620	74.0	1 500	1 900	**23230EMD1**	**23230EMKD1**	174	164	256	237	3	0.33	2.03	3.02	1.98	23.6	22.9
	320	108	4	20	9	1 740	1 890	98.9	1 400	1 700	**22330EMD1**	**22330EMKD1**	188	167	303	279	4	0.34	2.00	2.98	1.96	42.2	41.3
	220	45	2	9	4	455	683	45.6	1 900	2 400	**23932EMD1**	**23932EMKD1**	175	169	211	205	2	0.17	3.90	5.81	3.81	5.09	4.94
	240	60	2.1	11	5	748	1 000	59.1	1 800	2 300	**23032EAD1**	**23032EAKD1**	177	171	229	221	2.1	0.21	3.20	4.77	3.13	9.32	9.03
	240	60	2.1	11	5	748	1 000	59.1	1 800	2 300	**23032EMD1**	**23032EMKD1**	177	171	229	221	2.1	0.21	3.20	4.77	3.13	9.37	9.09
	240	80	2.1	10	5	901	1 290	56.8	1 600	2 000	**24032EMD1**	**24032EMK30D1**	175	171	229	215	2.1	0.29	2.32	3.45	2.26	12.6	12.4
	270	86	2.1	14	6	1 220	1 580	73.6	1 500	1 900	**23132EAD1**	**23132EAKD1**	185	172	258	240	2.1	0.29	2.35	3.50	2.30	20.1	19.5
160	270	86	2.1	14	6	1 220	1 580	73.6	1 500	1 900	**23132EMD1**	**23132EMKD1**	185	172	258	240	2.1	0.29	2.35	3.50	2.30	20.2	19.6
	270	109	2.1	14	6	1 360	1 860	70.6	1 500	1 800	**24132EMD1**	**24132EMK30D1**	181	172	258	232	2.1	0.37	1.83	2.72	1.79	25.4	25.1
	290	80	3	17	8	1 220	1 390	84.1	1 700	2 100	**22232EAD1**	**22232EAKD1**	190	174	276	260	3	0.25	2.69	4.00	2.63	22.3	21.8
	290	80	3	17	8	1 220	1 390	84.1	1 700	2 100	**22232EMD1**	**22232EMKD1**	190	174	276	260	3	0.25	2.69	4.00	2.63	22.9	22.4
	290	104	3	15	7	1 550	1 890	83.8	1 400	1 800	**23232EMD1**	**23232EMKD1**	187	174	276	254	3	0.33	2.03	3.02	1.98	29.6	28.8
	340	114	4	20	10	1 950	2 210	109	1 300	1 600	**22332EMD1**	**22332EMKD1**	205	177	323	296	4	0.33	2.03	3.02	1.98	50.5	49.5
	230	45	2	9	4.5	468	723	48.8	1 800	2 300	**23934EMD1**	**23934EMKD1**	185	179	221	215	2	0.16	4.11	6.12	4.02	5.39	5.23
	260	67	2.1	12	5	914	1 240	68.8	1 700	2 200	**23034EAD1**	**23034EAKD1**	190	181	249	238	2.1	0.22	3.07	4.57	3.00	12.7	12.3
	260	67	2.1	12	5	914	1 240	68.8	1 700	2 200	**23034EMD1**	**23034EMKD1**	190	181	249	238	2.1	0.22	3.07	4.57	3.00	12.8	12.4
	260	90	2.1	11	5	1 100	1 600	66.3	1 500	1 900	**24034EMD1**	**24034EMK30D1**	186	181	249	231	2.1	0.30	2.23	3.32	2.18	17.2	16.9
170	280	88	2.1	14	6	1 270	1 700	77.3	1 400	1 800	**23134EAD1**	**23134EAKD1**	195	182	268	250	2.1	0.28	2.39	3.56	2.34	21.5	20.9
	280	88	2.1	14	6	1 270	1 700	77.3	1 400	1 800	**23134EMD1**	**23134EMKD1**	195	182	268	250	2.1	0.28	2.39	3.56	2.34	21.6	20.9
	280	109	2.1	14	6	1 410	1 990	74.4	1 400	1 700	**24134EMD1**	**24134EMK30D1**	193	182	268	243	2.1	0.35	1.91	2.85	1.87	26.7	26.3
	310	86	4	18	8	1 400	1 610	94.7	1 600	2 000	**22234EMD1**	**22234EMKD1**	201	187	293	277	4	0.26	2.60	3.87	2.54	28.3	27.7
	310	110	4	16	8	1 700	2 070	94.6	1 300	1 700	**23234EMD1**	**23234EMKD1**	199	187	293	272	4	0.33	2.03	3.02	1.98	35.8	34.8
	360	120	4	20	10	2 200	2 630	121	1 200	1 500	**22334EMD1**	**22334EMKD1**	223	187	343	313	4	0.32	2.09	3.11	2.04	60.3	59.1

1) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio 1:30. 2) Smallest allowable dimension for chamfer dimension *r*.

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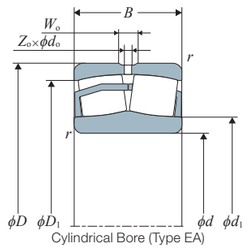
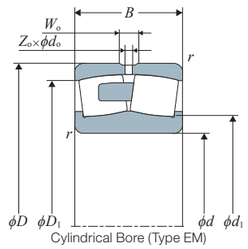
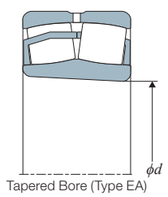
ULTAGE™ series Spherical Roller Bearings [Type EA, Type EM]



Cylindrical Bore (Type EA)



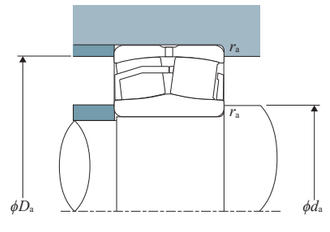
Cylindrical Bore (Type EM)



Tapered Bore (Type EA)

Number of oil inlets on outer ring

Nominal Bearing Outside Diameter D mm		Number of oil inlets Z_o
Or Higher	Less Than	
—	320	4
320	600	8



