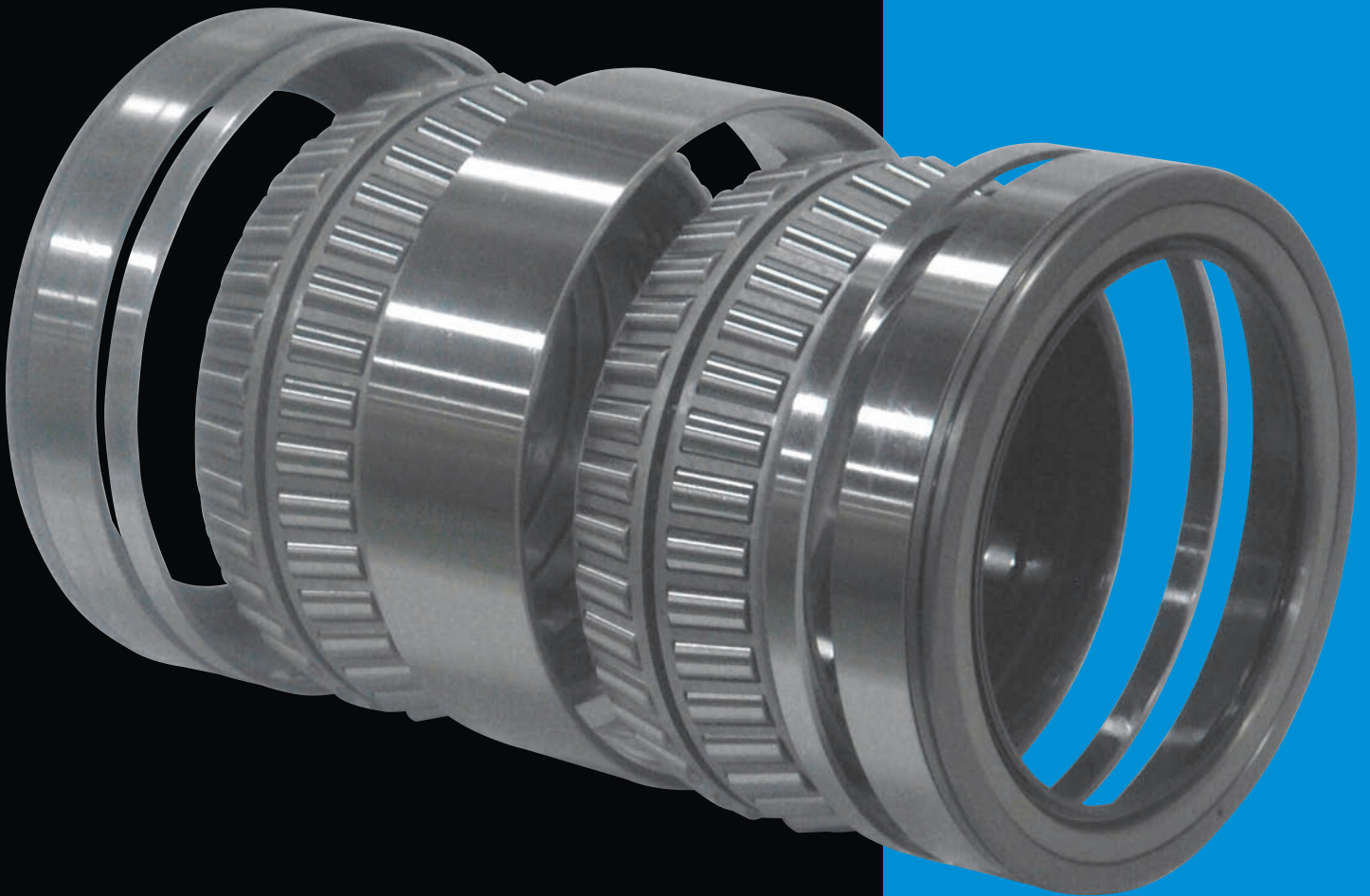


NTN[®]

**Sealed Four Row Tapered Roller Bearings
for Rolling Mill Roll-Necks
[CROU..LL Type]**

ULTAGE



ULTAGE[®]

CAT. No. 3801/E

ULTAGE®

Load capacity
40% increase

Load resistance
Twice as great

Sealing performance
50% reduction in water intrusion volume

Sealed Four Row Tapered Roller Bearings for Rolling Mill Roll-Necks [CROU..LL Type]

The ULTAGE series sealed four row tapered roller bearings (CROU..LL type) are new standard series products especially developed to satisfy the “high load capacity”, “high load resistance performance” and “high sealing performance” required for steel mill roll-neck applications and to improve reliability through long life design.

