

# NTN<sup>®</sup>

## Spherical Roller Bearings with High-strength Cage [EMA Type]



# ULTAGE<sup>®</sup>

CAT. No. 3036/E

# ULTAGE®

**Life**  
Max.  
**2X**

**Basic dynamic load rating**  
Max.  
**20% up**

**Cage strength**  
Max.  
**55% up**

**Temperature rise**  
Max.  
**10% down**

## Spherical Roller Bearings with High-strength Cage [EMA Type]

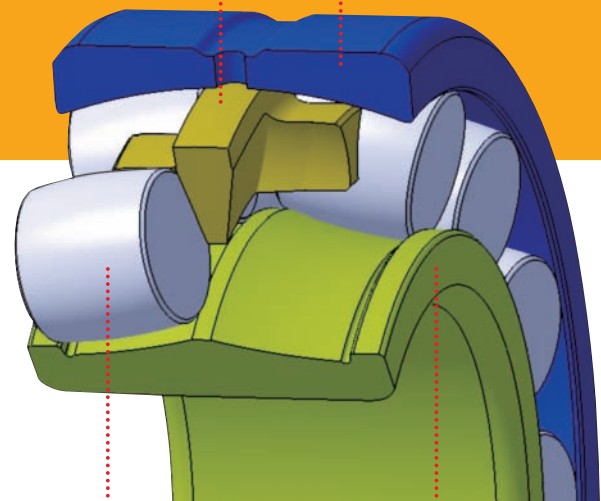
Industrial machineries are typically used under extremely severe operating conditions (eccentric rotation and impact load, for example). ULTAGE® series spherical roller bearings with a high-strength cage [EMA type] are our new standard series bearings developed to satisfy the needs of such heavy-duty machineries for improvements in "long life", "vibration resistance", and "low temperature rise" characteristics.

### Cage

- One-piece machined cage with staggered pockets
- Outer-ring-guided

### Outer ring

- Optimum curvature
- Oil groove/hole provided



### Rollers

- Large-diameter rollers
- The largest number of rollers

### Inner ring

- Optimum curvature
- No inner ring flange

### Improved vibration resistance

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

### Long life

- Load capacity of the world's highest level
- Extended maintenance intervals
- Downsizing and light-weighting opportunities
- Heat resistant up to 200°C

### Reduced temperature rise

- Permitted rotational speed of the world's highest level
- Optimized internal bearing design including curvature

"ULTAGE®" (a name created from the 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.

## Accuracy and Clearance (Vibration Screen Specification)

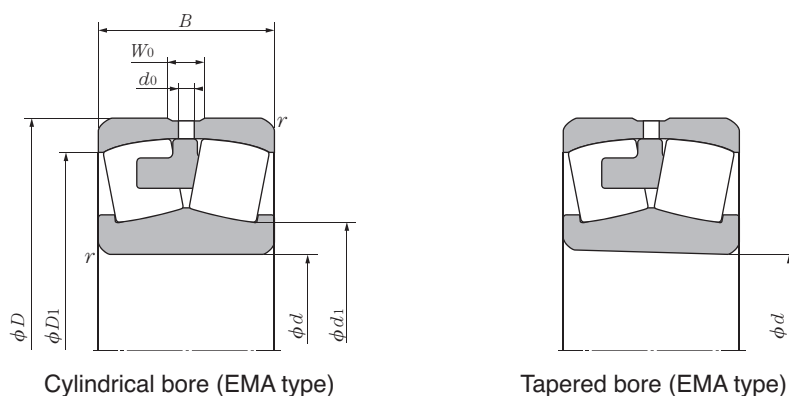
This is a bearing specification for vibration screen applications. Inner and outer diameter tolerances and radial internal clearance are adjusted to set adequate running internal clearance levels.

For information about bearing specifications (accuracy, clearance, etc.) for other applications than vibration screens, please see CAT. No. 3033/E: ULTAGE® series spherical roller bearings [EA type] and [EM type].

