

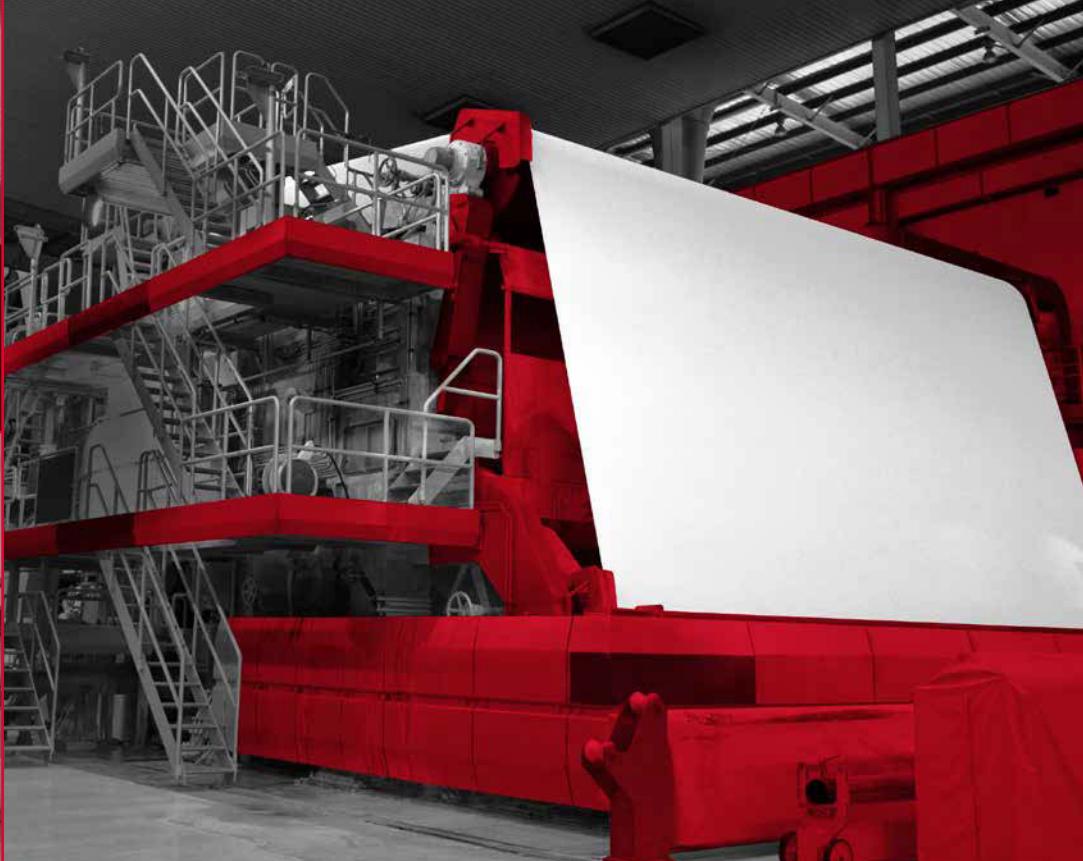
NSK

TL SERIES SPHERICAL ROLLER BEARINGS

TOUGH AND LONG-LIFE PERFORMANCE IN PAPER MACHINES



STAY IN MOTION. STAY IN CONTROL.



AT HIGH SPEEDS, IN HIGH HEAT

BEARINGS FOR PAPER MAKING MACHINERY

High speeds. Moisture. Intense heat. The forces at work on the bearings used throughout these massive mechanical marvels are extreme. And the stakes are high.

With throughput as great as thousands of feet per minute -hundreds of tons each day - a single bearing failure can bring the paper that flies across a machine's interdependent rolls to an abrupt halt. At a significant cost.

Reliability is paramount.

For NSK, product development and design is focused squarely on withstanding the manifold operating and environmental stresses of these applications with:

- › increasing capacities for high loads and high speeds
- › advanced materials for durability, wear resistance and longer life
- › lubrication and seal technology for smooth and clean running

Our product solutions are designed to optimize the performance of machinery and equipment, to assure predictable reliability and to deliver total cost-efficiency.

**OUTSTANDING DURABILITY.
ENGINEERED IN.**

NSK engineered our TL - Tough & Long Life - spherical roller bearings to outlast and outperform conventional bearing solutions in the high-heat conditions of dryer and calender sections of paper making machines, where inner ring fracture and bearing failures resulting from hoop stress are an all-too-common occurrence.

With an innovative and proprietary steel formulation and heat treatment approach - augmented by our optimized bearing design - NSK's TL bearings deliver strength, durability, superior stability and predictably reliable performance - extending maintenance intervals and supporting total machine efficiency.



DESIGN AND OPERATING ADVANTAGES

NSK's TL series spherical roller bearings are ideally designed for paper machine dryer roll applications - and wherever elevated temperatures prevail - optimizing machine uptime and efficiency with superior resistance to inner ring fracture and exceptional dimensional stability at high temperatures.



DESIGN FEATURES

- › Optimized, high capacity internal design
- › Inner rings manufactured with proprietary TL steel composition and heat-treatment process
- › With cylindrical and tapered bore
- › With a heavy-duty machined brass cage; pressed steel cages with wear-resistant surface treatment utilized for limited range, or available on request
- › Dimensional series 222, 223, 230, 231, 232, 239, 240 and 241 in bore diameters from 40 to 1000 mm
- › Radial internal clearances from C-normal through C5
- › Superior dimensional stability for operating temperatures as high as 200°C

HIGH-PERFORMANCE FACTORS

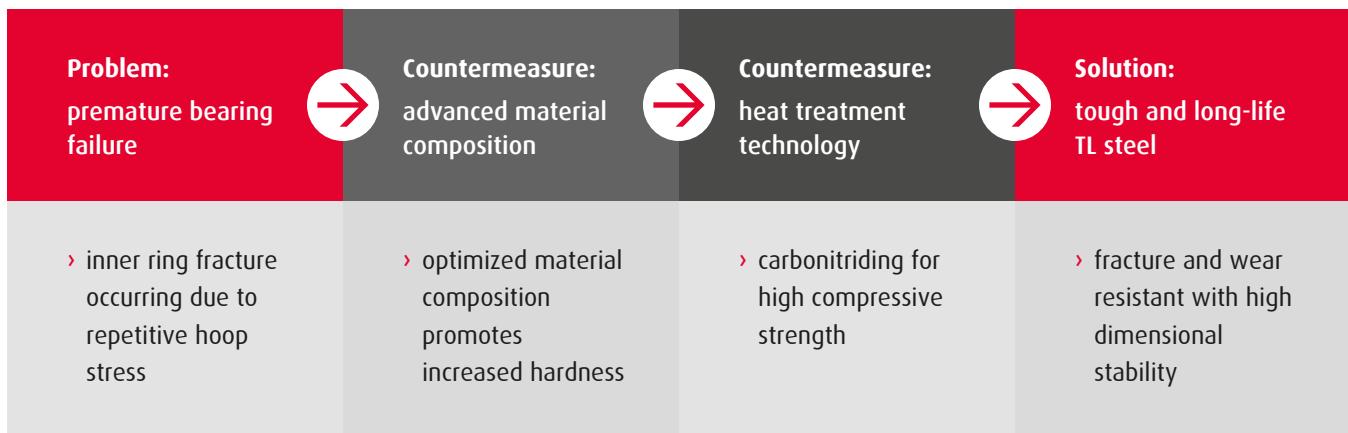
NSK

HIGH-PERFORMANCE FACTOR: TL TECHNOLOGY

NSK TL series spherical roller bearings extend bearing life through the utilization of leading-edge bearing material and heat treatment technologies. The outcome is an application-optimized solution that effectively mitigates inner ring fracture caused by rising hoop stress, and is equally resilient to the damaging effects of particle or water contaminated lubrication.

A proprietary material composition containing appropriate levels of chrome promotes increased hardness. Coupled with an advanced carbonitriding process, the result is a case-hardened inner ring with considerable advantages:

- › Exceptional ring fracture resistance from high compressive residual stress after heat treatment
- › Long life wear resistance due to superior surface hardness values, exceeding conventional through hardened and carburized materials
- › High dimensional stability at operating temperatures up to 200°