High load capacity

- Compact seal design helps maximize bearing side volume.
- Maximization in the size and number of rollers helps realize high load capacity.

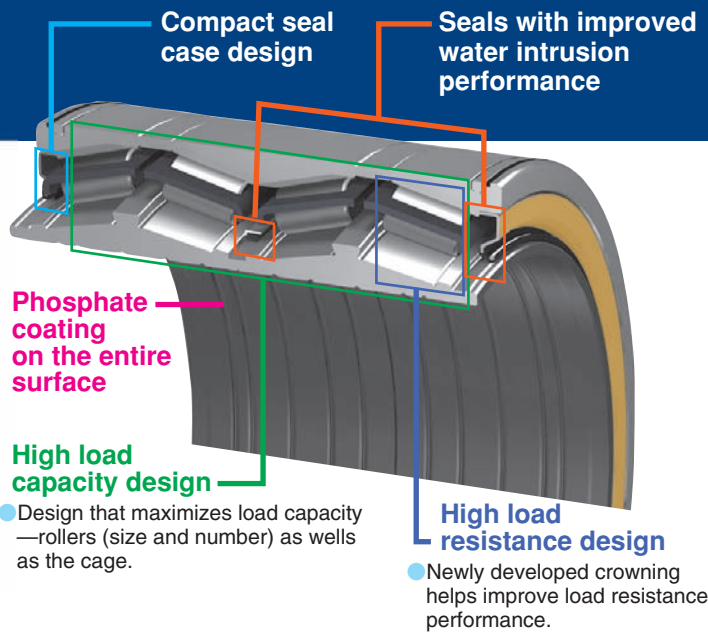
Longer bearing life

High load resistance performance

- Newly developed crowning helps reduce and ensure uniform contact pressure.
- World's highest level in load resistance performance.

Improved sealing performance

- Newly developed seal lip design significantly reduces water intrusion volume.
- Fluoro-rubber seal boasts more positive sealing performance.



Features

1. High load capacity design —the world's highest level

Maximum size and number of rollers help realize high load capacity and longer life.

2. High load resisting design —the world's highest level Patent pending

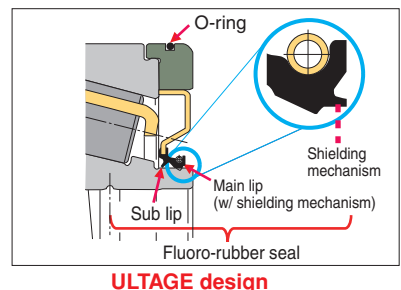
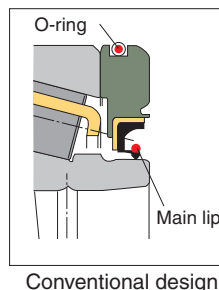
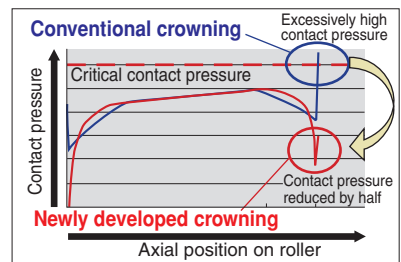
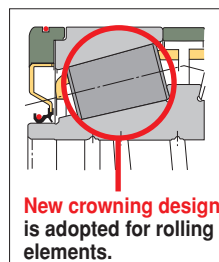
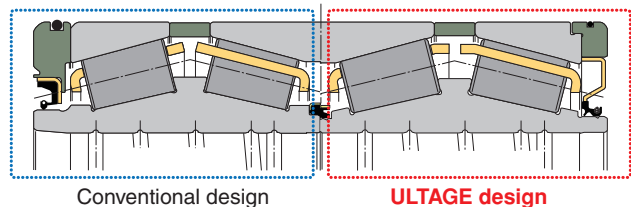
Assurance of uniform contact pressure on rolling elements within bearings and against outside loads has helped greatly enhance load resistance performance.

