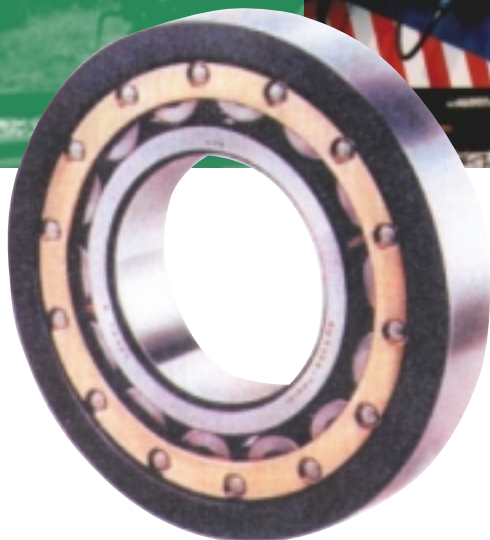


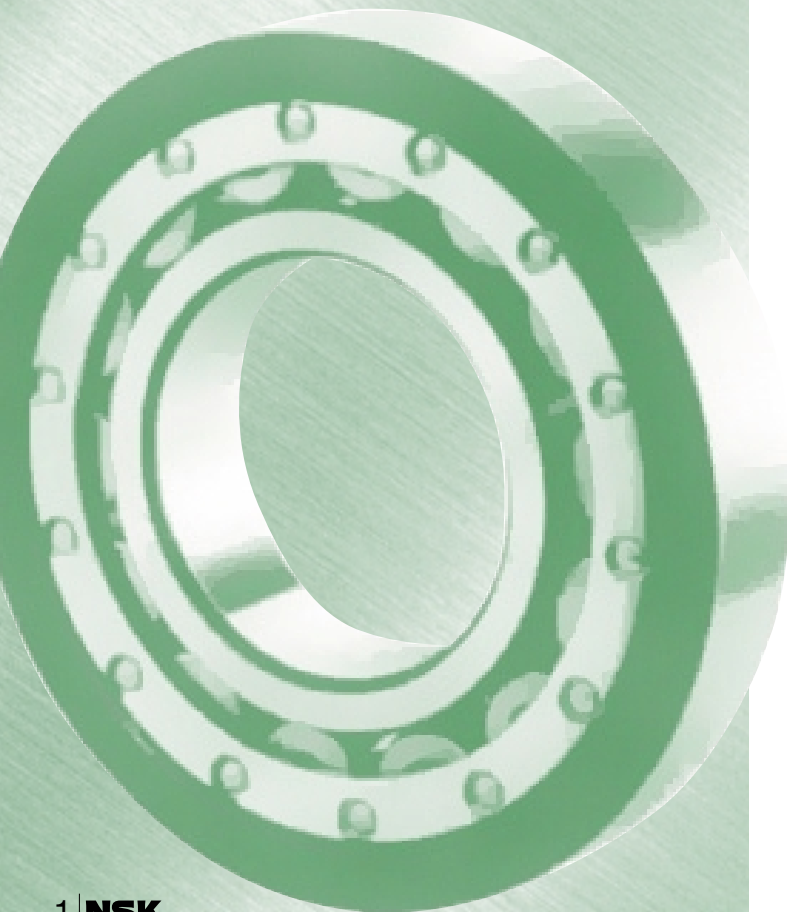
# Bearings for Traction Motors

## Cylindrical Roller Bearings and Ball Bearings

In all traction motors for electric locomotives and electric cars are used roller bearings, and they are usually cylindrical ones because of their high-speed and heavy-load capabilities as well as easy assembly and disassembly. In the case of small motors, deep groove ball bearings may also be used.