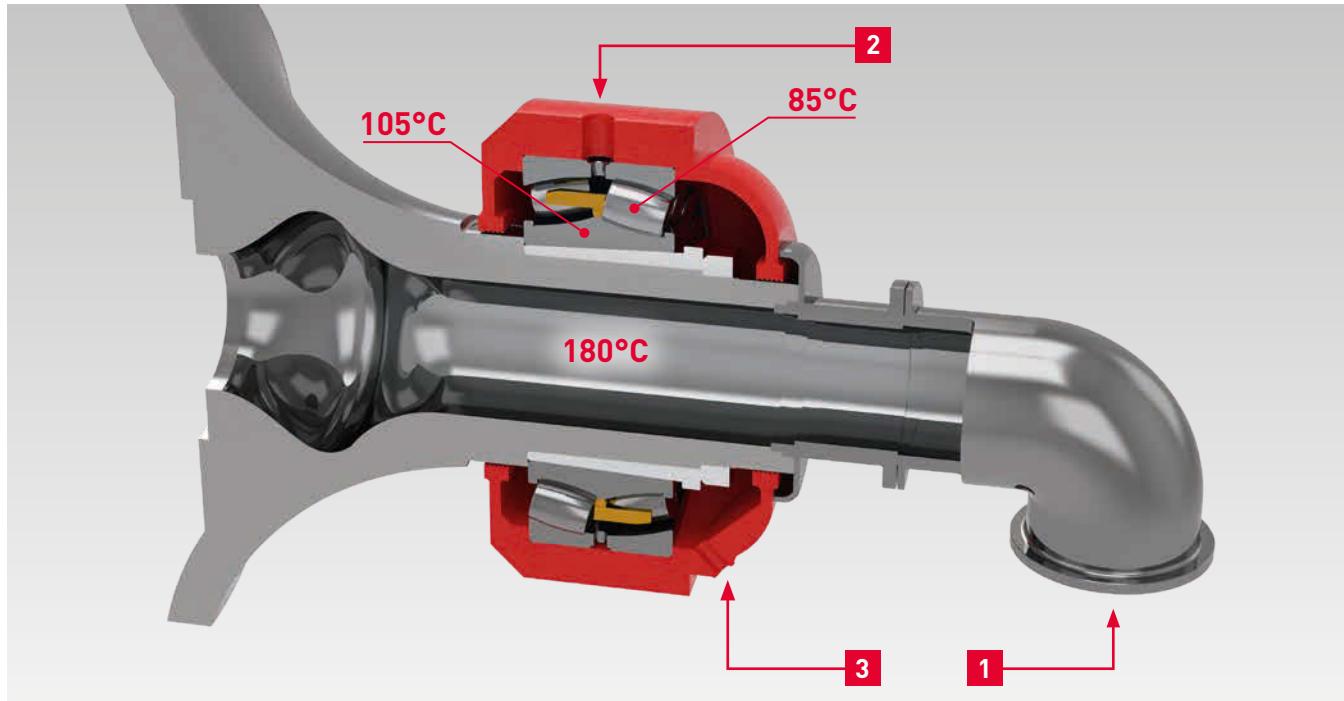


OPERATING ADVANTAGES

- › Service life is more than twice that of conventional bearings operating under contaminated conditions
- › High strength resistance to hoop stress and inner ring cracking
- › High raceway surface hardness promotes a wear resistant, long service life

- › Dramatically reduced incidents of bearing failure translate into extended uptime, reduced maintenance costs and increased machine throughput

TL STEEL TECHNOLOGY: THE LONG-LIFE SOLUTION



Pictured: Example of a dryer cylinder roll structure showing the typical temperatures present. 1) Steam, 2) Lubrication oil, 3) Oil return

FAILURE MECHANISM IN DRYER ROLLS

On a paper or board machine, the drying process occurs when heat is transferred from the dryer roll to the sheet contacting to the roll. The source of this heat is steam, passing through the hollow axis of the roll. Increasingly higher steam temperatures can contribute to higher drying speed and improved machine efficiency, but not without presenting a significant challenge to the bearings that are essential to smooth and trouble-free operation.

On machine start-up in particular, high steam temperature causes the journal to expand more rapidly than the bearing. This increases the tightness of fit between the mating surfaces and causes hoop stress (circumferential force) to be applied to the bearing inner ring. As this thermal stress increases, so too does the risk of crack formation and the inevitability of inner ring fracture.

TL STEEL TECHNOLOGY - NO COMPROMISE

Conventional measures such as adopting a slow start-up procedure can prevent such problems – by introducing temperature gradually – but can consume several hours and compromise production. And other approaches to product solutions exist, but with compromised success.

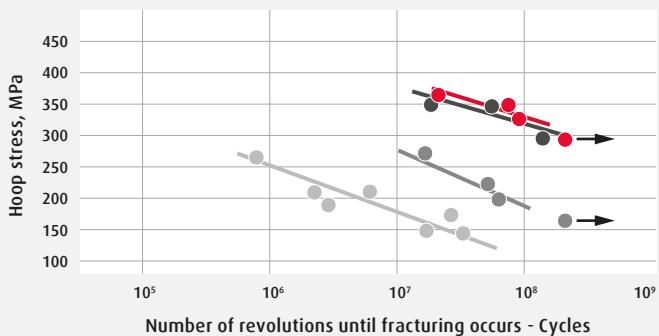
NSK's long life TL steel technology is a proven solution and standard specification - without special order - that consistently outperforms alternative product solutions such as carburized and bainite treated bearings with:

- › Higher fracture resistance
- › Longer fatigue life
- › Dimensional stability at high temperatures

Higher Fracture Resistance

High inner ring strength delivers high resistance to fracture resulting from increasing hoop stress caused by shaft temperature rise.

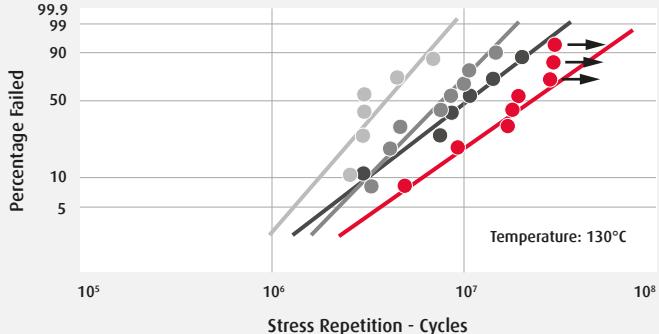
- TL specification steel
- Carburized steel
- Bearing steel with bainite treatment
- Bearing steel with standard heat treatment



Longer Fatigue Life

Increased raceway surface hardness delivers longer life, particularly when foreign debris is present.

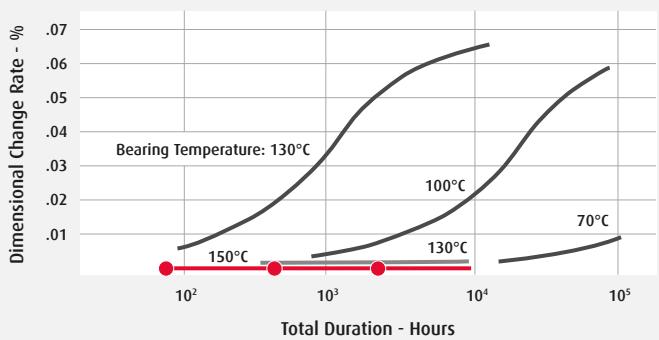
- TL specification steel
- Carburized steel with dimensional stabilizing treatment
- Bearing steel with bainite treatment
- Bearing steel with dimensional stabilizing treatment



Dimensional Stability

Dimensional stability at high temperatures - up to 200°C - is equal to or greater than traditional stabilizing approaches.

- TL specification steel
- Bearing steel with standard heat treatment
- Bearing steel with dimensional stabilizing treatment

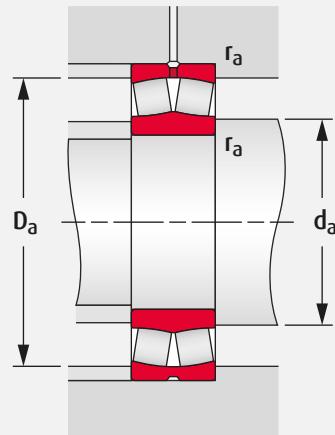
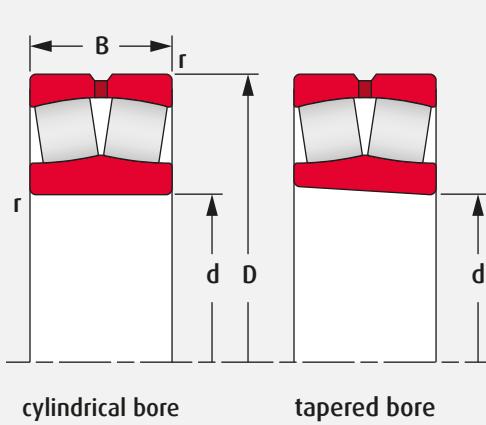


NSK's TL series spherical roller bearings are ideally designed to deliver Tough and Long Life performance wherever elevated temperatures prevail in the paper making process - in dryer rolls, canvas rolls, PV rolls and calender rolls.

When total machine efficiency and output hangs in the balance, NSK TL spherical roller bearings provide an advanced solution with a predictably reliable outcome.



BEARING DIMENSIONS AND OPERATING VALUES



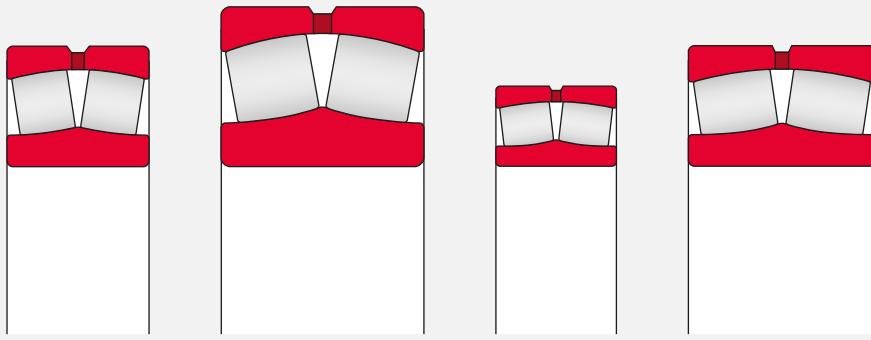
Dynamic equivalent load:
 $P = XF_r + YF_a$

| $F_a/F_r \leq e$ | | $F_a/F_r \leq e$ | |
|------------------|-------|------------------|-------|
| X | Y | X | Y |
| 1 | Y_3 | 0.67 | Y_2 |