3. Compact high sealing design Patent pending

“High sealing” fluoro-rubber seals, boasting a minimized seal volume, are adopted as standard. Through optimization of the tightening force of the main lip and the provision of a shielding arrangement against foreign substances, the water intrusion volume has been reduced by more than 50%: at the same time, the sub lip helps prevent the outflow of grease.

4. Long-life grease as standard

The bearing is prefilled with long-life grease. A rinsing and/or grease prefilling procedure is not necessary when the bearing is installed on the side of the machine.



ULTAGE®

"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.

Metric series Tolerances [JIS 0 Class]

(1) Inner rings

Unit : μm

| Nominal bore diameter d mm | | Dimensional tolerance of mean bore diameter within plane Δd_{mp} | | Bore diameter variation V_{dp} | Mean bore diameter variation V_{dmp} | Inner ring radial runout K_{ia} | Combination width deviation of 4-row bearings $\Delta B_{as}, \Delta C_{as}$ | |
|---------------------------------|-------|-----------------------------------------------------------------------------|------|-------------------------------------|-------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------|--------|
| over | incl. | high | low | max | max | max | high | low |
| 180 | 250 | 0 | -30 | 30 | 23 | 50 | +750 | -750 |
| 250 | 315 | 0 | -35 | 35 | 26 | 60 | +900 | -900 |
| 315 | 400 | 0 | -40 | 40 | 30 | 70 | +1 000 | -1 000 |
| 400 | 500 | 0 | -45 | 45 | 34 | 80 | +1 200 | -1 200 |
| 500 | 630 | 0 | -50 | 50 | 38 | 90 | +1 200 | -1 200 |
| 630 | 800 | 0 | -75 | 75 | 56 | 105 | +1 500 | -1 500 |
| 800 | 1 000 | 0 | -100 | 100 | 75 | 120 | +1 500 | -1 500 |

(2) Outer rings

Unit : μm

| Nominal outside diameter D mm | | Dimensional tolerance of mean outside diameter within plane ΔD_{mp} | | Outside diameter variation V_{Dp} | Mean outside diameter variation V_{Dmp} | Inner ring radial runout K_{ea} |
|------------------------------------|-------|--------------------------------------------------------------------------------|------|----------------------------------------|----------------------------------------------|--------------------------------------|
| over | incl. | high | low | max | max | max |
| 180 | 250 | 0 | -30 | 30 | 23 | 50 |
| 250 | 315 | 0 | -35 | 35 | 26 | 60 |
| 315 | 400 | 0 | -40 | 40 | 30 | 70 |
| 400 | 500 | 0 | -45 | 45 | 34 | 80 |
| 500 | 630 | 0 | -50 | 50 | 38 | 100 |
| 630 | 800 | 0 | -75 | 75 | 56 | 120 |
| 800 | 1 000 | 0 | -100 | 100 | 75 | 140 |

Inch series Tolerances [ABMA 0 Class]

(1) Inner rings

Unit : μm

| Nominal bore diameter d mm | | Single bore diameter deviation Δd_s | |
|---------------------------------|-------|------------------------------------------------|-----|
| over | incl. | high | low |
| 76.2 | 266.7 | +25 | 0 |
| 266.7 | 304.8 | +25 | 0 |
| 304.8 | 609.6 | +51 | 0 |
| 609.6 | 914.4 | +76 | 0 |

(2) Outer rings

Unit : μm

| Nominal outside diameter D mm | | Single outside diameter deviation ΔD_s | |
|------------------------------------|-------|---------------------------------------------------|-----|
| over | incl. | high | low |
| 266.7 | 304.8 | +25 | 0 |
| 304.8 | 609.6 | +51 | 0 |
| 609.6 | 914.4 | +76 | 0 |