# Cylindrical Roller Bearings and Ball Bearings



## Specification for Traction Motor Bearings

1. **Special consideration must be given to the economical operation of railway vehicles as well as their reliability and safety.**
2. **Traction motor bearings operate under severe conditions such as:**
  - 1) high radial and axial loads
  - 2) high impact loads
  - 3) high speed
  - 4) extended periods of operation without maintenance
3. **NSK uses the following bearing specifications to satisfy the above-noted severe requirements.**
  - 1) Bearing materials are vacuum degassed for high purity.
  - 2) Inner and outer rings are treated for heat dimensional stabilization.
  - 3) Raceway surfaces are always super-finished and the rolling surfaces of rollers are either super-finished or barrel-finished.
  - 4) High load-capacity design is applied for electric locomotives.
  - 5) Tapered ribs and roller end crowning are applied for cylindrical roller bearings to increase the axial load capacity (Fig. 1).

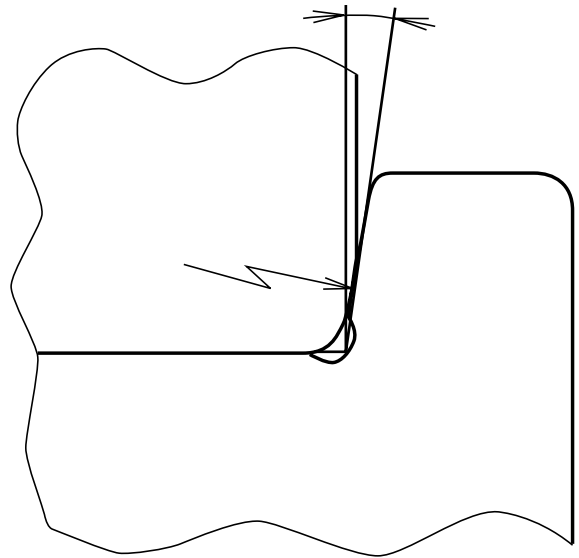


Fig. 1 The design of rib and roller end

- 6) Roller-guided cages is applied for superior lubrication, temperature rise (Fig. 2), etc.
- 7) High-strength cages are applied, particularly with means to prevent loosening of rivets due to vibration and impacts.
- 8) Outside surface and both end faces of outer ring are coated with ceramic or heat-resistant resin for prevention of electric pitting.

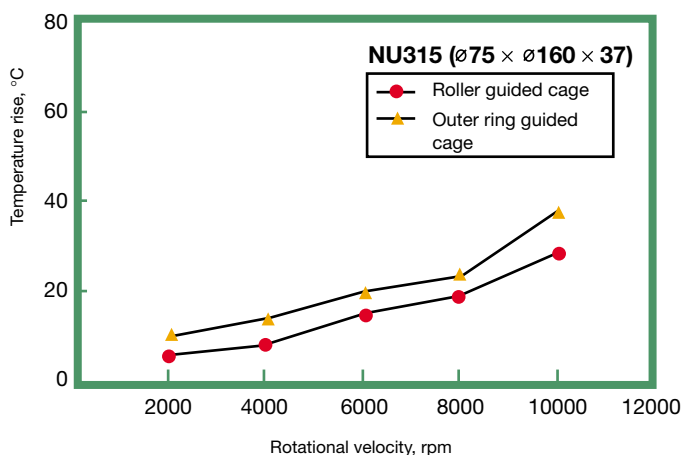


Fig. 2 Comparison of temperature rise



Ceramic-Insulated Bearing



PPS-Insulated Bearing

Photo 1 Insulated bearings

### Insulated Bearings

The most important factor hindering maintenance-free running of traction motor bearings is an occurrence of electric pitting of the bearings. To prevent electric pitting, NSK developed ceramic coating insulated bearings and PPS-resin coating insulated bearings (Photo 1).

Relationship between bearing temperature and insulation resistance of ceramic-insulated bearings was assessed. As a result, no deterioration of insulation resistance up to 110°C was observed. And even above 110°C, 100MΩ of resistance was maintained (Fig. 3).