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Allowable Speed min^{-1}		Bearing Designation		Installation-related Dimensions mm					Constant	Axial Load Factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [2]	W_o	d_o	C_r	C_{0r}	C_u	Grease Lubrication	Oil Lubrication	Cylindrical Bore	Tapered Bore [1]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore
180	250	52	2	10	5	573	869	57.2	1 700	2 100	**23936EMD1**	**23936EMKD1**	199	189	241	232	2	0.17	3.90	5.81	3.81	7.79	7.56
	280	74	2.1	13	6	1 080	1 450	78.6	1 600	2 000	**23036EAD1**	**23036EAKD1**	201	191	269	255	2.1	0.23	2.95	4.40	2.89	16.8	16.3
	280	74	2.1	13	6	1 080	1 450	78.6	1 600	2 000	**23036EMD1**	**23036EMKD1**	201	191	269	255	2.1	0.23	2.95	4.40	2.89	16.9	16.4
	280	100	2.1	13	6	1 310	1 880	76.0	1 400	1 800	**24036EMD1**	**24036EMK30D1**	199	191	269	248	2.1	0.31	2.15	3.20	2.10	22.8	22.4
	300	96	3	15	7	1 490	1 960	88.7	1 300	1 700	**23136EAD1**	**23136EAKD1**	205	194	286	267	3	0.29	2.32	3.45	2.26	27.2	26.4
	300	96	3	15	7	1 490	1 960	88.7	1 300	1 700	**23136EMD1**	**23136EMKD1**	205	194	286	267	3	0.29	2.32	3.45	2.26	27.4	26.5
	300	118	3	15	7	1 660	2 290	85.5	1 300	1 600	**24136EMD1**	**24136EMK30D1**	202	194	286	259	3	0.36	1.87	2.79	1.83	33.5	33.0
	320	86	4	18	8	1 450	1 660	101	1 500	1 900	**22236EMD1**	**22236EMKD1**	209	197	303	287	4	0.25	2.74	4.08	2.68	29.3	28.7
	320	112	4	16	8	1 800	2 270	101	1 200	1 600	**23236EMD1**	**23236EMKD1**	210	197	303	282	4	0.33	2.06	3.06	2.01	38.2	37.1
	380	126	4	21	10	2 420	2 810	132	1 100	1 400	**22336EMD1**	**22336EMKD1**	229	197	363	329	4	0.32	2.09	3.11	2.04	70.2	68.7
190	260	52	2	10	5	603	935	62.8	1 600	2 000	**23938EMD1**	**23938EMKD1**	209	199	251	243	2	0.17	4.05	6.04	3.96	8.20	7.96
	290	75	2.1	13	6	1 140	1 570	83.5	1 500	1 900	**23038EAD1**	**23038EAKD1**	213	201	279	266	2.1	0.22	3.01	4.48	2.94	17.8	17.3
	290	75	2.1	13	6	1 140	1 570	83.5	1 500	1 900	**23038EMD1**	**23038EMKD1**	213	201	279	266	2.1	0.22	3.01	4.48	2.94	17.9	17.4
	290	100	2.1	13	6	1 360	2 000	80.7	1 300	1 700	**24038EMD1**	**24038EMK30D1**	209	201	279	258	2.1	0.30	2.23	3.32	2.18	23.8	23.4
	320	104	3	17	8	1 670	2 250	100	1 200	1 600	**23138EMD1**	**23138EMKD1**	221	204	306	284	3	0.29	2.32	3.45	2.26	34.3	33.2
	320	128	3	16	8	1 900	2 700	96.8	1 200	1 500	**24138EMD1**	**24138EMK30D1**	216	204	306	275	3	0.37	1.84	2.74	1.80	42.1	41.5
	340	92	4	20	9	1 620	1 870	112	1 400	1 800	**22238EMD1**	**22238EMKD1**	222	207	323	305	4	0.25	2.74	4.08	2.68	35.6	34.9
	340	120	4	18	8	1 990	2 480	109	1 200	1 500	**23238EMD1**	**23238EMKD1**	220	207	323	299	4	0.33	2.03	3.02	1.98	46.1	44.7
	400	132	5	21	10	2 600	3 120	145	1 000	1 300	**22338EMD1**	**22338EMKD1**	247	210	380	346	5	0.32	2.12	3.15	2.07	81.5	79.9
200	280	60	2.1	12	6	766	1 190	71.8	1 500	1 900	**23940EMD1**	**23940EMKD1**	221	211	269	260	2.1	0.18	3.76	5.59	3.67	12.0	11.6
	310	82	2.1	15	7	1 310	1 790	94.1	1 400	1 800	**23040EMD1**	**23040EMKD1**	223	211	299	283	2.1	0.23	2.95	4.40	2.89	22.8	22.1
	310	109	2.1	14	7	1 570	2 280	91.1	1 200	1 600	**24040EMD1**	**24040EMK30D1**	221	211	299	275	2.1	0.31	2.18	3.24	2.13	30.2	29.7
	340	112	3	18	8	1 890	2 510	110	1 100	1 400	**23140EMD1**	**23140EMKD1**	231	214	326	301	3	0.30	2.25	3.34	2.20	41.9	40.6
	340	140	3	17	8	2 130	2 930	105	1 100	1 400	**24140EMD1**	**24140EMK30D1**	224	214	326	291	3	0.39	1.74	2.59	1.70	51.5	50.7
	360	98	4	20	10	1 810	2 100	124	1 400	1 700	**22240EMD1**	**22240EMKD1**	234	217	343	323	4	0.25	2.74	4.08	2.68	42.7	41.8
	360	128	4	19	9	2 250	2 840	120	1 100	1 300	**23240EMD1**	**23240EMKD1**	232	217	343	315	4	0.34	1.98	2.94	1.93	55.2	53.6
	420	138	5	21	10	2 830	3 530	158	950	1 200	**22340EMD1**	**22340EMKD1**	265	220	400	364	5	0.31	2.15	3.20	2.10	94.6	92.7
220	300	60	2.1	12	6	789	1 260	79.4	1 400	1 700	**23944EMD1**	**23944EMKD1**	241	231	289	280	2.1	0.17	4.05	6.04	3.96	12.5	12.1
	340	90	3	15	7	1 530	2 110	109	1 300	1 600	**23044EMD1**	**23044EMKD1**	246	233	327	310	3	0.23	2.95	4.40	2.89	29.9	29.1
	340	118	3	15	7	1 850	2 720	106	1 100	1 400	**24044EMD1**	**24044EMK30D1**	243	233	327	302	3	0.31	2.20	3.27	2.15	39.2	38.6
	370	120	4	19	9	2 190	2 940	128	1 000	1 300	**23144EMD1**	**23144EMKD1**	252	237	353	328	4	0.30	2.28	3.39	2.23	52.3	50.7
	370	150	4	19	9	2 540	3 620	124	1 000	1 300	**24144EMD1**	**24144EMK30D1**	247	237	353	317	4	0.38	1.78	2.65	1.74	65.2	64.3
	400	108	4	21	11	2 210	2 690	149	1 200	1 500	**22244EMD1**	**22244EMKD1**	264	237	383	358	4	0.25	2.74	4.08	2.68	59.6	58.4
	400	144	4	20	10	2 890	3 830	147	1 000	1 200	**23244EMD1**	**23244EMKD1**	261	237	383	349	4	0.34	2.00	2.98	1.96	79.4	77.1
240	320	60	2.1	12	6	815	1 350	87.7	1 300	1 600	**23948EMD1**	**23948EMKD1**	262	251	309	301	2.1	0.15	4.40	6.56	4.31	13.5	13.1
	360	92	3	16	8	1 630	2 350	120	1 100	1 400	**23048EMD1**	**23048EMKD1**	267	253	347	329	3	0.22	3.07	4.57	3.00	32.0	31.7
	360	118	3	16	8	1 940	2 980	116	1 000	1 300	**24048EMD1**	**24048EMK30D1**	264	253	347	322	3	0.28	2.37	3.53	2.32	42.2	41.6
	400	128	4	20	9	2 510	3 500	147	960	1 200	**23148EMD1**	**23148EMKD1**	276	257	383	356	4	0.29	2.32	3.45	2.26	65.1	63.1
	400	160	4	19	9	2 910	4 290	142	960	1 200	**24148EMD1**	**24148EMK30D1**	270	257	383	344	4	0.37	1.82	2.70	1.78	81.0	79.8
260	360	75	2.1	14	7	1 130	1 940	105	1 100	1 400	**23952EMD1**	**23952EMKD1**	292	271	349	335	2.1	0.17	3.90	5.81	3.81	23.9	23.1
	400	104	4	18	8	2 060	2 910	144	1 000	1 300	**23052EMD1**	**23052EMKD1**	291	275	385	366	4	0.23	2.95	4.40	2.89	47.8	46.3
	400	140	4	18	8	2 520	3 820	139	960	1 200	**24052EMD1**	**24052EMK30D1**	286	275	385	354	4	0.31	2.16	3.22	2.12	63.6	62.6
280	380	75	2.1	14	7	1 180	2 050	115	1 000	1 300	**23956EMD1**	**23956EMKD1**	310	291	369	356	2.1	0.16	4.16	6.20	4.07	25.2	24.4
	420	106	4	18	8	2 170	3 150	155	960	1 200	**23056EMD1**	**23056EMKD1**	310	295	405	386	4	0.22	3.07	4.57	3.00	51.3	49.7
	420	140	4	18	8	2 620	4 060	150	880	1 100	**24056EMD1**	**24056EMK30D1**	306	295	405	376	4	0.29	2.30	3.42	2.25	67.3	66.3

1) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio 1:30. 2) Smallest allowable dimension for chamfer dimension r.