(3) Radial deflection of inner and outer rings

Unit : μm

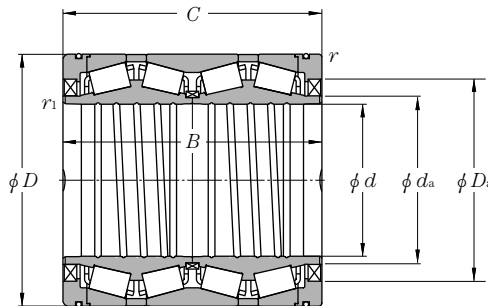
| Nominal outside diameter D mm | | Radial runout K_{ia}, K_{ea} |
|------------------------------------|-------|-----------------------------------|
| over | incl. | max |
| 266.7 | 304.8 | 51 |
| 304.8 | 609.6 | 51 |
| 609.6 | 914.4 | 76 |

(4) Combination width deviation of 4-row bearings

Unit : μm

| Nominal bore diameter d mm | | Nominal outside diameter D mm | | Combination width deviation of 4-row bearings $\Delta B_{as}, \Delta C_{as}$ | |
|---------------------------------|-------|------------------------------------|-------|---------------------------------------------------------------------------------|--------|
| over | incl. | over | incl. | high | low |
| 101.6 | 304.8 | — | 508.0 | +1 520 | -1 520 |
| 304.8 | 609.6 | — | 508.0 | +1 520 | -1 520 |
| 304.8 | 609.6 | 508.0 | — | +1 520 | -1 520 |
| 609.6 | — | — | — | +1 520 | -1 520 |

Dimension Table (For information about bearing models not listed in the Dimension Table, contact NTN Engineering.)



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

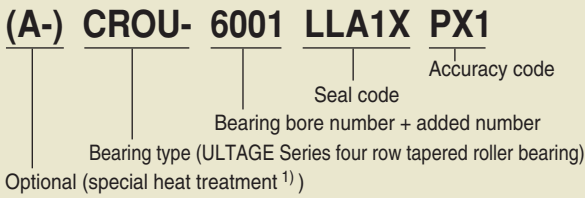
$$P_{or} = F_r + Y_0 F_a$$

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

| Series | Bearing numbers | Boundary dimensions mm | | | | | | Standard ^② radial clearance (approx.) mm | Standard ^② axial clearance mm |
|---------------|------------------------------|---------------------------|---------|---------|---------|----------------------------|----------------------------|--------------------------------------------------------|---------------------------------------------|
| | | d | D | B | C | $r_{1s \min}$ ^① | $r_{2s \min}$ ^① | | |
| Metric series | CROU-4401LLA1X | 220 | 295 | 315 | 315 | 1 | 2.5 | 0.093~0.106 | 0.420~0.480 |
| | CROU-4501LLA1X | 225 | 320 | 230 | 230 | 1 | 2.5 | 0.099~0.115 | 0.360~0.420 |
| | CROU-4801LLA1X | 240 | 338 | 248 | 248 | 1 | 2.5 | 0.104~0.118 | 0.450~0.510 |
| | CROU-4802LLA1X | 240 | 338 | 340 | 340 | 1 | 2.5 | 0.107~0.123 | 0.400~0.460 |
| | CROU-5001LLA1X | 250 | 365 | 270 | 270 | 1 | 2.5 | 0.113~0.129 | 0.420~0.480 |
| | CROU-5201LLA1X | 260 | 365 | 340 | 340 | 1 | 2.5 | 0.115~0.131 | 0.430~0.490 |
| | CROU-6001LLA1X | 300 | 420 | 310 | 310 | 1 | 2.5 | 0.131~0.147 | 0.490~0.550 |
| | CROU-6201LLA1X | 310 | 430 | 350 | 350 | 1 | 2.5 | 0.136~0.154 | 0.520~0.590 |
| | CROU-8201LLA1X | 410 | 546 | 400 | 400 | 1.5 | 2.5 | 0.173~0.188 | 0.780~0.850 |
| | CROU-8801LLA1X | 440 | 590 | 480 | 480 | 1.5 | 2.5 | 0.188~0.204 | 0.850~0.920 |
| | CROU-8802LLA1X | 440 | 620 | 454 | 454 | 3 | 2.5 | 0.195~0.211 | 0.880~0.950 |
| | CROU-10601LLA1X [※] | 530 | 780 | 570 | 570 | 3 | 2.5 | 0.244~0.259 | 1.100~1.170 |
| Inch series | CROU-4402LLA1X | 220.662 | 314.325 | 239.712 | 239.712 | 1 | 2.5 | 0.098~0.111 | 0.450~0.510 |
| | CROU-5101LLA1X | 254.000 | 358.775 | 269.875 | 269.875 | 1 | 2.5 | 0.111~0.127 | 0.430~0.490 |
| | CROU-6101LLA1X | 304.902 | 412.648 | 266.700 | 266.700 | 1 | 2.5 | 0.130~0.150 | 0.450~0.520 |
| | CROU-6901LLA1X | 343.052 | 457.098 | 254.000 | 254.000 | 1 | 2.5 | 0.136~0.158 | 0.430~0.500 |
| | CROU-6902LLA1X | 343.052 | 457.098 | 299.000 | 299.000 | 1 | 2.5 | 0.143~0.163 | 0.500~0.570 |
| | CROU-10001LLA1X [※] | 501.650 | 711.200 | 520.700 | 520.700 | 3 | 2.5 | 0.206~0.226 | 0.730~0.800 |
| | CROU-11901LLA1X | 595.312 | 844.550 | 615.950 | 615.950 | 3 | 2.5 | 0.266~0.282 | 1.200~1.270 |