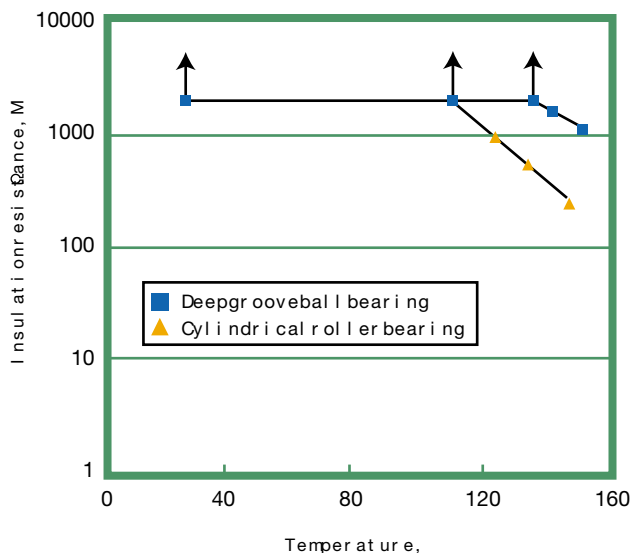
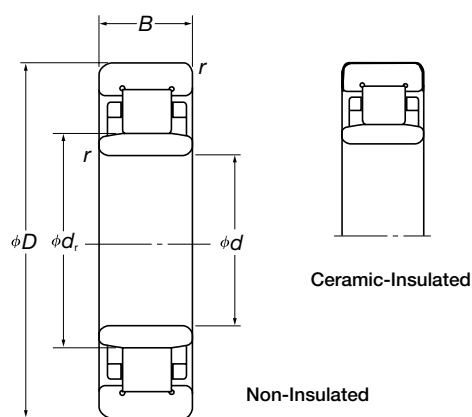


Fig. 3 Temperature vs. Insulation resistance

## Tables on Bearings for Electric Locomotive Traction Motors



Cylindrical Roller Bearing (NU Type)

### 2□□ Series (Free End-Bearings)

Boundary Dimensions (mm)					Basic Numbers	Internal Design <sup>(1)</sup>	Basic Dynamic Load Rating (N)	Basic Static Load Rating (N)	Mass (kg) approx.
d	D	B	d <sub>r</sub>	r (min)					
120	215	40	143.5	2.1	NU224	E	320 000	395 000	6.3
130	230	40	153.5	3	NU226	E	345 000	425 000	7.9

Note (1) E: High-Capacity Type

### 3□□ Series (Free End-Bearings)

Boundary Dimensions (mm)					Basic Numbers	Internal Design <sup>(1)</sup>	Basic Dynamic Load Rating (N)	Basic Static Load Rating (N)	Mass (kg) approx.
d	D	B	d <sub>r</sub>	r (min)					
90	190	43	113.5	3	NU318	E	315 000	355 000	6.1
100	215	47	127.5	3	NU320	E	380 000	425 000	8.6
110	240	50	143	3	NU322	E	425 000	485 000	11.5
120	260	55	154	3	NU324	E	530 000	610 000	15.0
130	280	58	165	4	NU326	B	655 000	795 000	18.8
			167			E	615 000	735 000	18.2
140	300	62	180	4	NU328	E	665 000	795 000	22.3
			178			F	705 000	860 000	22.9
150	320	65	193	4	NU330	E	760 000	920 000	27.1
			193			EA	715 000	855 000	26.8
			190.5			J	800 000	985 000	27.3
			190			L	790 000	970 000	27.5
160	340	68	204	4	NU332	E	860 000	1 050 000	31.5
180	380	75	231	4	NU336	E	985 000	1 230 000	43.5

Note (1) E, EA: High-Capacity Type B, F, J, L: Specific Types, respectively

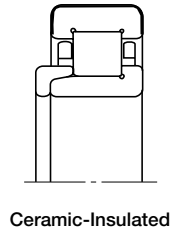
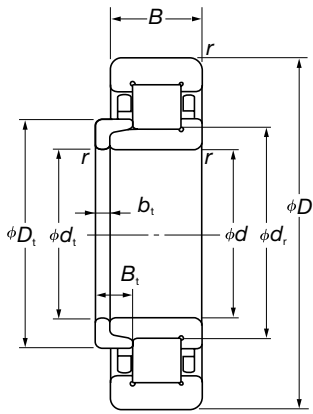
### 4□□ Series (Free End-Bearings)