Unit: mm

Single plane mean bore diameter deviation				Single plane mean outside diameter deviation				Radial internal clearance (cylindrical bore)					
Nominal bearing bore diameter		VS1, VS2		Nominal bearing outside diameter		VS1, VS2		Nominal bearing bore diameter		VS1		VS2	
over	incl.	high	low	over	incl.	high	low	over	incl.	min.	max.	min.	max.
	80	0	-0.010		150	-0.005	-0.013		65	0.075	0.090	0.100	0.120
80	120	0	-0.013	150	180	-0.005	-0.018	65	80	0.090	0.110	0.120	0.145
120	180	0	-0.015	180	315	-0.010	-0.023	80	100	0.110	0.135	0.150	0.180
180	200	0	-0.018	315	400	-0.013	-0.028	100	120	0.135	0.160	0.180	0.210
				400	420	-0.014	-0.030	120	140	0.160	0.190	0.205	0.240
								140	160	0.190	0.220	0.240	0.280
								160	180	0.200	0.240	0.260	0.310
								180	200	0.220	0.260	0.285	0.340

## List of Bearing Dimensions



Cylindrical bore (EMA type)

Tapered bore (EMA type)

Boundary dimension						dynamic $C_r$ kN	Basic load ratings			Allowable speed $\text{min}^{-1}$ Oil lubrication	Bearing number Cylindrical bore
$d$	$D$	mm $B$	$r_s \text{ min}$	$W_0$	$d_o$		static $C_{0r}$	dynamic $C_r$ kgf	static $C_{0r}$		
70	150	51	2.1	10	5	397	368	40 500	37 500	4 700	22314EMAD1
75	160	55	2.1	10	5	464	434	47 400	44 200	4 400	22315EMAD1
80	170	58	2.1	10	5	512	485	52 200	49 400	4 100	22316EMAD1
85	180	60	3	11	5	538	524	54 900	53 400	3 900	22317EMAD1
90	190	64	3	12	5	632	605	64 500	61 700	3 700	22318EMAD1
95	200	67	3	12	6	658	650	67 000	66 300	3 500	22319EMAD1
100	215	73	3	13	6	743	731	75 700	74 600	3 300	22320EMAD1
110	240	80	3	16	7	869	833	88 600	84 900	3 000	22322EMAD1
120	260	86	3	18	8	1 060	1 120	108 000	114 000	2 700	22324EMAD1
130	280	93	4	19	9	1 260	1 310	129 000	134 000	2 500	22326EMAD1
140	300	102	4	19	9	1 400	1 500	142 000	153 000	2 400	22328EMAD1
150	320	108	4	20	9	1 570	1 640	160 000	167 000	2 200	22330EMAD1
160	340	114	4	20	10	1 760	1 940	180 000	198 000	2 100	22332EMAD1
170	360	120	4	20	10	2 010	2 320	205 000	237 000	1 900	22334EMAD1
180	380	126	4	21	10	2 190	2 460	223 000	250 000	1 800	22336EMAD1
190	400	132	5	21	10	2 370	2 750	242 000	281 000	1 700	22338EMAD1
200	420	138	5	21	10	2 590	3 140	265 000	320 000	1 600	22340EMAD1

① Minimal allowable dimension for chamfer dimension  $r$ .

# Spherical Roller Bearings with High-strength Cage [EMA Type]

## Allowable Axial Load

$$F_a / F_r \leq e$$

$F_a$  : axial load,  $F_r$  : radial load,  $e$  : constant (ref. the list of dimensions)

If the bearing is used under excessive axial load, the rollers receive smaller radial load in the row not subjected to the axial load, which may cause the rollers to slide and eventually damage the bearing. When the ratio of axial load to radial load exceeds constant  $e$  in the list of bearing dimensions (i.e.,  $F_a/F_r > e$ ), please consult with NTN.