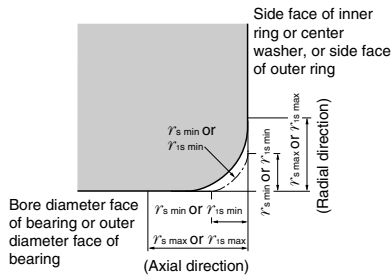
① Minimum allowable value of chamfer dimension r . ② Depending on operating conditions, appropriate values may vary. Contact NTN Engineering for technical assistance.

Bearing Number



NOTE 1) Carbonitriding

Chamfer Dimension



| $r's \text{ min}$ or $r'_{1s} \text{ min}$ | Nominal bore diameter d | | $r's \text{ max}$ OR $r'_{1s} \text{ max}$ | |
|--------------------------------------------------|---------------------------|-------|--------------------------------------------|-----------------|
| | over | incl. | Radial direction | Axial direction |
| 1 | 50 | — | 1.9 | 3 |
| 1.5 | 120 | 250 | 2.8 | 3.5 |
| | 250 | — | 3.5 | 4 |
| 2.5 | 120 | 250 | 4 | 5.5 |
| | 250 | — | 4.5 | 6 |
| 3 | 120 | 250 | 4.5 | 6.5 |
| | 250 | 400 | 5 | 7 |
| | 400 | — | 5.5 | 7.5 |

Operating Temperature Range

- 20 to +120°C

Fit (recommended)

- Metric series: Shaft d6/ Housing G7
- Inch series: Contact NTN Engineering for technical assistance.

Standard Prelubricating Grease

- Brand: Kyodo Yushi Palmax RBG (L373)
- Fill amount: Space volume ratio 35%

Limiting Speed

$$d_m \cdot N \leq 30 \times 10^4$$

d_m : bearing center diameter (mm) = $(d + D) / 2$

d : bearing bore diameter (mm)

D : bearing outside diameter (mm)

N : running speed (min⁻¹)

The values above are shown as a guide, and may not be met under certain operating conditions. For details, contact NTN Engineering.

Materials

- Inner and outer rings: Case hardening steel
- Rolling element: Bearing steel
- ※ mark only: Case hardening steel