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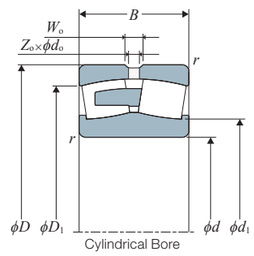
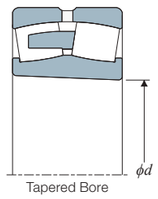
ULTAGE™ series Spherical Roller Bearings [Type EM (Large Size)]



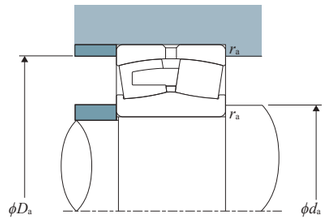
Cylindrical Bore



Tapered Bore

Number of oil inlets on outer ring

Number of oil Inlets Z_o
8



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Allowable Speed min^{-1}		Bearing Designation		Installation-related Dimensions mm					Constant	Axial Load Factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$ [2]	W_o	d_o	C_r	C_{0r}	C_u	Grease Lubrication	Oil Lubrication	Cylindrical Bore	Tapered Bore [1]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore
220	460	145	5	20	12	3 010	3 560	163	850	1 090	**22344EMD1**	**22344EMKD1**	277	240	440	388	5	0.32	2.10	3.13	2.06	119	116
	440	120	4	16	10	2 470	3 110	159	1 060	1 350	**22248EMD1**	**22248EMKD1**	288	257	423	383	4	0.27	2.53	3.77	2.47	82.6	80.9
240	440	160	4	20	12	3 140	4 260	156	850	1 090	**23248EMD1**	**23248EMKD1**	284	257	423	372	4	0.36	1.86	2.77	1.82	108	105
	500	155	5	20	12	3 500	4 170	193	780	1 000	**22348EMD1**	**22348EMKD1**	299	260	480	421	5	0.32	2.12	3.15	2.07	149	146
	440	144	4	20	12	2 780	4 020	160	860	1 090	**23152EMD1**	**23152EMKD1**	302	277	423	380	4	0.31	2.15	3.20	2.10	92.2	89.5
	440	180	4	27	16	3 290	4 880	147	850	1 090	**24152EMD1**	**24152EMK30D1**	295	277	423	371	4	0.40	1.69	2.52	1.65	111	109
260	480	130	5	20	12	2 890	3 680	183	970	1 240	**22252EMD1**	**22252EMKD1**	312	280	460	415	5	0.27	2.53	3.77	2.47	108	105
	480	174	5	27	16	3 650	5 050	180	780	1 000	**23252EMD1**	**23252EMKD1**	310	280	460	405	5	0.36	1.87	2.79	1.83	143	139
	540	165	6	27	16	4 020	4 830	221	720	920	**22352EMD1**	**22352EMKD1**	324	286	514	456	6	0.31	2.16	3.22	2.12	186	183
	460	146	5	20	12	2 980	4 400	182	810	1 030	**23156EMD1**	**23156EMKD1**	322	300	440	403	5	0.30	2.23	3.32	2.18	98.4	95.3
	460	180	5	27	16	3 550	5 450	167	810	1 030	**24156EMD1**	**24156EMK30D1**	316	300	440	394	5	0.38	1.78	2.65	1.74	118	117
280	500	130	5	20	12	3 010	3 920	198	920	1 180	**22256EMD1**	**22256EMKD1**	333	300	480	437	5	0.25	2.69	4.00	2.63	113	111
	500	176	5	27	16	3 770	5 340	193	740	950	**23256EMD1**	**23256EMKD1**	331	300	480	426	5	0.35	1.95	2.90	1.91	152	148
	580	175	6	27	16	4 490	5 450	249	670	860	**22356EMD1**	**22356EMKD1**	349	306	554	489	6	0.31	2.18	3.24	2.13	228	223
	420	90	3	14	8	1 600	2 620	145	890	1 140	**23960EMD1**	**23960EMKD1**	329	313	407	387	3	0.20	3.42	5.09	3.34	40.1	39.2
	460	118	4	16	10	2 400	3 610	176	890	1 130	**23060EMD1**	**23060EMKD1**	338	315	445	413	4	0.24	2.81	4.19	2.75	72.9	70.9
	460	160	4	20	12	3 150	5 190	166	760	970	**24060EMD1**	**24060EMK30D1**	332	315	445	401	4	0.33	2.04	3.04	2.00	98.0	96.9
300	500	160	5	20	12	3 540	5 170	205	750	950	**23160EMD1**	**23160EMKD1**	345	320	480	436	5	0.31	2.20	3.27	2.15	129	125
	500	200	5	27	16	4 270	6 610	198	750	950	**24160EMD1**	**24160EMK30D1**	340	320	480	425	5	0.39	1.74	2.59	1.70	159	157
	540	140	5	20	12	3 470	4 590	232	860	1 080	**22260EMD1**	**22260EMKD1**	358	320	520	469	5	0.25	2.69	4.00	2.63	134	131
	540	192	5	27	16	4 520	6 280	228	690	880	**23260EMD1**	**23260EMKD1**	352	320	520	461	5	0.35	1.92	2.86	1.88	194	188
	440	90	3	14	8	1 670	2 820	154	840	1 080	**23964EMD1**	**23964EMKD1**	350	333	427	407	3	0.19	3.62	5.39	3.54	42.1	40.8
	480	121	4	20	12	2 540	4 020	191	850	1 070	**23064EMD1**	**23064EMKD1**	360	335	465	433	4	0.23	2.92	4.35	2.86	78.9	76.6
	480	160	4	20	12	3 250	5 400	184	720	920	**24064EMD1**	**24064EMK30D1**	352	335	465	423	4	0.31	2.15	3.20	2.10	104	102
320	540	176	5	27	16	4 020	6 020	227	700	880	**23164EMD1**	**23164EMKD1**	373	340	520	468	5	0.31	2.15	3.20	2.10	169	164
	540	218	5	33	20	5 010	7 720	225	690	880	**24164EMD1**	**24164EMK30D1**	363	340	520	457	5	0.39	1.71	2.54	1.67	204	201
	580	150	5	20	12	3 950	5 100	261	800	1 020	**22264EMD1**	**22264EMKD1**	383	340	560	510	5	0.25	2.69	4.00	2.63	177	174
	580	208	5	33	20	5 230	7 370	259	640	820	**23264EMD1**	**23264EMKD1**	376	340	560	493	5	0.35	1.91	2.85	1.87	245	238
	460	90	3	14	8	1 710	2 980	162	800	1 020	**23968EMD1**	**23968EMKD1**	370	353	447	427	3	0.18	3.80	5.66	3.72	44.5	43.1
	520	133	5	20	12	2 990	4 690	219	790	1 000	**23068EMD1**	**23068EMKD1**	384	358	502	466	5	0.24	2.87	4.27	2.80	98.5	95.5
340	520	180	5	27	16	3 910	6 510	206	670	860	**24068EMD1**	**24068EMK30D1**	377	358	502	456	5	0.33	2.06	3.06	2.01	140	137
	580	190	5	27	16	4 670	6 870	257	650	830	**23168EMD1**	**23168EMKD1**	393	360	560	500	5	0.32	2.12	3.15	2.07	213	206
	580	243	5	33	20	5 980	9 340	254	650	830	**24168EMD1**	**24168EMK30D1**	385	360	560	486	5	0.41	1.65	2.46	1.61	266	262
	480	90	3	14	8	1 750	3 090	171	760	970	**23972EMD1**	**23972EMKD1**	390	373	467	447	3	0.17	4.00	5.96	3.91	46.2	44.8
360	540	134	5	20	12	3 070	4 910	232	750	950	**23072EMD1**	**23072EMKD1**	405	378	522	488	5	0.23	2.98	4.44	2.92	111	108
	540	180	5	27	16	4 040	6 840	220	640	820	**24072EMD1**	**24072EMK30D1**	398	378	522	478	5	0.31	2.16	3.22	2.12	147	145
	520	106	4	16	10	2 340	4 000	205	710	910	**23976EMD1**	**23976EMKD1**	412	395	505	481	4	0.18	3.66	5.46	3.58	68.0	65.9
380	560	135	5	20	12	3 230	5 270	247	720	910	**23076EMD1**	**23076EMKD1**	425	398	542	509	5	0.22	3.07	4.57	3.00	117	113
	560	180	5	27	16	4 140	7 280	240	610	780	**24076EMD1**	**24076EMK30D1**	420	398	542	499	5	0.30	2.25	3.34	2.20	154	151
400	540	106	4	16	10	2 370	4 170	215	680	870	**23980EMD1**	**23980EMKD1**	433	415	525	501	4	0.18	3.80	5.66	3.72	71.4	69.2
420	560	106	4	16	10	2 390	4 320	230	650	830	**23984EMD1**	**23984EMKD1**	454	435	545	522	4	0.17	3.95	5.88	3.86	74.9	72.6

1) Bearings appended with "**K**" have a tapered bore ratio of 1:12; bearings appended with "**K30**" have a tapered bore ratio 1:30. 2) Smallest allowable dimension for chamfer dimension r.