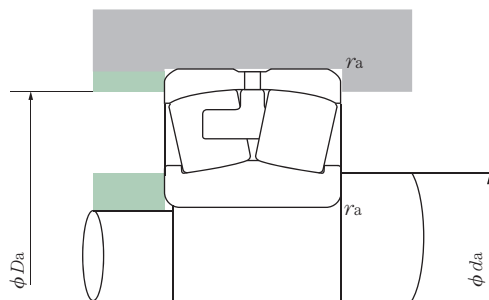
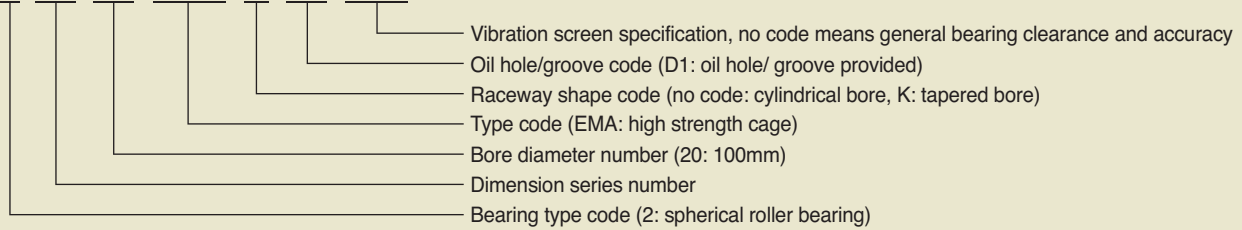
## Allowable Self-aligning Angle

- $0.06C_r <$  dynamic equivalent radial load:  $0.009\text{rad}$  ( $0.5^\circ$ )
- Dynamic equivalent radial load  $\leq 0.06C_r$ :  $0.035\text{rad}$  ( $2^\circ$ )

\* If self-aligning angle is too large, the rollers may stick out of the outer ring and hit against nearby parts. Special attention should be paid when setting self-aligning angles.

## Bearing number

**2 23 20 EMA K D1 VS1**



### Equivalent radial load dynamic

$$P_r = X F_r + Y F_a$$

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

### static

$$P_0 = F_r + Y_0 F_a$$

For values of  $e$ ,  $Y_1$ ,  $Y_2$ , and  $Y_0$  see the table below.

Bearing number	Abutment and fillet dimensions					constant	Axial load factor			Mass (approx.)	
	$d_1$	$d_a \text{ min}$	$D_a \text{ max}$	$D_1$	$r_{as \text{ max}}$		$e$	$Y_1$	$Y_2$	$Y_0$	Cylindrical bore
22314EMAKD1	85	82	138	131	2.1	0.34	2.00	2.98	1.96	4.34	4.25
22315EMAKD1	91	87	148	139	2.1	0.34	2.00	2.98	1.96	5.30	5.19
22316EMAKD1	98	92	158	148	2.1	0.34	2.00	2.98	1.96	6.32	6.19
22317EMAKD1	107	99	166	157	3	0.32	2.09	3.11	2.04	7.19	7.05
22318EMAKD1	110	104	176	166	3	0.33	2.06	3.06	2.01	8.58	8.41
22319EMAKD1	120	109	186	174	3	0.32	2.09	3.11	2.04	9.80	9.60
22320EMAKD1	127	114	201	187	3	0.34	1.98	2.94	1.93	12.8	12.5
22322EMAKD1	139	124	226	209	3	0.32	2.09	3.11	2.04	17.3	16.9
22324EMAKD1	156	134	246	225	3	0.32	2.09	3.11	2.04	22.5	22.0
22326EMAKD1	164	147	263	243	4	0.33	2.06	3.06	2.01	28.4	27.8
22328EMAKD1	181	157	283	261	4	0.33	2.03	3.02	1.98	34.6	33.8
22330EMAKD1	188	167	303	279	4	0.34	2.00	2.98	1.96	41.9	41.0
22332EMAKD1	205	177	323	296	4	0.33	2.03	3.02	1.98	50.1	49.1
22334EMAKD1	223	187	343	313	4	0.32	2.09	3.11	2.04	59.7	58.5
22336EMAKD1	229	197	363	329	4	0.32	2.09	3.11	2.04	69.3	67.9
22338EMAKD1	247	210	380	346	5	0.32	2.12	3.15	2.07	81.0	79.4
22340EMAKD1	265	220	400	364	5	0.31	2.15	3.20	2.10	94.1	92.2

## Features

### 1. Load capacity of the world's highest level

Maximizing the size and the number of the rollers achieved high load capacity and long life.