Static equivalent load:
 $P_0 = F_r + Y_0 F_a$

The values for e , Y_2 , Y_3 and Y_0 are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|---------------|--------------------|-----|------|---------|--------------------|--------|---------|---------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL22308CAME4 | TL22308CAMKE4 | 40 | 90 | 33 | 1.5 | 122 | 129 | 27 500 | 29 000 |
| TL22311CAME4 | TL22311CAMKE4 | 55 | 120 | 43 | 2.0 | 209 | 241 | 47 000 | 54 000 |
| TL22312CAME4 | TL22312CAMKE4 | 60 | 130 | 46 | 2.1 | 246 | 288 | 55 500 | 64 500 |
| TL22313EAE4 | TL22313EAKE4 | 65 | 140 | 48 | 2.1 | 375 | 380 | 84 500 | 85 500 |
| TL22314EAE4 | TL22314EAKE4 | 70 | 150 | 51 | 2.1 | 425 | 435 | 95 500 | 98 000 |
| TL22315CAME4 | TL22215CAMKE4 | 75 | 130 | 31 | 2.1 | 340 | 415 | 76 500 | 93 500 |
| TL22316CAME4 | TL22316CAMKE4 | 80 | 170 | 58 | 2.1 | 390 | 480 | 87 500 | 108 000 |
| TL22318EAE4 | TL22318EAKE4 | 90 | 190 | 64 | 3.0 | 665 | 705 | 149 500 | 158 500 |
| TL22319CAME4 | TL22319CAMKE4 | 95 | 200 | 67 | 3.0 | 525 | 675 | 118 000 | 151 500 |
| TL22320EAE4 | TL22320EAKE4 | 100 | 215 | 73 | 3.0 | 860 | 930 | 193 500 | 209 000 |
| TL23022CDE4 | TL23022CDKE4 | | 170 | 45 | 2.0 | 293 | 465 | 66 000 | 104 500 |
| TL23222CE4 | TL23222CKE4 | 110 | 200 | 69.8 | 2.1 | 515 | 760 | 116 000 | 171 000 |
| TL22322EAE4 | TL22322EAKE4 | | 240 | 80 | 3.0 | 1 030 | 1 120 | 231 500 | 252 000 |
| TL22324EAE4 | TL22324EAKE4 | 120 | 260 | 86 | 3.0 | 1 190 | 1 320 | 267 500 | 296 500 |
| TL22326CAME4 | TL22326CAMKE4 | 130 | 280 | 93 | 4.0 | 995 | 1 350 | 223 500 | 303 500 |
| TL23028CDE4 | TL23028CDKE4 | | 210 | 53 | 2.0 | 420 | 715 | 94 500 | 160 500 |
| TL22228CDE4 | TL22228CDKE4 | 140 | 250 | 68 | 3.0 | 645 | 930 | 145 000 | 209 000 |
| TL23228CE4 | TL23228CKE4 | | 250 | 88 | 3.0 | 835 | 1 300 | 187 500 | 292 500 |



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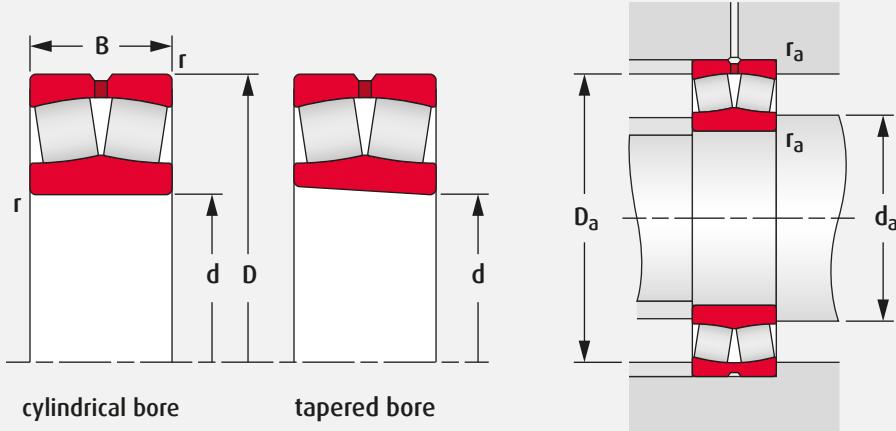
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| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-------|--------------------------------|-----|----------------|-----|----------------|----------|--------------------|----------------|----------------|--------|
| rpm | | d _a | | D _a | | r _a | | γ ₂ | γ ₃ | γ ₀ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 5 300 | 6 700 | 49 | - | 81 | 77 | 1.5 | 0.38 | 2.6 | 1.8 | 1.7 | 1.0 |
| 3 800 | 4 800 | 65 | - | 110 | 103 | 2.0 | 0.36 | 2.8 | 1.9 | 1.8 | 2.3 |
| 3 600 | 4 500 | 72 | - | 118 | 111 | 2.0 | 0.36 | 2.8 | 1.9 | 1.9 | 2.9 |
| 3 200 | 4 000 | 77 | 84 | 128 | 119 | 2.0 | 0.33 | 3.0 | 2.0 | 2.0 | 3.5 |
| 3 000 | 3 800 | 82 | 91 | 138 | 129 | 2.0 | 0.33 | 3.0 | 2.0 | 2.0 | 4.3 |
| 2 800 | 3 600 | 87 | - | 148 | 134 | 2.0 | 0.35 | 2.9 | 2.0 | 1.9 | 3.6 |
| 2 600 | 3 400 | 92 | - | 158 | 145 | 2.0 | 0.35 | 2.9 | 2.0 | 1.9 | 6.2 |
| 2 400 | 3 000 | 104 | 115 | 176 | 163 | 2.5 | 0.33 | 3.1 | 2.1 | 2.0 | 8.6 |
| 2 200 | 2 800 | 109 | - | 186 | 172 | 2.5 | 0.35 | 2.9 | 1.9 | 1.9 | 9.9 |
| 2 000 | 2 600 | 114 | 130 | 201 | 184 | 2.5 | 0.33 | 3.0 | 2.0 | 2.0 | 12.7 |
| 2 000 | 2 400 | 120 | 124 | 160 | 153 | 2.0 | 0.24 | 4.2 | 2.8 | 2.8 | 3.8 |
| 1 500 | 1 900 | 122 | 130 | 188 | 170 | 2.0 | 0.34 | 3.0 | 2.0 | 1.9 | 9.5 |
| 1 700 | 2 200 | 124 | 145 | 226 | 206 | 2.5 | 0.30 | 3.1 | 2.1 | 2.0 | 17.6 |
| 1 600 | 2 000 | 134 | 157 | 246 | 222 | 2.5 | 0.32 | 3.1 | 2.1 | 2.0 | 22.2 |
| 1 300 | 1 600 | 148 | - | 262 | 236 | 3.0 | 0.34 | 2.9 | 2.0 | 1.9 | 27.8 |
| 1 600 | 1 900 | 150 | 157 | 200 | 190 | 2.0 | 0.22 | 4.5 | 3.0 | 2.9 | 6.5 |
| 1 400 | 1 700 | 154 | 167 | 236 | 219 | 2.5 | 0.25 | 4.0 | 2.7 | 2.6 | 14.5 |
| 1 100 | 1 500 | 154 | 163 | 236 | 213 | 2.5 | 0.25 | 2.9 | 1.9 | 1.9 | 18.8 |

BEARING DIMENSIONS AND OPERATING VALUES



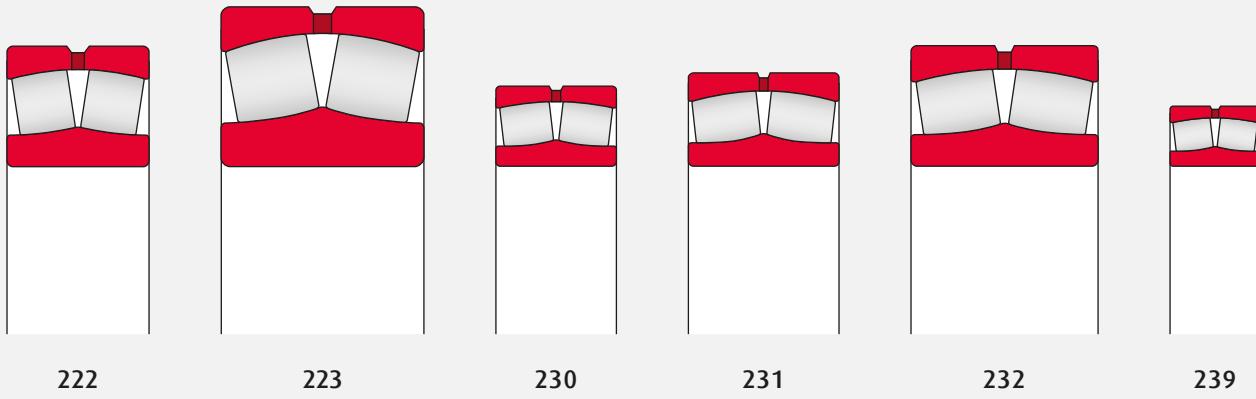
Dynamic equivalent load:
 $P = XF_r + YF_a$

| $F_a/F_r \leq e$ | | $F_a/F_r \leq e$ | |
|------------------|-------|------------------|-------|
| X | Y | X | Y |
| 1 | Y_3 | 0.67 | Y_2 |