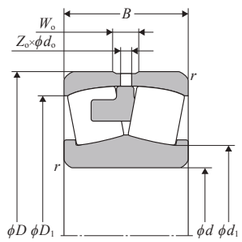
ULTAGE

ULTAGE™ Series Spherical Roller Bearings with High-strength Cage [EMA Type]

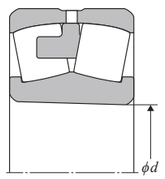
Bearing Designation

223	20	EMA	K	D1	VS1

- **Vibrating screen specification** – no code : general bearing clearance and precision
- **Oil inlet/groove code** – D1 : with oil inlet/groove
- **Bore configuration code** – no code : cylindrical; K : tapered
- **Bearing type code** – one-piece machined cage of outer ring guide
- Bore diameter number
- Bearing series (type code + width series code + diameter series code.)



Cylindrical bore



Tapered bore

Number of oil inlets on outer ring

Nominal Bearing Outside Diameter D mm		Number of Oil Inlets Z_O
Or Higher	Less Than	
–	320	4
320	420[1)]	8

1) 420 mm is included in this size class.

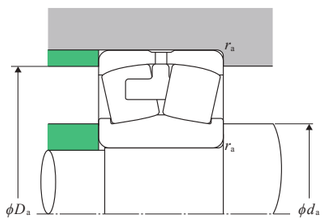
Vibrating Screen Specification (VS spec.)

Bearing specification suitable for vibrating screen applications.

The inner and outer diameter tolerances and radial internal clearances of these bearing specifications are set to the correct operating clearances for vibrating screen applications.

Unit : mm

Dimensional tolerance of mean bore diameter within plane				Dimensional tolerance of mean outside diameter within plane				Radial Internal Clearance (Cylindrical Bore)					
Nominal Bearing Bore Diameter d		VS1, VS2		Nominal Bearing Outside Diameter D		VS1, VS2		Nominal Bearing Bore Diameter d		VS1		VS2	
Over	Incl.	Upper	Lower	Over	Incl.	Upper	Lower	Over	Incl.	Min.	Max.	Min.	Max.
	80	0	– 0.010		150	– 0.005	– 0.013	65	65	0.075	0.090	0.100	0.120
80	120	0	– 0.013	150	180	– 0.005	– 0.018	80	80	0.090	0.110	0.120	0.145
120	180	0	– 0.015	180	315	– 0.010	– 0.023	100	100	0.110	0.135	0.150	0.180
180	200	0	– 0.018	315	400	– 0.013	– 0.028	120	120	0.135	0.160	0.180	0.210
				400	420	– 0.014	– 0.030	140	140	0.160	0.190	0.205	0.240
								160	160	0.190	0.220	0.240	0.280
								180	180	0.200	0.240	0.260	0.310
									200	0.220	0.260	0.285	0.340



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{or} = F_r + Y_0 F_a$

e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Allowable Speed min^{-1}	Bearing Designation		Installation-related Dimensions					Constant	Axial Load Factors			Mass (approx.) kg	
d	D	B	$r_{s\,min}$[2)]	W_o	d_o	C_r	C_{0r}	C_u	Oil Lubrication	Cylindrical Bore	Tapered Bore[1)]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore
70	150	51	2.1	10	5	397	368	24.2	4 700	**22314EMAD1**	**22314EMAKD1**	85	82	138	131	2.1	0.34	2.00	2.98	1.96	4.34	4.25
75	160	55	2.1	10	5	464	434	27.6	4 400	**22315EMAD1**	**22315EMAKD1**	91	87	148	139	2.1	0.34	2.00	2.98	1.96	5.30	5.19
80	170	58	2.1	10	5	512	485	30.2	4 100	**22316EMAD1**	**22316EMAKD1**	98	92	158	148	2.1	0.34	2.00	2.98	1.96	6.32	6.19
85	180	60	3	11	5	538	524	31.5	3 900	**22317EMAD1**	**22317EMAKD1**	107	99	166	157	3	0.32	2.09	3.11	2.04	7.19	7.05
90	190	64	3	12	5	632	605	37.1	3 700	**22318EMAD1**	**22318EMAKD1**	110	104	176	166	3	0.33	2.06	3.06	2.01	8.58	8.41
95	200	67	3	12	6	658	650	37.6	3 500	**22319EMAD1**	**22319EMAKD1**	120	109	186	174	3	0.32	2.09	3.11	2.04	9.80	9.60
100	215	73	3	13	6	743	731	43.4	3 300	**22320EMAD1**	**22320EMAKD1**	127	114	201	187	3	0.34	1.98	2.94	1.93	12.8	12.5
110	240	80	3	16	7	869	833	50.5	3 000	**22322EMAD1**	**22322EMAKD1**	139	124	226	209	3	0.32	2.09	3.11	2.04	17.3	16.9
120	260	86	3	18	8	1 060	1 120	59.8	2 700	**22324EMAD1**	**22324EMAKD1**	156	134	246	225	3	0.32	2.09	3.11	2.04	22.5	22.0
130	280	93	4	19	9	1 260	1 310	72.6	2 500	**22326EMAD1**	**22326EMAKD1**	164	147	263	243	4	0.33	2.06	3.06	2.01	28.4	27.8
140	300	102	4	19	9	1 400	1 500	77.7	2 400	**22328EMAD1**	**22328EMAKD1**	181	157	283	261	4	0.33	2.03	3.02	1.98	34.6	33.8
150	320	108	4	20	9	1 570	1 640	85.7	2 200	**22330EMAD1**	**22330EMAKD1**	188	167	303	279	4	0.34	2.00	2.98	1.96	41.9	41.0
160	340	114	4	20	10	1 760	1 940	95.6	2 100	**22332EMAD1**	**22332EMAKD1**	205	177	323	296	4	0.33	2.03	3.02	1.98	50.1	49.1
170	360	120	4	20	10	2 010	2 320	107	1 900	**22334EMAD1**	**22334EMAKD1**	223	187	343	313	4	0.32	2.09	3.11	2.04	59.7	58.5
180	380	126	4	21	10	2 190	2 460	115	1 800	**22336EMAD1**	**22336EMAKD1**	229	197	363	329	4	0.32	2.09	3.11	2.04	69.3	67.9
190	400	132	5	21	10	2 370	2 750	128	1 700	**22338EMAD1**	**22338EMAKD1**	247	210	380	346	5	0.32	2.12	3.15	2.07	81.0	79.4
200	420	138	5	21	10	2 590	3 140	140	1 600	**22340EMAD1**	**22340EMAKD1**	265	220	400	364	5	0.31	2.15	3.20	2.10	94.1	92.2

1) "**K**" indicates bearings have tapered bore with a taper ratio of 1:12. 2) Smallest allowable dimension for chamfer dimension r.

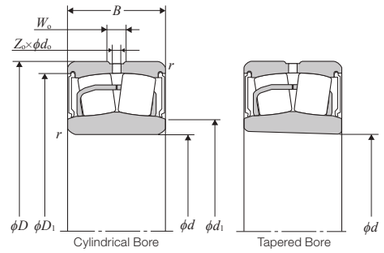
ULTAGE

ULTAGE™ series Sealed Spherical Roller Bearings [WA Type]

Bearing Designation

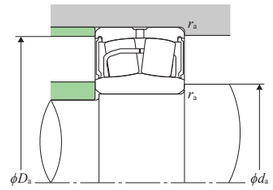
WA 222 20 EA LLS K D1 C3 / 8A

- 8A – Grease code – 8A : Alvania EP Grease 2
- C3 – Internal clearance code
- D1 – Oil inlet/groove code – D1 : with oil inlet/groove; W33 : with oil inlet/groove (Manufacturing in Europe)
- K – Bore configuration code – no code : cylindrical; K : tapered
- LLS – Contact seal code – both sides
- EA – Bearing type code – EA : window type pressed-steel cage
- 20 – Bore diameter number
- 222 – Bearing series (type code + width series code + diameter series code.)
- WA – Bearings with width dimensions different to standard sizes