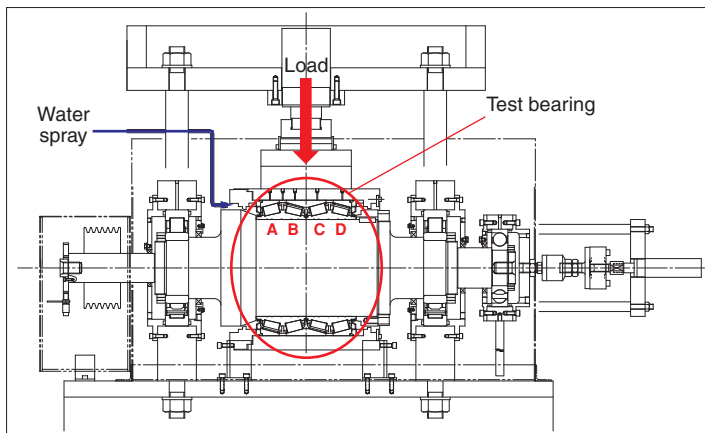
| dynamic C_R | Basic load ratings | | static C_{0r} | static C_{0r} | Abutment and fillet dimensions | | Constant e | Axial load factor | | |
|---------------|--------------------|-----------------|-----------------|-----------------|--------------------------------|-----------------|--------------|-------------------|-------|-------|
| | dynamic C_R | static C_{0r} | | | dynamic C_R | static C_{0r} | | d_a | D_a | Y_1 |
| 1 880 | 4 650 | 192 000 | 475 000 | 235 | 267 | 0.33 | 2.03 | 3.02 | 1.98 | |
| 1 870 | 3 700 | 190 000 | 375 000 | 241 | 294 | 0.41 | 1.64 | 2.44 | 1.6 | |
| 2 320 | 4 600 | 236 000 | 470 000 | 259 | 309 | 0.35 | 1.95 | 2.90 | 1.91 | |
| 2 960 | 6 850 | 302 000 | 700 000 | 257 | 299 | 0.40 | 1.68 | 2.50 | 1.64 | |
| 2 760 | 5 300 | 280 000 | 540 000 | 272 | 333 | 0.40 | 1.68 | 2.50 | 1.64 | |
| 3 340 | 7 450 | 340 000 | 760 000 | 275 | 327 | 0.40 | 1.68 | 2.50 | 1.64 | |
| 3 600 | 7 650 | 366 000 | 780 000 | 318 | 382 | 0.40 | 1.68 | 2.50 | 1.64 | |
| 4 020 | 8 900 | 410 000 | 910 000 | 329 | 388 | 0.39 | 1.72 | 2.56 | 1.68 | |
| 5 520 | 13 300 | 562 000 | 1 350 000 | 434 | 504 | 0.33 | 2.03 | 3.02 | 1.98 | |
| 6 600 | 16 200 | 670 000 | 1 650 000 | 462 | 540 | 0.33 | 2.03 | 3.02 | 1.98 | |
| 7 600 | 16 700 | 780 000 | 1 700 000 | 473 | 570 | 0.33 | 2.03 | 3.02 | 1.98 | |
| 13 400 | 29 400 | 1 370 000 | 3 000 000 | 581 | 710 | 0.33 | 2.03 | 3.02 | 1.98 | |
| 2 240 | 4 350 | 228 000 | 440 000 | 240 | 290 | 0.33 | 2.07 | 3.09 | 2.03 | |
| 2 760 | 5 700 | 282 000 | 580 000 | 274 | 328 | 0.39 | 1.74 | 2.59 | 1.70 | |
| 2 800 | 5 850 | 286 000 | 600 000 | 323 | 379 | 0.43 | 1.56 | 2.32 | 1.52 | |
| 2 820 | 5 950 | 288 000 | 605 000 | 360 | 423 | 0.47 | 1.43 | 2.12 | 1.40 | |
| 3 500 | 8 150 | 356 000 | 830 000 | 364 | 423 | 0.43 | 1.57 | 2.34 | 1.53 | |
| 10 000 | 23 900 | 1 020 000 | 2 440 000 | 542 | 642 | 0.42 | 1.60 | 2.38 | 1.56 | |
| 13 900 | 33 000 | 1 420 000 | 3 350 000 | 638 | 770 | 0.33 | 2.03 | 3.02 | 1.98 | |

Performance Test Data

Water Resistance Durability Test

[Test conditions]