Static equivalent load:
 $P_0 = F_r + Y_0 F_a$

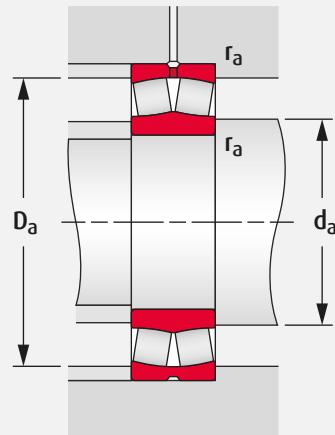
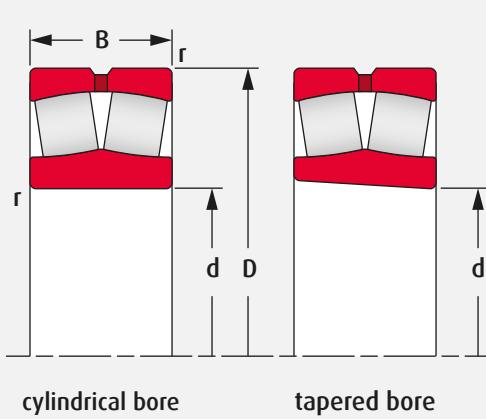
The values for e , Y_2 , Y_3 and Y_0 are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|---------------|--------------------|-----|-----|---------|--------------------|--------|---------|---------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL23030CAME4 | TL23030CAMKE4 | 150 | 225 | 56 | 2.1 | 470 | 815 | 105 500 | 183 000 |
| TL23130CAME4 | TL23130CAMKE4 | | 250 | 80 | 2.1 | 725 | 1 180 | 163 000 | 265 500 |
| TL22230CDE4 | TL22230CDKE4 | | 270 | 73 | 3.0 | 765 | 1 120 | 172 000 | 252 000 |
| TL22330CAME4 | TL22330CAMKE4 | | 320 | 108 | 4.0 | 1 220 | 1 690 | 274 500 | 380 000 |
| TL23032CDE4 | TL23032CDKE4 | 160 | 240 | 60 | 2.1 | 540 | 955 | 121 500 | 214 500 |
| TL22232CDE4 | TL22232CDKE4 | | 290 | 80 | 3.0 | 910 | 1 320 | 204 500 | 296 500 |
| TL23232CE4 | TL23232CKE4 | | 290 | 104 | 3.0 | 1 100 | 1 770 | 247 500 | 398 000 |
| TL23934CAME4 | TL23934CAMKE4 | 170 | 230 | 45 | 2.0 | 350 | 660 | 78 500 | 148 500 |
| TL23034CDE4 | TL23034CDKE4 | | 260 | 67 | 2.1 | 640 | 1 090 | 144 000 | 245 000 |
| TL23134CAME4 | TL23134CAMKE4 | | 280 | 88 | 2.1 | 940 | 1 570 | 211 500 | 353 000 |
| TL22334CAME4 | TL22334CAMKE4 | | 360 | 120 | 4.0 | 1 580 | 2 110 | 355 000 | 474 500 |
| TL23036CDE4 | TL23036CDKE4 | 180 | 280 | 74 | 2.1 | 750 | 1 270 | 168 500 | 285 500 |
| TL23236CAME4 | TL23236CAMKE4 | | 320 | 112 | 4.0 | 1 300 | 2 110 | 292 500 | 474 500 |
| TL23038CAME4 | TL23038CAMKE4 | 190 | 290 | 75 | 2.1 | 775 | 1 350 | 174 000 | 303 500 |
| TL23138CAME4 | TL23138CAMKE4 | | 320 | 104 | 3.0 | 1 190 | 2 020 | 267 500 | 454 000 |
| TL22238CAME4 | TL22238CAMKE4 | | 340 | 92 | 4.0 | 1 140 | 1 730 | 256 500 | 389 000 |
| TL23238CAME4 | TL23238CAMKE4 | | 340 | 120 | 4.0 | 1 440 | 2 350 | 323 500 | 528 500 |
| TL22338CAME4 | TL22338CAMKE4 | | 400 | 132 | 5.0 | 1 890 | 2 590 | 425 000 | 582 500 |



| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-------|--------------------------------|-----|----------------|-----|----------------|----------|--------------------|----------------|----------------|--------|
| rpm | | d _a | | D _a | | r _a | | e | γ ₂ | γ ₃ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 1 400 | 1 800 | 162 | - | 213 | 203 | 2.0 | 0.22 | 4.6 | 3.1 | 3.0 | 7.9 |
| 1 100 | 1 400 | 162 | - | 238 | 218 | 2.0 | 0.30 | 3.4 | 2.3 | 2.2 | 15.8 |
| 1 300 | 1 600 | 164 | 179 | 256 | 236 | 2.5 | 0.26 | 3.9 | 2.6 | 2.5 | 18.4 |
| 1 100 | 1 400 | 168 | - | 302 | 270 | 3.0 | 0.35 | 2.9 | 1.9 | 1.9 | 41.5 |
| 1 300 | 1 700 | 172 | 179 | 228 | 216 | 2.0 | 0.22 | 4.5 | 3.0 | 2.9 | 9.7 |
| 1 200 | 1 500 | 174 | 190 | 276 | 255 | 2.5 | 0.26 | 3.8 | 2.6 | 2.5 | 23.1 |
| 1 000 | 1 300 | 174 | 189 | 276 | 245 | 2.5 | 0.34 | 2.9 | 2.0 | 1.9 | 30.5 |
| 1 400 | 1 800 | 180 | - | 220 | 213 | 2.0 | 0.17 | 5.8 | 3.9 | 3.8 | 5.4 |
| 1 200 | 1 600 | 182 | 191 | 248 | 233 | 2.0 | 0.23 | 4.3 | 2.9 | 2.9 | 13.0 |
| 1 000 | 1 300 | 182 | - | 268 | 245 | 2.0 | 0.29 | 3.5 | 2.3 | 2.3 | 21.0 |
| 1 000 | 1 200 | 188 | - | 342 | 304 | 3.0 | 0.35 | 2.9 | 1.9 | 1.9 | 57.9 |
| 1 200 | 1 400 | 192 | 202 | 268 | 249 | 2.0 | 0.24 | 4.2 | 2.8 | 2.8 | 17.1 |
| 850 | 1 100 | 198 | - | 302 | 274 | 3.0 | 0.35 | 2.9 | 1.9 | 1.9 | 38.5 |
| 1 100 | 1 400 | 202 | - | 278 | 261 | 2.0 | 0.24 | 4.2 | 2.8 | 2.8 | 17.6 |
| 850 | 1 100 | 204 | - | 306 | 276 | 3.5 | 0.31 | 3.2 | 2.2 | 2.1 | 34.0 |
| 1 000 | 1 200 | 208 | - | 322 | 296 | 3.0 | 0.26 | 3.8 | 2.6 | 2.5 | 35.5 |
| 800 | 1 100 | 208 | - | 322 | 288 | 3.0 | 0.35 | 2.9 | 1.9 | 1.9 | 46.5 |
| 900 | 1 100 | 212 | - | 378 | 338 | 4.0 | 0.34 | 2.9 | 2.0 | 1.9 | 77.6 |

BEARING DIMENSIONS AND OPERATING VALUES



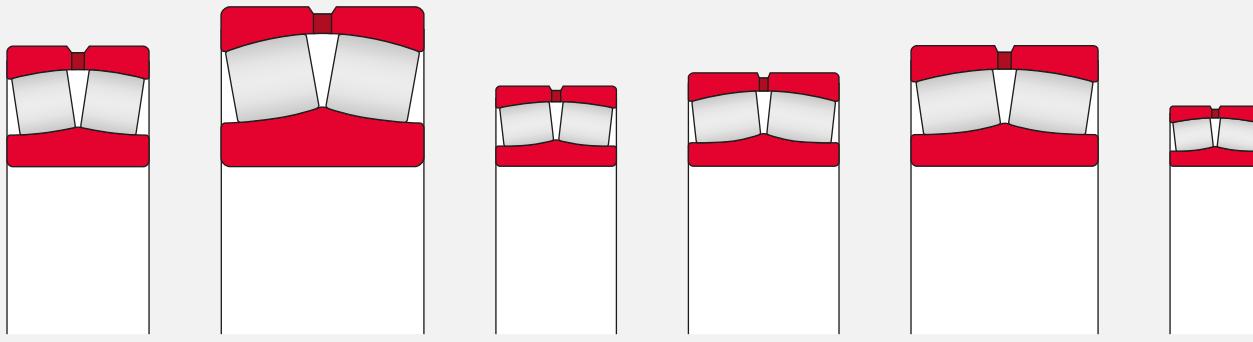
Dynamic equivalent load:
 $P = XF_r + YF_a$

| F _a /F _r ≤e | | F _a /F _r ≤e | |
|-----------------------------------|----------------|-----------------------------------|----------------|
| X | Y | X | Y |
| 1 | Y ₃ | 0.67 | Y ₂ |

Static equivalent load:
 $P_0 = F_r + Y_0 F_a$

The values for e, Y₂, Y₃ and Y₀ are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|------------------|--------------------|-----|-----|---------|--------------------|--------|---------|---------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL23040CAME4 | TL23040CAMKE4 | 200 | 310 | 82 | 2.1 | 940 | 1 700 | 211 500 | 382 000 |
| TL23140CAME4 | TL23140CAMKE4 | | 340 | 112 | 3.0 | 1 360 | 2 330 | 305 500 | 524 000 |
| TL22240CAME4 | TL22240CAMKE4 | | 360 | 98 | 4.0 | 1 300 | 2 010 | 292 500 | 452 000 |
| TL23240CAME4 | TL23240CAMKE4 | | 360 | 128 | 4.0 | 1 660 | 2 750 | 373 000 | 618 000 |
| TL23044CAME4 | TL23044CAMKE4 | 220 | 340 | 90 | 3.0 | 1 090 | 1 980 | 245 000 | 445 000 |
| TL23144CAME4 | TL23144CAMKE4 | | 370 | 120 | 4.0 | 1 570 | 2 710 | 353 000 | 609 000 |
| TL22244CAME4 | TL22244CAMKE4 | | 400 | 108 | 4.0 | 1 570 | 2 430 | 353 000 | 546 500 |
| TL23244CAME4 | TL23244CAMKE4 | | 400 | 144 | 4.0 | 2 520 | 3 400 | 566 500 | 764 500 |
| TL22344CAME4 | TL22344CAMKE4 | | 460 | 145 | 5.0 | 2 350 | 3 400 | 528 500 | 764 500 |
| TL23948CAME4 | TL23948CAMKE4 | 240 | 320 | 60 | 2.1 | 635 | 1 300 | 143 000 | 292 500 |
| TL23048CAME4 | TL23048CAMKE4 | | 350 | 92 | 3.0 | 1 160 | 2 140 | 261 000 | 481 000 |
| TL23148CAME4 | TL23148CAMKE4 | | 400 | 128 | 4.0 | 1 790 | 3 100 | 402 500 | 697 000 |
| TL22348CAME4 | TL22348CAMKE4 | | 500 | 155 | 5.0 | 2 600 | 3 800 | 584 500 | 854 500 |
| TLI-112618CAME4 | TLI-112618CAMKE4 | 250 | 410 | 128 | 4.0 | 1 780 | 3 150 | 400 000 | 708 000 |
| TL23952CAME4 | TL23952CAMKE4 | 260 | 350 | 75 | 2.1 | 930 | 1 870 | 209 000 | 420 500 |
| TL23052CAME4 | TL23052CAMKE4 | | 400 | 104 | 4.0 | 1 430 | 2 580 | 321 500 | 580 000 |
| TL23152CAME4 | TL23152CAMKE4 | | 440 | 144 | 4.0 | 2 160 | 3 750 | 485 500 | 843 000 |