Boundary Dimensions (mm)					Basic Numbers	Internal Design	Basic Dynamic Load Rating (N)	Basic Static Load Rating (N)	Mass (kg) approx.
d	D	B	d <sub>r</sub>	r (min)					
90	225	54	123.5	4	NU418	-	375 000	400 000	11.5
105	260	60	144.5	4	NU421	-	495 000	555 000	17.3
160	400	88	226	5	NU432	-	1 000 000	1 220 000	61.3

### 22□□ Series (Free End-Bearings)

Boundary Dimensions (mm)					Basic Numbers	Internal Design <sup>(1)</sup>	Basic Dynamic Load Rating (N)	Basic Static Load Rating (N)	Mass (kg) approx.
d	D	B	d <sub>r</sub>	r (min)					
100	180	46	119	2.1	NU2220	EA	320 000	425 000	5.3

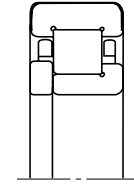
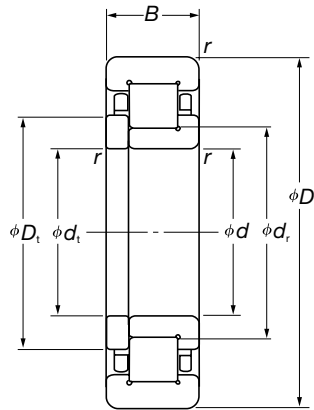
Note (1) EA: High-Capacity Type



Ceramic-Insulated

Non-Insulated

Cylindrical Roller Bearing (NH Type)



Ceramic-Insulated

Non-Insulated

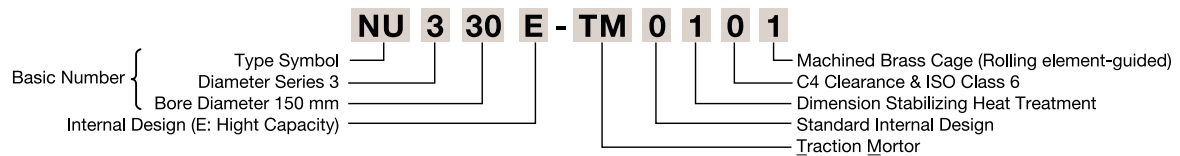
Cylindrical Roller Bearing (NUP Type)

3□□ Series (Fixed End-Bearings)

Boundary Dimensions (mm)								Basic Numbers	Internal Design <sup>(1)</sup>	Basic Dynamic Load Rating (N)	Basic Static Load Rating (N)	Mass (kg) approx.
$d, d_i$	$D$	$B$	$d_r$	$D_i$	$B_i$	$b_i$	$r$ (min)					
60	130	40	77	84.2	15.5	9	2.1	NH312	—	124 000	126 000	2.3
65	140	43	83.5	91	17	10	2.1	NH313	—	143 000	151 000	2.9
70	150	45	90	98	17.5	10	2.1	NH314	—	158 000	168 000	3.4
75	160	37	95.5	104.2	16.5	11	2.1	NH315	E	240 000	263 000	4.2
75	160	37	95	104.2	—	—	2.1	NUP315	E	240 000	263 000	3.9
80	170	50	101	111.8	17	11	2.1	NH316	E	256 000	282 000	5.0
90	190	55	115	125	21	12	3	NH318	—	240 000	265 000	6.8
			113.5	124.2	18.5				E	315 000	355 000	6.8
90	190	43	115	125	—	—	3	NUP318	B	240 000	265 000	6.3
			113.5	124.2	—				E	315 000	355 000	6.3
100	215	60	129.5	140.5	22.5	13	3	NH320	A	310 000	355 000	9.5
			129.5	140.5	22.5				B	310 000	355 000	9.5
			127.5	139	20.5				E	380 000	425 000	9.6
110	240	64	143	155	22	14	3	NH322	E	425 000	485 000	12.9
120	260	69	154	168.5	23.5	14	3	NH324	—	475 000	550 000	16.6
130	280	72	167	182	24	14	4	NH326	—	560 000	665 000	20.2
			181	181					E	615 000	735 000	20.1
140	300	77	180	196	26	15	4	NH328	—	615 000	745 000	24.7