Number of oil inlets on outer ring

Number of oil inlets Z_o	
D1	W33
4	3



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

e, Y_1, Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Bearing Designation[3]		Installation-related Dimensions mm					Constant	Axial Load Factors			Mass (approx.) kg		Amount of Grease Fill (approx.) g
d	D	B	$r_{s\,min}$[2]	W_o	d_o	C_r	C_{0r}	C_u	Cylindrical Bore	Tapered Bore[1]	d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	e	Y_1	Y_2	Y_0	Cylindrical Bore	Tapered Bore	
25	52	23	1	3	1.5	57.3	46.1	3.23	**WA22205EALLSW33/8A**	—	29	29	47	47	1	0.34	2.00	2.98	1.96	0.19	–	1.4 – 2.4
30	62	25	1	4	2	75.7	64.5	4.58	**WA22206EALLSW33/8A**	—	36	36	56	56	1	0.31	2.15	3.20	2.10	0.31	–	2.0 – 3.3
35	72	28	1.1	5	2	100	92	6.11	**WA22207EALLSW33/8A**	**WA22207EALLSKW33/8A**	43	42	65	65	1.1	0.31	2.21	3.29	2.16	0.51	0.50	2.3 – 3.9
40	80	28	1.1	5	2.5	116	105	7.78	**WA22208EALLSD1/8A**	**WA22208EALLSKD1/8A**	48	47	73	73	1.1	0.27	2.47	3.67	2.41	0.60	0.59	3.1 – 5.2
45	85	28	1.1	6	2.5	121	113	8.76	**WA22209EALLSD1/8A**	**WA22209EALLSKD1/8A**	53	52	78	78	1.1	0.26	2.64	3.93	2.58	0.65	0.63	3.4 – 5.7
50	90	28	1.1	6	2.5	130	124	10.1	**WA22210EALLSD1/8A**	**WA22210EALLSKD1/8A**	58	57	83	83	1.1	0.24	2.84	4.23	2.78	0.72	0.70	3.4 – 5.6
55	100	31	1.5	6	3	155	148	12.6	**WA22211EALLSD1/8A**	**WA22211EALLSKD1/8A**	64	64	93	93	1.5	0.23	2.95	4.40	2.89	0.97	0.94	4.7 – 7.9
60	110	34	1.5	7	3	187	181	15.4	**WA22212EALLSD1/8A**	**WA22212EALLSKD1/8A**	70	69	102	102	1.5	0.24	2.84	4.23	2.78	1.29	1.26	6.6 – 11.0
65	120	38	1.5	8	3.5	226	224	18.2	**WA22213EALLSD1/8A**	**WA22213EALLSKD1/8A**	76	74	111	110	1.5	0.24	2.79	4.15	2.73	1.73	1.68	8.5 – 14.2
70	125	38	1.5	7	3.5	235	240	20.1	**WA22214EALLSD1/8A**	**WA22214EALLSKD1/8A**	82	79	116	116	1.5	0.22	3.01	4.48	2.94	1.86	1.81	9.6 – 16.0
75	130	38	1.5	7	3.5	244	249	21.1	**WA22215EALLSD1/8A**	**WA22215EALLSKD1/8A**	86	84	121	121	1.5	0.22	3.14	4.67	3.07	1.93	1.88	9.9 – 16.4
80	140	40	2	8	3.5	278	287	24.0	**WA22216EALLSD1/8A**	**WA22216EALLSKD1/8A**	93	91	131	131	2	0.22	3.14	4.67	3.07	2.38	2.32	12.0 – 20.0
85	150	44	2	8	3.5	324	330	27.1	**WA22217EALLSD1/8A**	**WA22217EALLSKD1/8A**	98	96	140	140	2	0.22	3.07	4.57	3.00	2.97	2.89	16.9 – 28.1
90	160	48	2	10	4.5	384	398	30.2	**WA22218EALLSD1/8A**	**WA22218EALLSKD1/8A**	103	101	149	147	2	0.23	2.90	4.31	2.83	3.75	3.66	20.0 – 34.0
95	170	51	2.1	10	4.5	416	417	33.4	**WA22219EALLSD1/8A**	**WA22219EALLSKD1/8A**	108	107	158	157	2.1	0.23	2.95	4.40	2.89	4.44	4.32	25.9 – 43.2
100	180	55	2.1	11	5	472	495	36.9	**WA22220EALLSD1/8A**	**WA22220EALLSKD1/8A**	115	112	168	165	2.1	0.24	2.84	4.23	2.78	5.53	5.39	28.8 – 48.0
110	200	63	2.1	12	6	602	643	45.0	**WA22222EALLSD1/8A**	**WA22222EALLSKD1/8A**	127	122	188	183	2.1	0.25	2.69	4.00	2.63	7.98	7.76	41.6 – 69.3
120	215	69	2.1	12	6	688	753	49.9	**WA22224EALLSD1/8A**	**WA22224EALLSKD1/8A**	138	132	203	197	2.1	0.25	2.74	4.08	2.68	9.96	9.67	52.8 – 88.0
130	230	75	3	13	6	808	898	56.6	**WA22226EALLSD1/8A**	**WA22226EALLSKD1/8A**	148	144	216	211	3	0.25	2.69	4.00	2.63	12.2	11.8	62.6 – 104.4

1) "**K**" indicates bearings have tapered bore with a taper ratio of 1:12. 2) Smallest allowable dimension for chamfer dimension *r*. 3) "**W33**" indicates manufacturing in Europe.

Handling Precautions

1. Because the internal radial clearance of sealed spherical roller bearings cannot be measured with a feeler gauge, please monitor clearances by measuring the axial movement of the inner ring as shown in **Table 1**.
2. During assembly, if misalignment exceeding the allowable misalignment angle of ±1/115 is applied to the bearing, rollers may come in direct contact with seals causing seal deformation. Furthermore, if additional force is applied under these conditions, seals may separate from the bearing entirely. Therefore, caution is advised.
3. Please use Lithium based grease. In case other types of grease are to be used, please consult **NTN**.
4. If a shrink fit is to be applied, please do not exceed a bearing temperature of 100 ˚C. However, these bearing cannot be shrink fit via immersion in a hot oil bath.

Table 1 Installing Tapered Bore Spherical Roller Bearings (ULTAGE™ series)

Unit : mm

Nominal Bearing Bore Diameter d		Reduction of Radial Internal Clearance		Axial Displacement Drive-up		Minimum Residual Radial Internal Clearance		
Over	Incl.	Min.	Max.	Min.	Max.	CN	C3	C4
24	30	0.010	0.015	0.15	0.20	0.015	0.025	0.040
30	40	0.015	0.020	0.25	0.30	0.015	0.030	0.045
40	50	0.020	0.025	0.35	0.40	0.020	0.035	0.055
50	65	0.025	0.030	0.40	0.45	0.025	0.045	0.065
65	80	0.035	0.040	0.50	0.60	0.030	0.055	0.080
80	100	0.040	0.050	0.60	0.70	0.030	0.060	0.090
100	120	0.055	0.065	0.80	0.90	0.035	0.070	0.105
120	130	0.065	0.075	0.90	1.00	0.045	0.085	0.125

ULTAGE

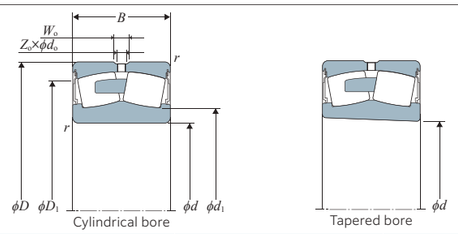
ULTAGE™ series Sealed Spherical Roller Bearings [EMLLX Type]

Bearing Designation

231 36 EM LLX K D1 C3 / 0G V11

- Product specification code – V10: installed seals for both sides
  V11: installed a seal for one side only
  Seal for opposite side (on the side with smaller diameter for tapered bore) is not installed but packed with product.
- Lubricant code – /8A: Alvania EP Grease 2
  /0G: No grease
- Internal clearance code
- Oil inlet/groove code – D1: with oil inlet/groove
- Bore configuration code – no code : cylindrical
  K : tapered
- Contact seal code – both sides
- Bearing Type Code – EM: one-piece machined high-tension brass cage
- Bore diameter number
- Bearing series (type code + width series code + diameter series code.)