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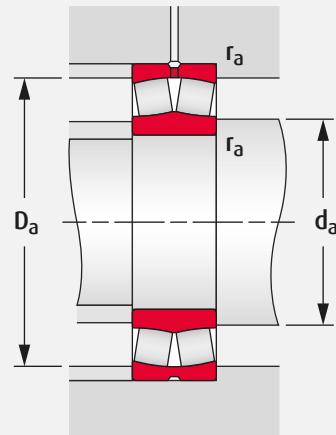
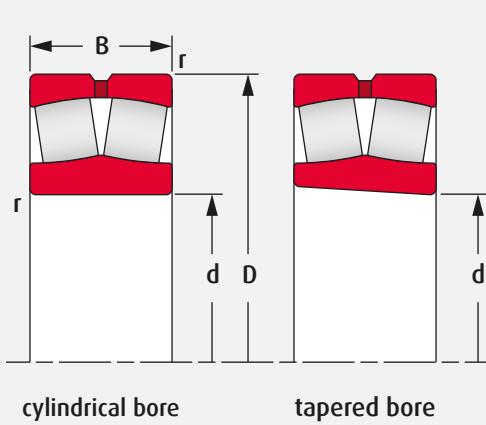
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| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-------|--------------------------------|-----|----------------|-----|----------------|----------|--------------------|----------------|----------------|--------|
| rpm | | d _a | | D _a | | r _a | | γ ₂ | γ ₃ | γ ₀ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 1 000 | 1 300 | 212 | - | 298 | 279 | 2.0 | 0.25 | 4.0 | 2.7 | 2.6 | 22.6 |
| 800 | 2 000 | 214 | - | 326 | 293 | 2.5 | 0.32 | 3.2 | 2.1 | 2.1 | 41.5 |
| 950 | 1 200 | 218 | - | 342 | 315 | 3.0 | 0.26 | 3.8 | 2.6 | 2.5 | 42.6 |
| 750 | 1 000 | 218 | - | 342 | 307 | 3.0 | 0.35 | 2.9 | 1.9 | 1.9 | 57.0 |
| 950 | 1 200 | 234 | - | 326 | 302 | 2.5 | 0.24 | 4.1 | 2.8 | 2.7 | 29.7 |
| 710 | 950 | 238 | - | 352 | 320 | 3.0 | 0.31 | 3.2 | 2.2 | 2.1 | 52.0 |
| 850 | 1 000 | 238 | - | 382 | 348 | 3.0 | 0.27 | 3.7 | 2.5 | 2.4 | 59.0 |
| 670 | 900 | 238 | - | 382 | 337 | 3.0 | 0.36 | 2.8 | 1.9 | 1.8 | 79.5 |
| 750 | 950 | 242 | - | 438 | 391 | 4.0 | 0.33 | 3.0 | 2.0 | 2.0 | 116.0 |
| 950 | 1 200 | 252 | - | 308 | 298 | 2.0 | 0.17 | 6.0 | 4.0 | 3.9 | 13.3 |
| 850 | 1 100 | 254 | - | 346 | 324 | 2.5 | 0.24 | 4.2 | 2.8 | 2.7 | 32.6 |
| 670 | 850 | 258 | - | 382 | 347 | 3.0 | 0.31 | 3.3 | 2.2 | 2.2 | 64.5 |
| 670 | 850 | 262 | - | 478 | 423 | 4.0 | 0.32 | 3.2 | 2.1 | 2.1 | 147.0 |
| 640 | 840 | 268 | - | 392 | 357 | 3.0 | 0.30 | 3.4 | 2.2 | 2.2 | 65.2 |
| 850 | 1 000 | 272 | - | 348 | 333 | 2.0 | 0.19 | 5.4 | 3.6 | 3.5 | 23.0 |
| 800 | 950 | 278 | - | 382 | 356 | 3.0 | 0.25 | 4.1 | 2.7 | 2.7 | 46.6 |
| 600 | 800 | 278 | - | 422 | 380 | 3.0 | 0.32 | 3.2 | 2.1 | 2.1 | 88.2 |

BEARING DIMENSIONS AND OPERATING VALUES



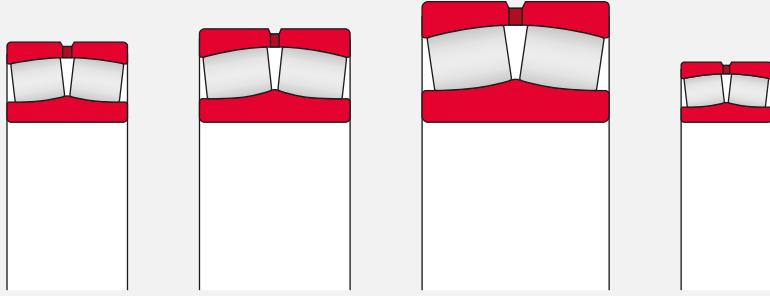
Dynamic equivalent load:
 $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ | | $F_a/F_r \leq e$ | |
|------------------|-------|------------------|-------|
| X | Y | X | Y |
| 1 | Y_3 | 0.67 | Y_2 |

Static equivalent load:
 $P_0 = F_r + Y_0 F_a$

The values for e , Y_2 , Y_3 and Y_0 are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|---------------|--------------------|-----|-----|---------|--------------------|--------|---------|-----------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL23956CAME4 | TL23956CAMKE4 | 280 | 380 | 75 | 2.1 | 925 | 1 950 | 208 000 | 438 500 |
| TL23056CAME4 | TL23056CAMKE4 | | 420 | 106 | 4.0 | 1 540 | 2 950 | 346 000 | 663 000 |
| TL23156CAME4 | TL23156CAMKE4 | | 460 | 146 | 5.0 | 2 230 | 4 000 | 501 500 | 899 000 |
| TL23256CAME4 | TL23256CAMKE4 | | 500 | 176 | 5.0 | 2 880 | 4 900 | 647 500 | 1 101 500 |
| TL23960CAME4 | TL23960CAMKE4 | 300 | 420 | 90 | 3.0 | 1 230 | 2 490 | 276 500 | 560 000 |
| TL23060CAME4 | TL23060CAMKE4 | | 460 | 118 | 4.0 | 1 920 | 3 700 | 431 500 | 832 000 |
| TL23160CAME4 | TL23160CAMKE4 | | 500 | 160 | 5.0 | 2 670 | 4 800 | 600 000 | 1 079 000 |
| TL23260CAME4 | TL23260CAMKE4 | | 540 | 192 | 5.0 | 3 400 | 5 900 | 764 500 | 1 326 500 |
| TL23164CAME4 | TL23164CAMKE4 | 320 | 540 | 176 | 5.0 | 3 050 | 5 500 | 685 500 | 1 236 500 |
| TL23068CAME4 | TL23068CAMKE4 | 340 | 520 | 133 | 5.0 | 2 280 | 4 400 | 512 500 | 989 000 |
| TL23168CAME4 | TL23168CAMKE4 | | 580 | 190 | 5.0 | 3 600 | 6 600 | 809 500 | 1 483 500 |
| TL23072CAME4 | TL23072CAMKE4 | 360 | 540 | 134 | 4.0 | 2 390 | 4 700 | 537 500 | 1 056 500 |
| TL23976CAME4 | TL23976CAMKE4 | 380 | 520 | 106 | 4.0 | 1 870 | 4 100 | 420 500 | 921 500 |
| TL23080CAME4 | TL23080CAMKE4 | 400 | 600 | 148 | 5.0 | 2 970 | 5 900 | 667 500 | 1 326 500 |
| TL23984CAME4 | TL23984CAMKE4 | 420 | 560 | 106 | 4.0 | 1 870 | 4 250 | 420 500 | 955 500 |
| TL23088CAME4 | TL23088CAMKE4 | 440 | 650 | 157 | 6.0 | 3 150 | 6 350 | 708 000 | 1 427 500 |
| TL23992CAME4 | TL23992CAMKE4 | 460 | 620 | 118 | 4.0 | 2 220 | 4 950 | 499 000 | 1 113 000 |