Note (1) E: High-Capacity Type A, B: Specific Types, respectively

Standard Number of Cylindrical Roller Bearings

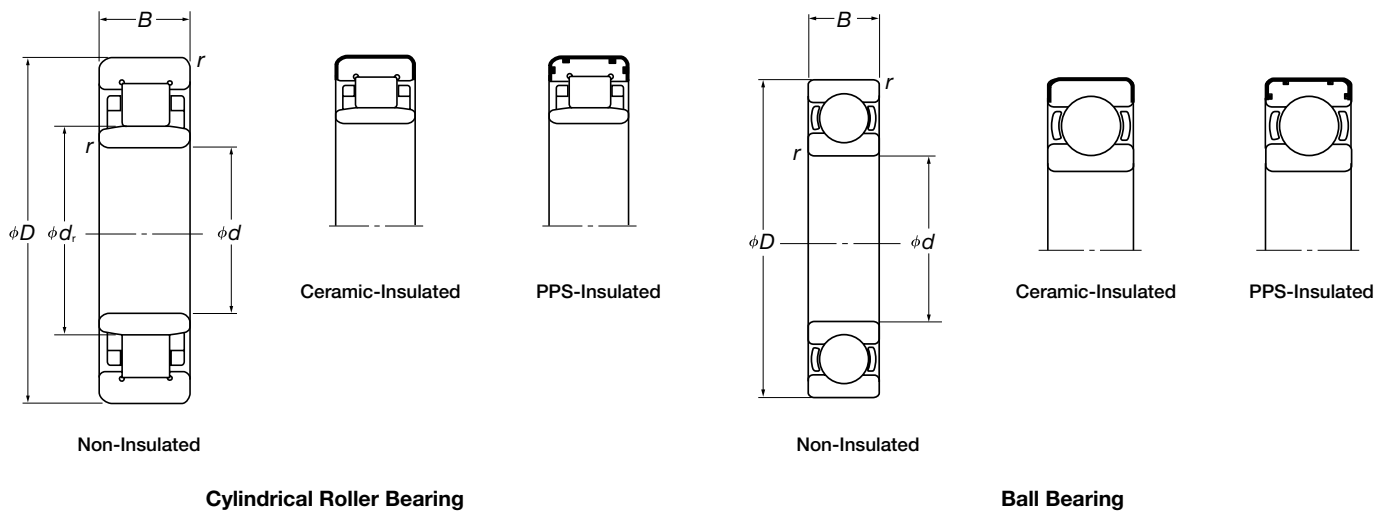


Remarks : For cylindrical roller bearings for traction motors not listed above, please contact NSK.