*The lubricant code and the product specification code have the following combinations
/8AV10 or /0GV11



Number of oil inlets on outer ring

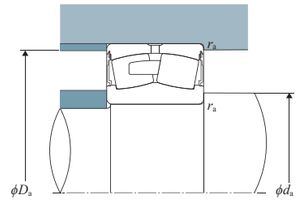
Nominal Bearing Outside Diameter D mm		Number of Oil Inlets Z_o
Or Higher	Less Than	
—	320	4
320	—	8

Table 2 Installing Tapered Bore Sealed Spherical Roller Bearings (EMLLX Type)

Unit : mm

Nominal Bearing Bore Diameter d	Bearing Designation	Reduction of Radial Internal Clearance Min.	Reduction of Radial Internal Clearance Max.	Axial Displacement Drive-up Min.	Axial Displacement Drive-up Max.	Minimum Residual Radial Internal Clearance[1] CN	C3	C4
140	**22228EMLLXKD1**	0.065	0.075	1.0	1.1	0.045	0.085	0.125
150	**22230EMLLXKD1**	0.070	0.085	1.0	1.2	0.045	0.095	0.145
160	**22232EMLLXKD1**	0.065	0.085	1.0	1.2	0.045	0.095	0.145
170	**22234EMLLXKD1**	0.075	0.095	1.1	1.4	0.045	0.105	0.165
170	**23134EMLLXKD1**	0.075	0.095	1.1	1.4	0.045	0.105	0.165
180	**23136EMLLXKD1**	0.075	0.095	1.1	1.4	0.045	0.105	0.165
190	**23138EMLLXKD1**	0.085	0.105	1.2	1.5	0.055	0.115	0.185
200	**23140EMLLXKD1**	0.085	0.105	1.2	1.5	0.055	0.115	0.185
220	**23144EMLLXKD1**	0.105	0.125	1.5	1.8	0.055	0.125	0.195
220	**22244EMLLXKD1**	0.100	0.120	1.5	1.8	0.060	0.130	0.200
240	**23048EMLLXKD1**	0.115	0.135	1.6	1.9	0.065	0.135	0.215
240	**23148EMLLXKD1**	0.110	0.130	1.6	1.9	0.070	0.140	0.220

1) Minimum residual radial internal clearance: Standard value of radial internal clearance (min) - reduction in radial internal clearance (max)
Note:For models not shown on the table, contact **NTN** Engineering.



Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
X	Y	X	Y
1	Y_1	0.67	Y_2

Static equivalent radial load

$P_{0r} = F_r + Y_0 F_a$

e , Y_1 , Y_2 and Y_0 are obtained from the tables below.

Boundary Dimensions mm d	D	B	$r_{s\,min}$[2]	W_o	d_o	Basic Dynamic Load Rating kN C_r	Basic Static Load Rating kN C_{0r}	Fatigue Load Limit kN C_u	Bearing Designation Cylindrical Bore	Tapered Bore[1]	Installation-related Dimensions mm d_1	$d_{a\,min}$	$D_{a\,max}$	D_1	$r_{as\,max}$	Constant e	Axial Load Factors Y_1	Y_2	Y_0	Mass (approx.) kg Cylindrical Bore	Tapered Bore	Amount of Grease Fill (approx.) g *For /8AV10	Internal Free Space (approx.) cm³	Seal Part No.	Retaining Ring Part No.
140	250	68	3	14	7	866	944	65.9	**22228EMLLXD1**	**22228EMLLXKD1**	168	154	236	235	3	0.23	2.92	4.35	2.86	13.9	13.6	99.5 – 139	442	**F1#22228EMLX**	**HH#22228EMLX**
150	270	73	3	15	7	990	1 090	74.5	**22230EMLLXD1**	**22230EMLLXKD1**	181	164	256	254	3	0.23	2.90	4.31	2.83	17.6	17.2	126 – 176	559	**F1#22230EMLX**	**HH#22230EMLX**
160	290	80	3	17	8	1 170	1 320	84.1	**22232EMLLXD1**	**22232EMLLXKD1**	194	174	276	271	3	0.24	2.81	4.19	2.75	22.5	22.0	158 – 221	703	**F1#22232EMLX**	**HH#22232EMLX**
170	310	86	4	18	8	1 180	1 420	88.1	**22234EMLLXD1**	**22234EMLLXKD1**	211	187	293	281	4	0.25	2.69	4.00	2.63	28.4	27.9	171 – 240	762	**F1#22234EMLX**	**HH#22234EMLX**
170	280	88	2.1	14	6	1 170	1 540	77.6	**23134EMLLXD1**	**23134EMLLXKD1**	203	182	268	263	2.1	0.26	2.60	3.87	2.54	21.2	20.6	137 – 192	610	**F1#23134EMLX**	**HH#23134EMLX**
180	300	96	3	15	7	1 390	1 800	88.9	**23136EMLLXD1**	**23136EMLLXKD1**	213	194	286	280	3	0.27	2.49	3.71	2.43	26.8	26.0	180 – 252	800	**F1#23136EMLX**	**HH#23136EMLX**
190	320	104	3	17	8	1 590	2 120	100	**23138EMLLXD1**	**23138EMLLXKD1**	228	204	306	298	3	0.28	2.43	3.61	2.37	33.8	32.8	216 – 302	960	**F1#23138EMLX**	**HH#23138EMLX**
200	340	112	3	18	8	1 800	2 380	111	**23140EMLLXD1**	**23140EMLLXKD1**	240	214	326	315	3	0.29	2.35	3.50	2.30	41.5	40.2	273 – 382	1 214	**F1#23140EMLX**	**HH#23140EMLX**
220	370	120	4	19	9	2 070	2 730	128	**23144EMLLXD1**	**23144EMLLXKD1**	259	237	353	345	4	0.28	2.43	3.61	2.37	51.6	50.1	339 – 474	1 506	**F1#23144EMLX**	**HH#23144EMLX**
220	400	108	4	21	11	1 930	2 410	136	**22244EMLLXD1**	**22244EMLLXKD1**	271	237	383	365	4	0.24	2.84	4.23	2.78	59.7	58.5	342 – 479	1 520	**F1#22244EMLX**	**HH#22244EMLX**
240	360	92	3	15	8	1 400	2 120	113	**23048EMLLXD1**	**23048EMLLXKD1**	276	253	347	342	3	0.20	3.34	4.98	3.27	33.0	32.0	182 – 255	811	**F1#23048EMLX**	**HH#23048EMLX**
240	400	128	4	20	9	2 360	3 240	148	**23148EMLLXD1**	**23148EMLLXKD1**	286	257	383	373	4	0.27	2.47	3.67	2.41	64.4	62.4	410 – 574	1 823	**F1#23148EMLX**	**HH#23148EMLX**

1) "**K**" indicates bearings have tapered bore with a taper ratio of 1:12. 2) Smallest allowable dimension for chamfer dimension *r*.
Note:For bearing designations not shown on the 231 series dimension table (bore dirmeter over 240 mm and 420 mm or less), contact **NTN** Engineering.

Handling Precautions

1. When assembling tapered bore bearings, maintain the reduction in radial internal clearance shown in **Table 2**. The reduction in radial internal clearance is the difference in the initial clearance and the clearance after assembly. Note that the axial displacement drive-up in **Table 2** should be taken to be a reference value.
2. During assembly, if misalignment exceeding the allowable misalignment angle (±1/115) is applied to the bearing, rollers may come in direct contact with seals causing seal deformation. Furthermore, if additional force is applied under these conditions, the seals and retaining rings may separate from the bearing, so caution is advised.
3. If a shrink fit is to be used for assembly, do not exceed a bearing temperature of 100 ℃. However, the method of shrink fit by immersion in a hot oil bath cannot be used.
4. The retaining ring can be installed without the use of special tools. Fit it to the groove in the outer ring sequentially from one end (see **Photo 1**).
5. There is a possibility that the seals or retaining rings will fall out during operation or handling of the bearing, so it is necessary to properly fit the seals and retaining rings. Confirm the seal and retaining ring are securely fit.

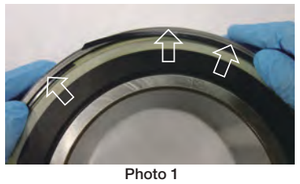


Photo 1

6. After assembly of the bearing, check that there is no slack in the retaining rings.
7. Remove the retaining ring by inserting a flathead screwdriver or similar into the notch of the retaining ring and remove it (see **Photo 2**).
8. When fitting or removing the seals or retaining rings, wear protective glasses for safety, and use caution when handling the retaining rings. Also, wear gloves during operations with the retaining rings so as not to injure your hand or finger with the tip of the retaining ring.
9. When fitting or removing the seals or retaining rings, be careful not to damage the seals or retaining rings.
10. When supplying grease, the guideline for grease supply pressure is about 0.1 MPa. If pressure is applied suddenly, there is a possibility that the seals or retaining rings could be dislodged.
11. For the 8AV10 specification, use lithium mineral grease for filling and replenishment. If other types of Photo 1 grease are to be used, please contact **NTN** Engineering.