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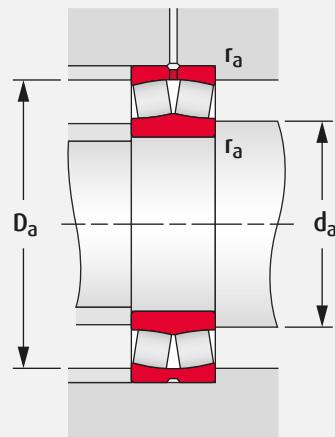
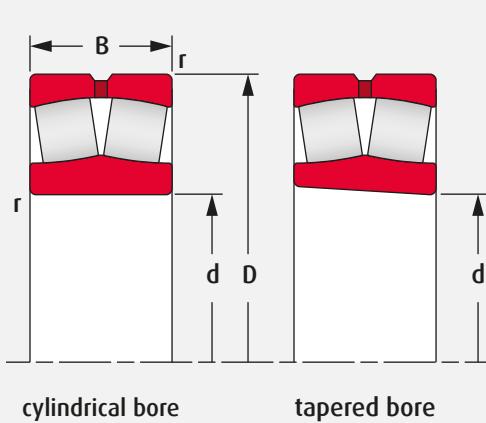
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| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-----|--------------------------------|-----|----------------|-----|----------------|----------|--------------------|----------------|----------------|--------|
| rpm | | d _a | | D _a | | r _a | | γ ₂ | γ ₃ | γ ₀ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 800 | 950 | 292 | - | 368 | 351 | 2.0 | 0.18 | 5.7 | 3.9 | 3.8 | 24.5 |
| 710 | 900 | 298 | - | 402 | 377 | 3.0 | 0.24 | 4.2 | 2.8 | 2.7 | 50.5 |
| 560 | 750 | 302 | - | 438 | 400 | 4.0 | 0.30 | 3.3 | 2.2 | 2.2 | 94.3 |
| 530 | 670 | 302 | - | 478 | 425 | 4.0 | 0.35 | 2.9 | 1.9 | 1.9 | 147.0 |
| 710 | 900 | 314 | - | 406 | 386 | 2.5 | 0.19 | 5.2 | 3.5 | 3.4 | 38.2 |
| 670 | 850 | 318 | - | 442 | 413 | 3.0 | 0.24 | 4.2 | 2.8 | 2.7 | 70.5 |
| 500 | 670 | 322 | - | 478 | 433 | 4.0 | 0.31 | 3.3 | 2.2 | 2.2 | 125.0 |
| 480 | 630 | 322 | - | 518 | 458 | 4.0 | 0.35 | 2.9 | 1.9 | 1.9 | 189.0 |
| 480 | 600 | 342 | - | 518 | 466 | 4.0 | 0.31 | 3.2 | 2.1 | 2.1 | 162.0 |
| 560 | 710 | 362 | - | 458 | 465 | 4.0 | 0.24 | 4.2 | 2.8 | 2.8 | 101.0 |
| 430 | 560 | 362 | - | 558 | 499 | 4.0 | 0.31 | 3.2 | 2.1 | 2.1 | 206.0 |
| 530 | 670 | 382 | - | 518 | 485 | 4.0 | 0.24 | 4.2 | 2.8 | 2.8 | 106.0 |
| 530 | 670 | 398 | - | 502 | 482 | 3.0 | 0.18 | 5.5 | 3.7 | 3.6 | 65.4 |
| 480 | 600 | 422 | - | 578 | 540 | 4.0 | 0.23 | 4.4 | 3.0 | 2.9 | 146.0 |
| 500 | 600 | 438 | - | 542 | 521 | 3.0 | 0.17 | 6.0 | 4.0 | 3.9 | 71.6 |
| 430 | 530 | 468 | - | 622 | 587 | 5.0 | 0.23 | 4.3 | 2.9 | 2.8 | 173.0 |
| 430 | 530 | 478 | - | 602 | 573 | 3.0 | 0.17 | 5.9 | 4.0 | 3.9 | 100.0 |

BEARING DIMENSIONS AND OPERATING VALUES



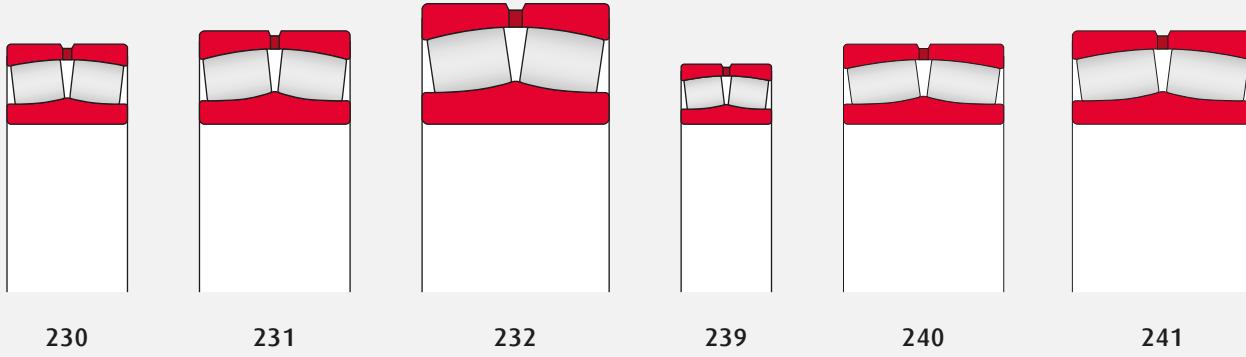
Dynamic equivalent load:
 $P = XF_r + YF_a$

| $F_a/F_r \leq e$ | | $F_a/F_r \leq e$ | |
|------------------|-------|------------------|-------|
| X | Y | X | Y |
| 1 | Y_3 | 0.67 | Y_2 |

Static equivalent load:
 $P_0 = F_r + Y_0 F_a$

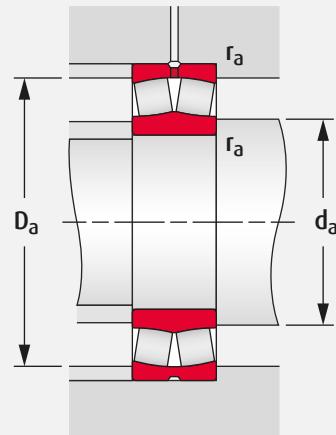
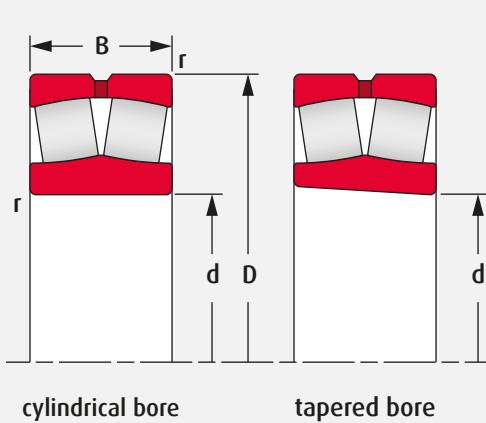
The values for e , Y_2 , Y_3 and Y_0 are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|-----------------|--------------------|------|-----|---------|--------------------|--------|-----------|-----------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL239/500CAME4 | TL239/500CAMKE4 | 500 | 670 | 128 | 5.0 | 2 460 | 5 550 | 553 000 | 1 247 500 |
| TL230/500CAME4 | TL230/500CAMKE4 | | 720 | 167 | 6.0 | 3 750 | 8 100 | 843 000 | 1 821 000 |
| TL240/500CAME4 | TL240/500CAMKE4 | | 720 | 218 | 6.0 | 4 450 | 9 900 | 1 001 500 | 2 227 500 |
| TL231/500CAME4 | TL231/500CAMKE4 | | 830 | 264 | 7.5 | 6 850 | 13 400 | 1 540 000 | 3 012 500 |
| TL241/500CAME4 | TL241/500CAMKE4 | | 830 | 325 | 7.5 | 8 000 | 16 000 | 1 800 000 | 3 600 000 |
| TL232/500CAME4 | TL232/500CAMKE4 | | 920 | 336 | 7.5 | 9 000 | 16 600 | 2 023 500 | 3 732 000 |
| TL239/530CAME4 | TL239/530CAMKE4 | 530 | 710 | 136 | 5.0 | 2 930 | 6 800 | 658 500 | 1 528 500 |
| TL230/530CAME4 | TL230/530CAMKE4 | | 780 | 185 | 6.0 | 4 400 | 9 200 | 989 000 | 2 068 000 |
| TL240/530CAME4 | TL240/530CAMKE4 | | 780 | 250 | 6.0 | 5 400 | 11 800 | 1 215 000 | 2 655 000 |
| TL231/530CAME4 | TL231/530CAMKE4 | | 870 | 272 | 7.5 | 7 150 | 14 100 | 1 607 500 | 3 170 000 |
| TL241/530CAME4 | TL241/530CAMKE4 | | 870 | 335 | 7.5 | 8 500 | 17 500 | 1 912 500 | 3 937 500 |
| TL232/530CAME4 | TL232/530CAMKE4 | | 980 | 355 | 9.5 | 10 100 | 18 800 | 2 270 500 | 4 226 500 |
| TL239/560CAME4 | TL239/560CAMKE4 | 560 | 750 | 140 | 5.0 | 3 100 | 7 250 | 697 000 | 1 630 000 |
| TL230/560CAME4 | TL230/560CAMKE4 | | 820 | 195 | 6.0 | 5 000 | 10 700 | 1 124 000 | 2 405 500 |
| TL240/560CAME4 | TL240/560CAMKE4 | | 820 | 258 | 6.0 | 5 950 | 13 300 | 1 339 000 | 2 992 500 |
| TL231/560CAME4 | TL231/560CAMKE4 | | 920 | 280 | 7.5 | 7 850 | 15 500 | 1 765 000 | 3 484 500 |
| TL241/560CAME4 | TL241/560CAMKE4 | | 920 | 355 | 7.5 | 9 400 | 19 600 | 2 115 000 | 4 410 000 |
| TL232/560CAME4 | TL232/560CAMKE4 | | 1030 | 365 | 9.5 | 10 900 | 20 500 | 2 450 500 | 4 608 500 |



| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-----|--------------------------------|-----|----------------|-----|----------------|----------|--------------------|----------------|----------------|---------|
| rpm | | d _a | | D _a | | r _a | | γ ₂ | γ ₃ | γ ₀ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 400 | 500 | 522 | - | 648 | 622 | 4.0 | 0.17 | 6.0 | 4.0 | 3.9 | 124.0 |
| 380 | 480 | 528 | - | 692 | 655 | 5.0 | 0.21 | 4.8 | 3.2 | 3.1 | 220.0 |
| 300 | 400 | 528 | - | 692 | 643 | 5.0 | 0.30 | 3.4 | 2.3 | 2.2 | 276.0 |
| 280 | 360 | 536 | - | 794 | 720 | 6.0 | 0.31 | 3.2 | 2.2 | 2.1 | 567.0 |
| 280 | 360 | 536 | - | 794 | 703 | 6.0 | 0.39 | 2.6 | 1.7 | 1.7 | 666.0 |
| 260 | 320 | 536 | - | 884 | 773 | 6.0 | 0.38 | 2.7 | 1.8 | 1.8 | 969.0 |
| 360 | 450 | 552 | - | 688 | 659 | 4.0 | 0.17 | 6.0 | 4.0 | 3.9 | 149.0 |
| 340 | 430 | 558 | - | 752 | 706 | 5.0 | 0.22 | 4.6 | 3.1 | 3.0 | 298.0 |
| 280 | 360 | 558 | - | 752 | 690 | 5.0 | 0.31 | 3.3 | 2.2 | 2.2 | 390.0 |
| 260 | 340 | 566 | - | 834 | 758 | 6.0 | 0.30 | 3.3 | 2.2 | 2.2 | 628.0 |
| 260 | 340 | 566 | - | 834 | 740 | 6.0 | 0.38 | 2.6 | 1.8 | 1.7 | 773.0 |
| 240 | 300 | 574 | - | 936 | 824 | 8.0 | 0.38 | 2.7 | 1.8 | 1.7 | 1 170.0 |
| 340 | 430 | 582 | - | 728 | 697 | 4.0 | 0.16 | 6.1 | 4.1 | 4.0 | 172.0 |
| 320 | 400 | 588 | - | 792 | 742 | 5.0 | 0.22 | 4.5 | 3.0 | 2.9 | 344.0 |
| 260 | 340 | 588 | - | 792 | 729 | 5.0 | 0.30 | 3.3 | 2.2 | 2.2 | 440.0 |
| 240 | 320 | 596 | - | 884 | 804 | 6.0 | 0.30 | 3.4 | 2.3 | 2.2 | 727.0 |
| 240 | 320 | 596 | - | 884 | 782 | 6.0 | 0.39 | 2.6 | 1.8 | 1.7 | 886.0 |
| 220 | 280 | 604 | - | 986 | 870 | 8.0 | 0.36 | 2.8 | 1.9 | 1.8 | 1 320.0 |

BEARING DIMENSIONS AND OPERATING VALUES



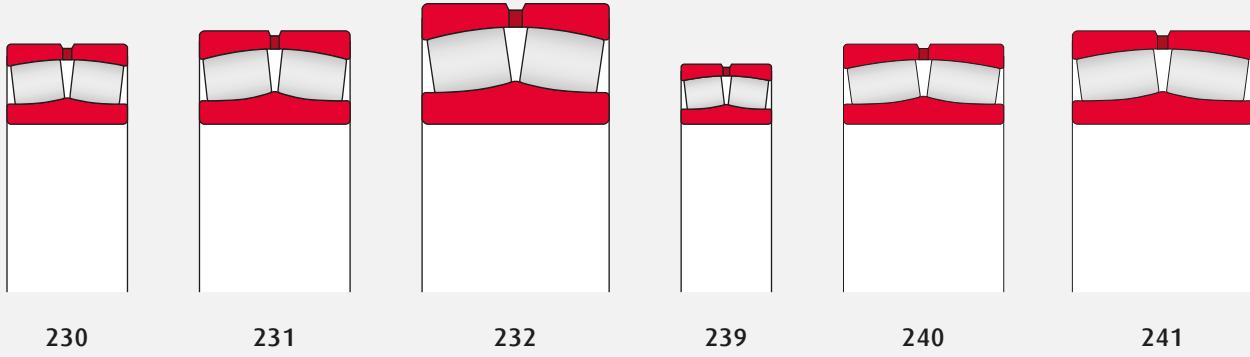
Dynamic equivalent load:
 $P = XF_r + YF_a$

| $F_a/F_r \leq e$ | | $F_a/F_r \leq e$ | |
|------------------|-------|------------------|-------|
| X | Y | X | Y |
| 1 | Y_3 | 0.67 | Y_2 |

Static equivalent load:
 $P_0 = F_r + Y_0 F_a$

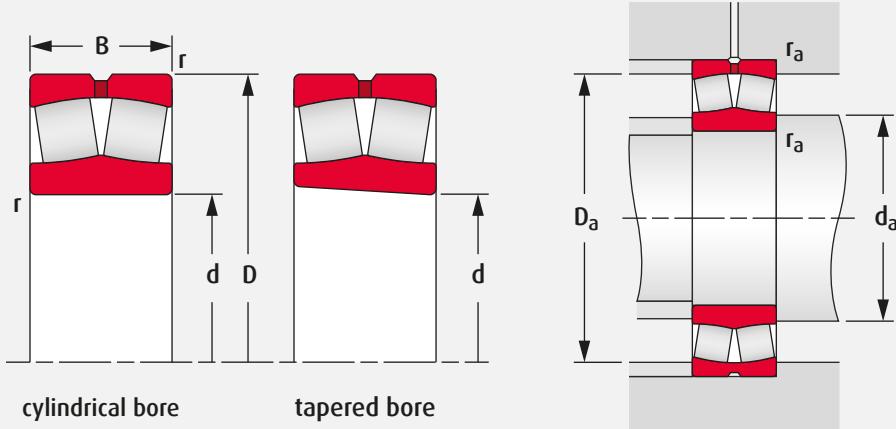
The values for e , Y_2 , Y_3 and Y_0 are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|-----------------|--------------------|-------|-----|---------|--------------------|--------|-----------|-----------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL239/600CAME4 | TL239/600CAMKE4 | 600 | 800 | 150 | 5.0 | 3 450 | 8 100 | 775 500 | 1 821 000 |
| TL230/600CAME4 | TL230/600CAMKE4 | | 870 | 200 | 6.0 | 5 450 | 12 200 | 1 225 000 | 2 742 500 |
| TL240/600CAME4 | TL240/600CAMKE4 | | 870 | 272 | 6.0 | 6 600 | 15 100 | 1 485 000 | 3 397 500 |
| TL231/600CAME4 | TL231/600CAMKE4 | | 980 | 300 | 7.5 | 8 750 | 17 500 | 1 967 000 | 3 934 000 |
| TL241/600CAME4 | TL241/600CAMKE4 | | 980 | 375 | 7.5 | 10 400 | 21 900 | 2 340 000 | 4 927 500 |
| TL232/600CAME4 | TL232/600CAMKE4 | | 1 090 | 388 | 9.5 | 12 700 | 24 900 | 2 855 000 | 5 597 500 |
| TL239/630CAME4 | TL239/630CAMKE4 | 630 | 850 | 165 | 6.0 | 4 000 | 9 350 | 899 000 | 2 102 000 |
| TL230/630CAME4 | TL230/630CAMKE4 | | 920 | 212 | 7.5 | 5 900 | 12 700 | 1 326 500 | 2 855 000 |
| TL231/630CAME4 | TL231/630CAMKE4 | | 1 030 | 315 | 7.5 | 9 600 | 19 400 | 2 158 000 | 4 361 500 |
| TL241/630CAME4 | TL241/630CAMKE4 | | 1 030 | 400 | 7.5 | 11 300 | 23 900 | 2 542 500 | 5 377 500 |
| TL239/670CAME4 | TL239/670CAMKE4 | 670 | 900 | 170 | 6.0 | 4 350 | 10 300 | 979 000 | 2 317 500 |
| TL230/670CAME4 | TL230/670CAMKE4 | | 980 | 230 | 7.5 | 6 850 | 15 000 | 1 541 500 | 3 375 000 |
| TL241/670CAME4 | TL241/670CAMKE4 | | 1 090 | 412 | 7.5 | 12 400 | 26 500 | 2 790 000 | 5 962 500 |



| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-----|--------------------------------|-----|----------------|-----|----------------|----------|--------------------|----------------|----------------|---------|
| rpm | | d _a | | D _a | | r _a | | γ ₂ | γ ₃ | γ ₀ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 320 | 400 | 622 | - | 778 | 745 | 4.0 | 0.17 | 5.9 | 3.9 | 3.9 | 205.0 |
| 300 | 360 | 628 | - | 842 | 794 | 5.0 | 0.21 | 4.8 | 3.3 | 3.2 | 389.0 |
| 240 | 320 | 628 | - | 842 | 772 | 5.0 | 0.30 | 3.3 | 2.2 | 2.2 | 529.0 |
| 220 | 280 | 636 | - | 944 | 856 | 6.0 | 0.30 | 3.4 | 2.3 | 2.2 | 898.0 |
| 220 | 280 | 636 | - | 944 | 836 | 6.0 | 0.39 | 2.6 | 1.8 | 1.7 | 1050.0 |
| 200 | 260 | 644 | - | 1 046 | 923 | 8.0 | 0.36 | 2.8 | 1.9 | 1.8 | 1590.0 |
| 300 | 360 | 658 | - | 822 | 786 | 5.0 | 0.18 | 5.6 | 3.8 | 3.7 | 259.0 |
| 280 | 340 | 666 | - | 884 | 835 | 6.0 | 0.22 | 4.7 | 3.1 | 3.1 | 468.0 |
| 200 | 260 | 666 | - | 994 | 900 | 6.0 | 0.30 | 3.4 | 2.3 | 2.2 | 1 040.0 |
| 200 | 260 | 666 | - | 994 | 876 | 6.0 | 0.38 | 2.7 | 1.8 | 1.7 | 1 250.0 |
| 260 | 340 | 698 | - | 872 | 836 | 5.0 | 0.17 | 5.8 | 3.9 | 3.8 | 300.0 |
| 240 | 320 | 706 | - | 944 | 891 | 6.0 | 0.22 | 4.7 | 3.1 | 3.1 | 571.0 |
| 190 | 240 | 706 | - | 1 054 | 934 | 6.0 | 0.37 | 2.7 | 1.8 | 1.8 | 1 440.0 |