- Basic dynamic load rating: max. **20% up** (vs. our conventional bearing)
- Long life: max. **2X** (vs. our conventional bearing)

### 2. High strength cage

Modifying its shape and incorporating staggered pockets increased cage strength.

- Cage strength: max. **55% up** (vs. our conventional bearing)

### 3. Low heat-generation

Optimizing internal bearing design including curvature reduced temperature rise.

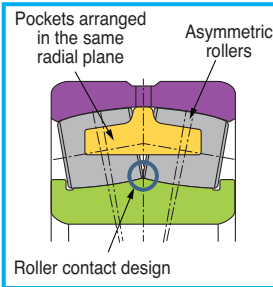
- Temperature rise: max. **10% down** (vs. our conventional bearing)

### 4. Heat resistant up to 200°C

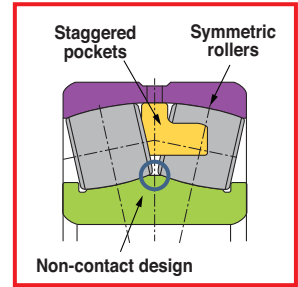
Being heat-treated by a special method, these bearings exhibit excellent dimensional stability at high temperatures, contributing to extended service life.

※Our conventional design refers to UA type bearings

Our conventional design



EMA type



Sectional views of bearings



3D views of cages

## Performance Test Data

### ● Temperature rise test

#### [Test conditions]

- Bearing number: **22316** (80D X 170D X 58)
- Vibrational acceleration: 10G
- Rotational speed: 800 to 2,400min<sup>-1</sup>
- Operating time: up to the point where temperature rise stabilizes
- Lubrication: oil lubrication
- Testing machine: please see **Fig. 1**

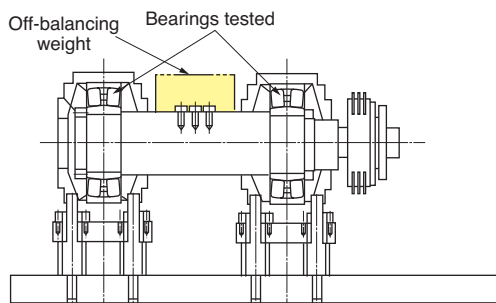
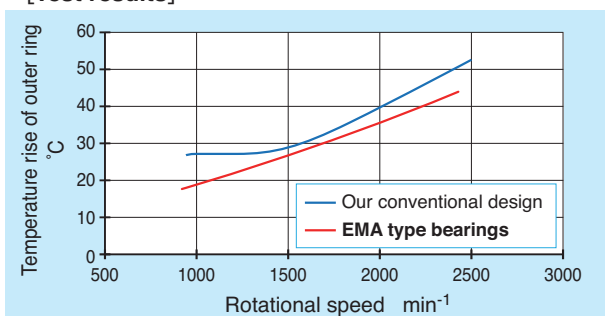


Fig. 1 Structure of testing machine

#### [Test results]



### ● Cage strength analysis

#### [Analysis conditions]

- Bearing number: **22316** (80D X 170D X 58)
- Vibrational acceleration: 100G

\* This cage strength analysis is designed to predict the stress generated in the cage when vibrational acceleration of 100G is exerted on the bearing as impact load.

Bearing	Analysis model	Cage strength
Our conventional design		1
EMA type bearings		1.55

\* The cage strength of each bearing is expressed in terms of the cage strength of our conventional bearing taken as 1.