Bearing number: ULTAGE sealed four row tapered roller bearing CROU-6001LLAX1
 (Dimensions: $\phi 300 \times \phi 420 \times 310$, C_r : 3600 kN, C_{0r} : 7650 kN)
 Prelubricating grease: Palmax RBG
 Radial load: 390 kN ($0.11 C_r$)
 Running speed: Cyclic operation where one cycle consists of
 $\Rightarrow 300 \text{ min}^{-1}$ (0.5 h) $\Rightarrow 500 \text{ min}^{-1}$ (1 h) \Rightarrow
 standstill (1 h)
 Water spray: 0.15 L/min
 Total running hours: 1000 h



Structure of test rig

[Status of bearing interior after test, and water content in grease (wt%)]

* Water content in factory-fresh grease is in the range of 0.001% to 0.04%.

| | Rollers on side A | Outer ring on side B | Outer ring on side C | Rollers on side D | Outer ring on side D |
|-------------------|-------------------|----------------------|----------------------|-------------------|----------------------|
| Conventional seal | 0.27% | 0.03% | 2.01% | 0.03% | 0.04% |
| High sealing seal | 0.03% | 0.02% | 0.02% | 0.03% | 0.02% |



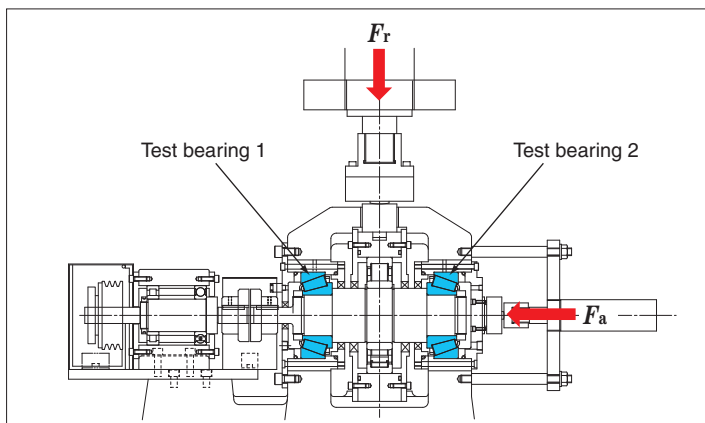
Appearance of test rig

Evidence of water intrusion is found on the conventional seal. In contrast, the NTN "high sealing" seal does not exhibit evidence of water intrusion.

Life test result

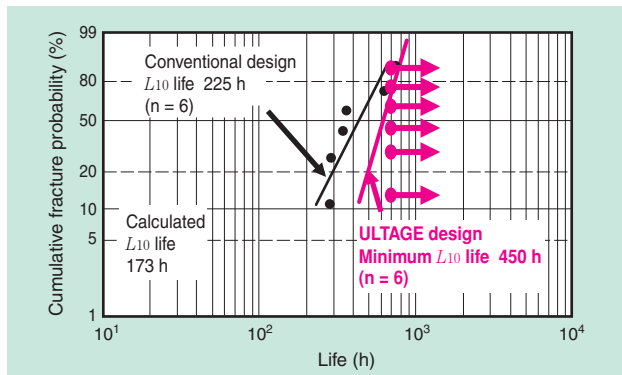
[Test conditions]

Bearing number: Comparison of conventional design and ULTAGE in terms of life 30316U
 (dimensions: $\phi 80 \times \phi 170 \times 42.5$)
 Lubrication: Turbine Oil VG68, circulating lubrication
 Combined radial and axial loads: 117 kN/bearing
 ($0.4 C_r$ equivalent, radial load: 75 kN/bearing, axial load: 50 kN/bearing)
 Running speed: 2000 min^{-1}
 Misalignment: 1/600 (0.1°)



Structure of test rig

[Test result]



| | Appearance of assembled inner ring | Appearance of outer ring | Status |
|---------------------|------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Conventional design | Flaking | Flaking | Flaking occurred near the chamfered end of rollers as well as at the corresponding contact point on the outer ring. ($L_{10} = 225 \text{ h}$) |
| ULTAGE | No damage | No damage | After termination of the test at 690 hours, the test bearing was free from any failures including flaking. |

ULTAGE bearings boast a life 2.6 times as long as their design life, and twice as long as the life of conventional bearings, when both bearing types are tested under test conditions of $0.4 C_r$ and 1/600 misalignment.