# Cylindrical Roller Bearings and Ball Bearings

## Table on Bearings for Electric Car Traction Motors



**Cylindrical Roller Bearing**

**Ball Bearing**

Loaded Side, Cylindrical Roller Bearings	Boundary Dimensions (mm)					Non-Loaded Side, Ball Bearings	Boundary Dimensions (mm)			
	$d$	$D$	$B$	$d_i$	$r$ (min)		$d$	$D$	$B$	$r$ (min)
NU212	60	110	22	73.5	1.5	6310	50	110	27	2
NU312	60	130	31	77	2.1	6310	50	110	27	2
NU213	65	120	23	79.6	1.5	6310	50	110	27	2
NU313	65	140	33	83.5	2.1	6311	55	120	29	2
NU214	70	125	24	84.5	1.5	6310 6311	50 55	110 120	27 29	2
NU314	70	150	35	90	2.1	6311	55	120	29	2
NU215	75	130	25	88.5	1.5	6311 6312	55 60	120 130	29 31	2 2.1
NU315	75	160	37	95.5	2.1	6311 6312 6314	55 60 70	120 130 150	29 31 35	2 2.1
NU415	75	190	45	104.5	3	6313	65	140	33	2.1
NU216	80	140	26	95.3	2	6312	60	130	31	2.1
NU316	80	170	39	103	2.1	6312	60	130	31	2.1
NU416	80	200	48	110	3	6313	65	140	33	2.1
NU217	85	150	28	101.8	2	6217	85	150	28	2
NU218	90	160	30	107	2	6218	90	160	30	2
NU219	95	170	32	113.5	2.1	6219	95	170	32	2.1

# Interchangeability of Traction Motor Bearings

	NSK Bearing Numbers <sup>(1)</sup>	Internal Clearance	Tolerance Class	Other Maker's Numbers (SKF)
Loaded-Side Bearings (Free End-Bearings) NU3□□Series	NU315E-TM0102	C4	P6	NU315ECMC4VA301
	NU316E-TM0101	C4	P6	NU316ECMC4VA301
	NU317E-TM0101	C4	P6	NU317ECMC4VA301
	NU318E-TM0101	C4	P6	NU318ECMC4VA301
	NU320E-TM0102	C4	P6	NU320ECMC4VA301
	NU322E-TM0101	C4	P6	NU322ECMC4VA301
	NU324E-TM0102	C4	P6	NU324ECMC4VA301
	NU326B-TM0113 <sup>(2)</sup>	CG185	P6A	468540VAS
	NU326E-TM0101	C4	P6	NU326ECMC4VA301
	NU328E-TM0102	C4	P6	NU328ECMC4VA301
	NU330E-TM0101	C4	P6	NU330ECMC4VA301
	NU330E-TM1105 <sup>(3)</sup>	C4	P6	NU330ECMRDC4VA301
	NU330J-TM0111	CG205	P6	466830M/W23
	NU332E-TM0101	C4	P6	NU332ECMC4VA301
	NU332EH2 <sup>(4)</sup> -TM0101	C4	P6	NU332ECMC4VA309
Non-Loaded Side-Bearings (Fixed End-Bearings) NH3□□Series	NH312E-TM0101	C4	P6	NH312ECMC4VA301
	NH313E-TM0101	C4	P6	NH313ECMC4VA301
	NH314E-TM0101	C4	P6	NH314ECMC4VA301
	NH315E-TM0102	C4	P6	NH315ECMC4VA301
	NH316E-TM0101	C4	P6	NH316ECMC4VA301
	NH317E-TM0101	C4	P6	NH317ECMC4VA301
	NH318E-TM0101	C4	P6	NH318ECMC4VA301
	NH320E-TM0102	C4	P6	NH320ECMC4VA301
	NH320B-TM0312 <sup>(2)</sup>	CG153	P6A	NH320M2/W23B/W83
	NH320EH2 <sup>(4)</sup> -TM0102	C4	P6	NH320ECMC4VA309
	NH322E-TM0101	C4	P6	NH322ECMC4VA301
	NH324E-TM0102	C4	P6	NH324ECMC4VA301
	NH324E-TM0105 <sup>(3)</sup>	C4	P6	NH324ECMRDC4VA301
	NH326E-TM0101	C4	P6	NH326ECMC4VA301
	NH328E-TM0102	C4	P6	NH328ECMC4VA301

Notes (1) E: High-Capacity Type B, J: Specific Types, respectively

(2) Two-Piece Roller Drop Type

(3) One-Piece Roller Drop Type

(4) Ceramic-Insulated Type