BEARING DIMENSIONS AND OPERATING VALUES



Dynamic equivalent load:

$$P = XF_r + YF_a$$

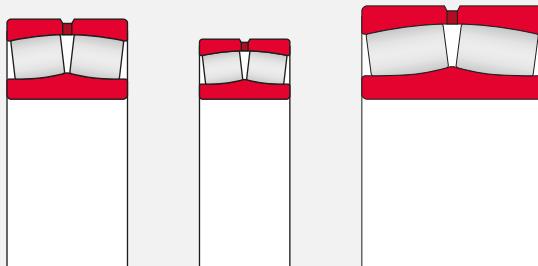
| $F_a/F_r \leq e$ | | $F_a/F_r \leq e$ | |
|------------------|-------|------------------|-------|
| X | Y | X | Y |
| 1 | Y_3 | 0.67 | Y_2 |

Static equivalent load:

$$P_0 = F_r + Y_0 F_a$$

The values for e , Y_2 , Y_3 and Y_0 are given in the table below.

| BASIC BEARING NO. | | BEARING DIMENSIONS | | | | BASIC LOAD RATINGS | | | |
|-------------------|------------------|--------------------|-------|-----|---------|--------------------|--------|-----------|-----------|
| | | mm | | | | kN | | lbf | |
| cylindrical bore | tapered bore | d | D | B | r (min) | dynamic | static | dynamic | static |
| TL239/710CAME4 | TL239/710CAMKE4 | 710 | 950 | 180 | 6.0 | 4 800 | 11 700 | 1 080 000 | 2 632 500 |
| TL230/710CAME4 | TL230/710CAMKE4 | | 1 030 | 236 | 7.5 | 7 100 | 15 800 | 1 597 500 | 3 555 000 |
| TL241/710CAME4 | TL241/710CAMKE4 | | 1 150 | 438 | 9.5 | 13 900 | 30 500 | 3 127 500 | 6 862 500 |
| TL239/750CAME4 | TL239/750CAMKE4 | 750 | 1 000 | 185 | 6.0 | 5 250 | 12 800 | 1 181 500 | 2 880 000 |
| TL230/750CAME4 | TL230/750CAMKE4 | | 1 090 | 250 | 7.5 | 7 750 | 17 200 | 1 744 000 | 3 870 000 |
| TL239/800CAME4 | TL239/800CAMKE4 | 800 | 1 060 | 195 | 6.0 | 5 600 | 13 700 | 1 260 000 | 3 082 500 |
| TL230/800CAME4 | TL230/800CAMKE4 | | 1 150 | 258 | 7.5 | 8 350 | 19 100 | 1 879 000 | 4 297 500 |
| TL239/850CAME4 | TL239/850CAMKE4 | 850 | 1 120 | 200 | 6.0 | 6 100 | 15 200 | 1 372 500 | 3 420 000 |
| TL230/850CAME4 | TL230/850CAMKE4 | 850 | 1 220 | 272 | 7.5 | 9 300 | 21 400 | 2 092 500 | 4 815 000 |
| TL239/950CAME4 | TL239/950CAMKE4 | 950 | 1 250 | 224 | 7.5 | 7 600 | 19 900 | 1 710 000 | 4 477 500 |
| TL230/950CAME4 | TL230/950CAMKE4 | 950 | 1 360 | 300 | 7.5 | 11 300 | 26 500 | 2 542 500 | 5 962 500 |
| TL239/1000CAME4 | TL239/1000CAMKE4 | 1 000 | 1 320 | 236 | 7.5 | 8 200 | 21 700 | 1 845 000 | 4 882 500 |



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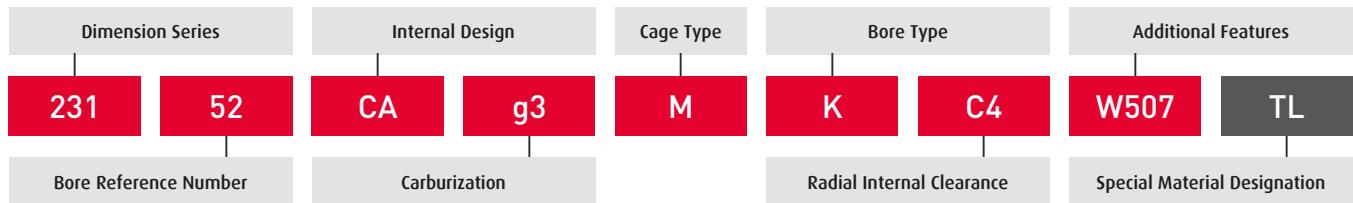
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| LIMITING SPEEDS | | ABUTMENT AND FILLET DIMENSIONS | | | | | CONSTANT | AXIAL LOAD FACTORS | | | MASS ~ |
|-----------------|-----|--------------------------------|-----|----------------|-------|----------------|----------|--------------------|----------------|----------------|---------|
| rpm | | d _a | | D _a | | r _a | | γ ₂ | γ ₃ | γ ₀ | |
| grease | oil | min | max | max | min | max | | | | | kg |
| 240 | 300 | 738 | - | 922 | 883 | 5.0 | 0.17 | 5.8 | 3.9 | 3.8 | 352.0 |
| 240 | 280 | 746 | - | 994 | 936 | 6.0 | 0.22 | 4.6 | 3.1 | 3.0 | 647.0 |
| 170 | 220 | 754 | - | 1 106 | 981 | 8.0 | 0.38 | 2.6 | 1.8 | 1.7 | 1 730.0 |
| 220 | 280 | 778 | - | 972 | 931 | 5.0 | 0.17 | 6.0 | 4.1 | 4.0 | 398.0 |
| 220 | 260 | 786 | - | 1 054 | 990 | 6.0 | 0.22 | 4.6 | 3.1 | 3.0 | 768.0 |
| 220 | 260 | 828 | - | 1 032 | 987 | 5.0 | 0.17 | 6.0 | 4.0 | 3.9 | 462.0 |
| 200 | 240 | 836 | - | 1 114 | 1 045 | 6.0 | 0.21 | 4.7 | 3.2 | 3.1 | 870.0 |
| 190 | 240 | 878 | - | 1 092 | 1 046 | 5.0 | 0.16 | 6.2 | 4.2 | 4.1 | 523.0 |
| 180 | 220 | 886 | - | 1 184 | 1 109 | 6.0 | 0.21 | 4.8 | 3.2 | 3.1 | 1 020.0 |
| 160 | 200 | 986 | - | 1 214 | 1 169 | 6.0 | 0.16 | 6.3 | 4.2 | 4.1 | 732.0 |
| 150 | 190 | 986 | - | 1 324 | 1 241 | 6.0 | 0.21 | 4.8 | 3.2 | 3.2 | 1 400.0 |
| 150 | 190 | 1 036 | - | 1 284 | 1 229 | 6.0 | 0.16 | 6.4 | 4.3 | 4.2 | 881.0 |

DESIGNATION SYSTEM - AFTERMARKET

TL SERIES SPHERICAL ROLLER BEARINGS



| DESIGNATION | ATTRIBUTE | DESIGNATION | ATTRIBUTE | | |
|---------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------|---------------------|------------------------------|----------------------------------------------------------------------------|
| Dimensional Series | 222 | medium duty type | Additional Features | P55 | extra-close running accuracy, inner and outer ring |
| | 223 | heavy duty type | | S11 | dimensionally stabilized up to 200°C |
| | 230 | very light duty type | | W31 | special inspection measure of superior raceway finish + upgraded packaging |
| | 231 | light duty type | | W507 | W31 + lubrication groove and holes in the outer ring (E4) + S11 |
| | 232 | medium duty type, wide | | W509 | W31 + lubrication groove and holes in the outer and inner ring (E7) + S11 |
| | 239 | extra-light duty type | | Special Material Designation | TL |
| Bore Reference Number | multiply x 5 for bore diameter in mm; 500 mm and greater expressed with a "/" eg. /500 = 500 mm | | | | |
| Internal Design | EA | high capacity design, steel cage | | | |
| | CA | high capacity design, brass cage | | | |
| Carburization | g | complete bearing | | | |
| | g3 | inner ring | | | |
| | g5 | inner and outer ring | | | |
| Cage Type | blank | two piece steel cage | | | |
| | CD ⁽¹⁾ | two piece steel cage with guide ring | | | |
| | M | machined brass cage with guide ring | | | |
| Bore Type | blank | cylindrical bore | | | |
| | K | 1:12 tapered bore | | | |
| Radial Internal Clearance | blank | normal (CN) | | | |
| | C3 | greater than normal | | | |
| | C4 | greater than C3 | | | |
| | C5 | greater than C4 | | | |

Note: 1) When cage type CD is used, it follows the bore reference number in the designation system eg. 23028CDg3KC4W507TL



IMPROVEMENT PAYS

END-TO-END SERVICE DELIVERS CUSTOMER SUCCESS

Improvement never ends. And we never stop looking for better ways to support our customers in a complete, collaborative and continuous way. The focus of NSK isn't simply on a quick fix for immediate gain – it's about incremental and sustainable improvement to deliver long-term benefits.

When NSK is on-site, we're there to understand our customers' challenges and identify problems contributing to frequent bearing replacement, breakdowns caused by poor specification, high energy costs from inefficient product selection and lost production because of downtime. We collaborate with our customers to institute an **Asset Improvement Program (AIP)** that encompasses process and maintenance management, diagnostic and educational support to deliver measurable gains in output and cost-efficiency.

With NSK, our customers embark on a critical path to realizing improvements in equipment, productivity, people and financial performance.





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