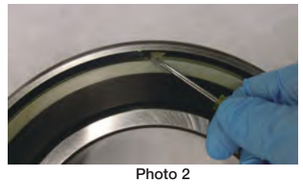
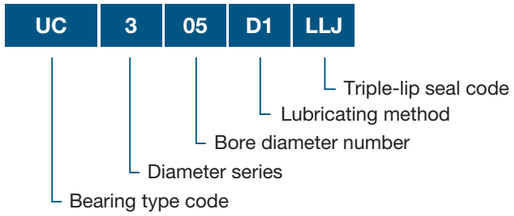
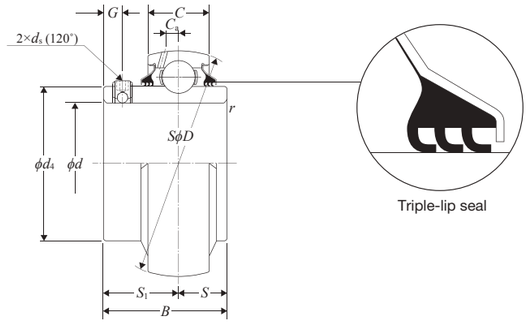


Photo 2

Triple-Lip Sealed Bearings for Bearing Units

Bearing Designation





Dynamic equivalent radial load

$P_r = XF_r + YF_a$

$\frac{f_0 \cdot F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \le e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19				2.30
0.345	0.22				1.99
0.689	0.26				1.71
1.03	0.28				1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34				1.31
3.45	0.38				1.15
5.17	0.42				1.04
6.86	0.44				1.00

Static equivalent radial load

$P_{0r} = 0.6F_r + 0.5F_a$

When $P_{0r} < F_r$ use $P_{0r} = F_r$

Bearing Designation	Dimensions mm											Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Factor	Mass kg
	d	D	B	C	$r_{s\,min}$ [1]	S	S_1	G	d_s	C_a	d_4	C_r	C_{0r}	C_u	f_0	(approx.)
UC201D1LLJ	12	47	31	17	0.6	12.7	18.3	4.5	M 5 × 0.8	3.8	29.6	14.2	6.65	0.505	13.2	0.21
UC202D1LLJ	15	47	31	17	0.6	12.7	18.3	4.5	M 5 × 0.8	3.8	29.6	14.2	6.65	0.505	13.2	0.20
UC203D1LLJ	17	47	31	17	0.6	12.7	18.3	4.5	M 5 × 0.8	3.8	29.6	14.2	6.65	0.505	13.2	0.18
UC204D1LLJ	20	47	31	17	1	12.7	18.3	4.5	M 5 × 0.8	3.8	29.6	14.2	6.65	0.505	13.2	0.17
UC205D1LLJ	25	52	34.1	17	1	14.3	19.8	5	M 5 × 0.8	4	33.9	15.5	7.85	0.55	13.9	0.20
UC206D1LLJ	30	62	38.1	19	1	15.9	22.2	5	M 6 × 0.75	4.9	40.8	21.6	11.3	0.795	13.8	0.32
UC207D1LLJ	35	72	42.9	20	1.5	17.5	25.4	6	M 6 × 0.75	5.4	46.8	28.4	15.3	1.09	13.8	0.46
UC208D1LLJ	40	80	49.2	21	1.5	19	30.2	8	M 8 × 1	6	53	32.5	17.8	1.24	14.0	0.64
UC209D1LLJ	45	85	49.2	22	1.5	19	30.2	8	M 8 × 1	6.1	57.5	36.0	20.4	1.60	14.1	0.68
UC210D1LLJ	50	90	51.6	24	1.5	19	32.6	9	M 8 × 1	6.1	62.4	39.0	23.2	1.82	14.4	0.78
UC211D1LLJ	55	100	55.6	25	2	22.2	33.4	9	M 8 × 1	6.5	69	48.0	29.2	2.29	14.3	1.04
UC212D1LLJ	60	110	65.1	27	2	25.4	39.7	10	M10 × 1.25	7.3	77	58.0	36.0	2.83	14.3	1.46
UC213D1LLJ	65	120	65.1	32	2	25.4	39.7	10	M10 × 1.25	7.3	82.5	63.5	40.0	3.15	14.4	1.86
UC214D1LLJ	70	125	74.6	33	2	30.2	44.4	12	M10 × 1.25	7.7	87	69.0	44.0	3.45	14.5	2.10
UC215D1LLJ	75	130	77.8	34	2	33.3	44.5	12	M10 × 1.25	8	93	73.5	49.5	3.80	14.7	2.34
UC216D1LLJ	80	140	82.6	35	2.5	33.3	49.3	12	M10 × 1.25	8	98.1	80.5	53.0	3.95	14.6	2.78
UC217D1LLJ	85	150	85.7	36	2.5	34.1	51.6	12	M12 × 1.5	7.9	106.4	92.0	64.0	4.60	14.7	3.54
UC218D1LLJ	90	160	96	37	2.5	39.7	56.3	12	M12 × 1.5	8.7	111.6	106	71.5	5.00	14.5	4.40

1) Smallest allowable dimension for chamfer dimension *r*.

Note:1. Refer to the related catalog "Bearing Units (CAT. No. 2400/E)" for the shaft size tolerances.
2. The precision of ball bearings is identical to JIS B 1558 (ball bearings for rolling bearing units).
3. Contact **NTN** for information on tapered bore shapes or ball bearings with bores diameters in inches.

Bearing Designation	Dimensions mm											Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Fatigue Load Limit kN	Factor	Mass kg
	d	D	B	C	$r_{s\,min}$ [1]	S	S_1	G	d_s	C_a	d_4	C_r	C_{0r}	C_u	f_0	(approx.)
UC305D1LLJ	25	62	38	20	1.5	15	23	6	M 6 × 0.75	5	36.8	23.5	10.9	0.855	12.6	0.35
UC306D1LLJ	30	72	43	23	1.5	17	26	6	M 6 × 0.75	5.6	44.9	29.5	15.0	1.14	13.3	0.56
UC307D1LLJ	35	80	48	25	2	19	29	8	M 8 × 1	5.7	49.4	37.0	19.1	1.47	13.1	0.70
UC308D1LLJ	40	90	52	27	2	19	33	10	M10 × 1.25	6.1	56	45.0	24.0	1.83	13.2	0.96
UC309D1LLJ	45	100	57	29	2	22	35	10	M10 × 1.25	7.1	63.5	58.5	32.0	2.50	13.1	1.28
UC310D1LLJ	50	110	61	32	2.5	22	39	12	M12 × 1.5	7.9	70.6	68.5	38.5	2.99	13.2	1.68
UC311D1LLJ	55	120	66	34	2.5	25	41	12	M12 × 1.5	8.5	76.6	79.5	45.0	3.50	13.2	2.08
UC312D1LLJ	60	130	71	36	2.5	26	45	12	M12 × 1.5	9	82.7	90.5	52.0	4.10	13.2	2.62
UC313D1LLJ	65	140	75	39	2.5	30	45	12	M12 × 1.5	9.4	88.2	103	60.0	4.60	13.2	3.22
UC314D1LLJ	70	150	78	41	2.5	33	45	12	M12 × 1.5	10	94.8	115	68.0	5.10	13.2	3.86
UC315D1LLJ	75	160	82	43	2.5	32	50	14	M14 × 1.5	10.5	101.3	126	77.0	5.55	13.2	4.70
UC316D1LLJ	80	170	86	45	2.5	34	52	14	M14 × 1.5	11.1	107.9	136	86.5	6.05	13.3	5.60
UC317D1LLJ	85	180	96	47	3	40	56	16	M16 × 1.5	11.5	114.4	147	97.0	6.55	13.3	6.70
UC318D1LLJ	90	190	96	49	3	40	56	16	M16 × 1.5	12.2	120.9	158	107	7.10	13.3	7.60
UC319D1LLJ	95	200	103	51	3	41	62	16	M16 × 1.5	12.7	127.5	169	119	7.65	13.3	8.70
UC320D1LLJ	100	215	108	55	3	42	66	18	M18 × 1.5	14	135.6	192	141	8.75	13.2	10.8

1) Smallest allowable dimension for chamfer dimension *r*.

Note:1. Refer to the related catalog "Bearing Units (CAT. No. 2400/E)" for the shaft size tolerances.
2. The precision of ball bearings is identical to JIS B 1558 (ball bearings for rolling bearing units).
3. Contact **NTN** for information on tapered bore shapes or ball bearings with bores diameters in inches.

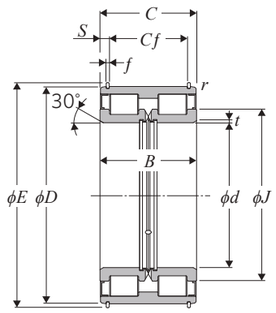
SL Type Cylindrical Roller Bearings for Sheaves

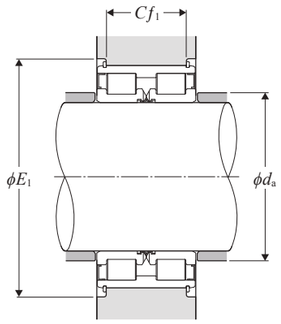
Shaft diameter 40 - 170 mm

Bearing Designation

SL04- 50 08 NR

- NR: with snap ring
- N: without snap ring
- 08: Bore diameter number
- 50: Size code
- SL04-: Type code





Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Allowable Speed min⁻¹	Bearing Designation	Dimensions mm					Installation-related Dimensions mm			Mass kg
d	D	B	C	t	$r_{s\,min}$ [1]	C_r	C_{0r}	Grease Lubrication		J	E (approx.)	f	Cf	S	$d_{a\,min}$	E_1	Cf_1 [2]	(approx.)
40	68	38	37	0.8	0.6	79.5	116	2 500	SL04-5008NR	51	71.8	2	28	4.5	43.5	82	28	10.552
45	75	40	39	0.8	0.6	95.5	144	2 200	SL04-5009NR	56.6	79	2	30	4.5	48.5	88	30	0.688
50	80	40	39	0.8	0.6	100	158	2 000	SL04-5010NR	61	83.8	2	30	4.5	53.5	94	30	0.752
55	90	46	45	1	0.6	118	193	1 800	SL04-5011NR	67.9	95	2.5	34	5.5	60	106	34	1.12
60	95	46	45	1	0.6	123	208	1 700	SL04-5012NR	73.4	100	2.5	34	5.5	65	112	34	1.2
65	100	46	45	1	0.6	128	224	1 500	SL04-5013NR	78	105	2.5	34	5.5	70	116	34	1.27
70	110	54	53	1	0.6	171	285	1 400	SL04-5014NR	84.5	114.5	2.5	42	5.5	75	130	42	1.87
75	115	54	53	1	0.6	197	325	1 300	SL04-5015NR	90	119.7	2.5	42	5.5	80	135	42	1.97
80	125	60	59	1	0.6	205	350	1 300	SL04-5016NR	96.5	129.7	2.5	48	5.5	85	145	48	2.66
85	130	60	59	1	0.6	214	380	1 200	SL04-5017NR	103.7	134.5	2.5	48	5.5	90	155	48	2.79
90	140	67	66	1.5	0.6	305	540	1 100	SL04-5018NR	110	146.3	2.5	54	6	96	165	54	3.71
95	145	67	66	1.5	0.6	310	560	1 100	SL04-5019NR	114.4	151.3	2.5	54	6	101	175	54	3.87
100	150	67	66	1.5	0.6	330	580	1 000	SL04-5020NR	118.5	156.3	2.5	54	6	106	180	54	4.03
110	170	80	79	1.8	1	385	695	910	SL04-5022NR	131.5	176.4	2.5	65	7	116.5	200	65	7
120	180	80	79	1.8	1	400	750	830	SL04-5024NR	141.5	188.4	3	65	7	126.5	210	65	7.5
130	200	95	94	1.8	1	535	1 000	770	SL04-5026NR	158	208.4	3	77	8.5	136.5	230	77	11.4
140	210	95	94	1.8	1	600	1 120	710	SL04-5028NR	167	218.5	3	77	8.5	146.5	245	77	12.1
150	225	100	99	2	1	690	1 290	670	SL04-5030NR	178	233.5	3	81	9	157	260	81	14.6
160	240	109	108	2	1.1	720	1 390	630	SL04-5032NR	191	248.5	3	89	9.5	167	275	89	18.2
170	260	122	121	2	1.1	925	1 790	590	SL04-5034NR	203	270.5	4	99	11	177	300	99	24.6

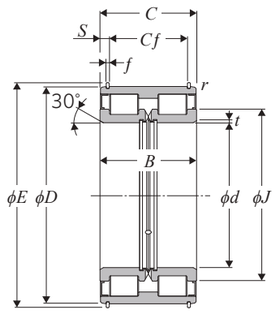
1) Smallest allowable dimension for chamfer dimension r.

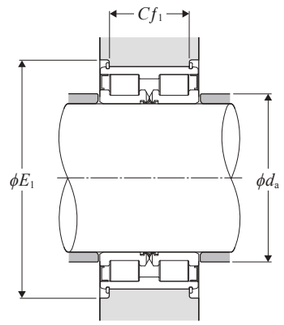
2) Tolerances for Cf_1 dimensions SL04-5008NR to SL04-5034NR : — 0.1 to — 0.5 mm

Note:1.These bearings are packed with grease.
2.These bearings are surface treated to prevent rust.
3.These bearings are non-contact type shielded bearings. However, **NTN** also manufactures contact type sealed bearings, which are available on request.

SL Type Cylindrical Roller Bearings for Sheaves

Shaft diameter 180 - 440 mm





Boundary Dimensions mm						Basic Dynamic Load Rating kN	Basic Static Load Rating kN	Allowable Speed min⁻¹	Bearing Designation	Dimensions mm					Installation-related Dimensions mm			Mass kg
d	D	B	C	t	$r_{s\,min}$ [1]	C_r	C_{0r}	Grease Lubrication		J	E (approx.)	f	Cf	S	$d_{a\,min}$	E_1	Cf_1 [2]	(approx.)
180	280	136	135	2	1.1	1 090	2 140	560	SL04-5036NR	220	290.5	4	110	12.5	187	320	110	32.3
190	290	136	135	2	1.1	1 120	2 230	530	SL04-5038NR	226	300.5	4	110	12.5	197	330	110	33.7
200	310	150	149	2	1.1	1 310	2 650	500	SL04-5040NR	245.5	320.5	4	120	14.5	207	350	120	43.5
220	340	160	159	2.5	1.1	1 640	3 300	450	SL04-5044NR	260	357	6	130	14.5	228.5	380	130	55.5
240	360	160	159	2.5	1.1	1 710	3 550	420	SL04-5048NR	280.5	377	6	130	14.5	248.5	400	130	59.5
260	400	190	189	3	1.5	1 950	4 200	380	SL04-5052NR	310	417	7	154	17.5	270	445	154	90.7
280	420	190	189	3	1.5	2 170	4 700	360	SL04-5056NR	325	437	7	154	17.5	290	465	154	96.2
300	460	218	216	3	1.5	2 670	5 850	330	SL04-5060NR	363	481	8	176	20	310	510	176	137
320	480	218	216	3	1.5	2 720	6 100	310	SL04-5064NR	376	501	8	176	20	330	530	176	144
340	520	243	241	3.5	2	3 650	8 000	290	SL04-5068NR	406	545	8	194	23.5	352	580	194	194
360	540	243	241	3.5	2	3 750	8 300	280	SL04-5072NR	421	565	10	194	23.5	372	600	194	203
380	560	243	241	3.5	2	3 800	8 750	260	SL04-5076NR	442	585	10	194	23.5	392	620	194	212
400	600	272	270	3.5	2	4 250	9 950	250	SL04-5080NR	470	627	12	210	30	412	675	210	281
420	620	272	270	3.5	2	4 350	10 300	240	SL04-5084NR	486	647	12	210	30	432	695	210	292
440	650	280	278	4.5	3	4 500	11 000	230	SL04-5088NR	518	677	12	210	34	456	725	210	331

1) Smallest allowable dimension for chamfer dimension r.

2) Tolerances for Cf_1 dimensions SL04-5036NR to SL04-5088NR : — 0.1 to — 0.7 mm

Note:1.These bearings are packed with grease.

2.These bearings are surface treated to prevent rust.

3.These bearings are non-contact type shielded bearings. However, **NTN** also manufactures contact type sealed bearings, which are available on request.

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NTN corporation

◀ Sales Network

NOTE : The appearance and specifications may be changed without prior notice if required to improve performance. Although care has been taken to assure the accuracy of the data compiled in this catalog, **NTN** does not assume any liability to any company or person for errors or omissions.