701-8848

# Thrust Roller Bearings

NTN Thrust Roller Bearings incorporate a roller and cage thrust assembly, which has needle rollers or cylindrical rollers radially arranged in a cage, and a disc-shaped bearing washer. It can carry an axial load in one direction.

A shaft and housing can be used directly as a raceway, without the use of a bearing washer. This arrangement contributes to the design of compact, lightweight machinery featuring a low profile.

Theoretically, a perfect rolling motion is impossible with this type of thrust roller bearing because slippage occurs on the raceway surface. However, this phenomenon poses no problem in most practical bearing applications, and the bearing is capable of relatively high-speed operation.

## Types and designs

NTN Roller and Cage Thrust Assemblies are available in the **series AXK**, which has needle rollers; and in **series K811**, **K812**, and **K893**, each of which incorporates cylindrical rollers. Each pocket of the **series K811** and **K812** has a single row of cylindrical rollers, while those of **series K893** have two rows of cylindrical rollers.

**Series AXK** bearings, which have needle rollers, use a pressed-steel cage. **Series K811**, **K812** and **K893** bearings have an aluminum alloy cage as standard; they can optionally employ a pressed-steel cage (suffix **J**) or a cage of molded polyamide reinforced with glass fiber or carbon fiber (suffix **T2**). The **T2** cage features a maximum allowable operating temperature of 120°C and maximum allowable continuous operating temperature of 100°C.

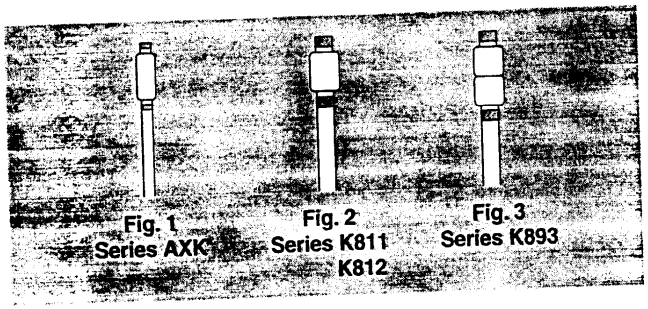


Fig. 1 Series AXK

Fig. 2 Series K811 K812

Fig. 3 Series K893

The bearing washers for **NTN** Thrust Roller Bearings are available in an **AS** model made of surface-hardened 1 mm-thick steel plate, and in **WS** and **GS** models, which are machined types.

The **AS** model can be used on either the shaft or housing side. This bearing washer, however, requires that the adjacent mechanical components have sufficient rigidity and good form accuracy. Before being mounted, the bearing washer may remain somewhat warped. This phenomenon should not be regarded as a problem because the warpage will be eliminated once a predetermined level of thrust load is exerted on the washer.

The bore of the **WS** model is fitted to a shaft, and the outside surface of the **GS** model is fitted to a housing. Both models therefore provide the bearings with greater rigidity and higher running accuracy.

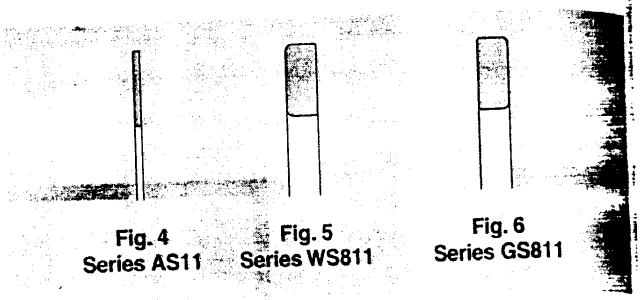


Fig. 4 Series AS11

Fig. 5 Series WS811

Fig. 6 Series GS811

Bearing models **811**, **812**, and **893** are formed by respectively combining the roller and cage thrust assemblies of models **K811**, **K812**, and **K893** with the associated model **WS** or **GS** bearing washer. They are standard series bearings whose dimension series, specified in JIS B 1512 (ISO 104) (Boundary dimensions for rolling bearings), are 11, 12, and 93, respectively.

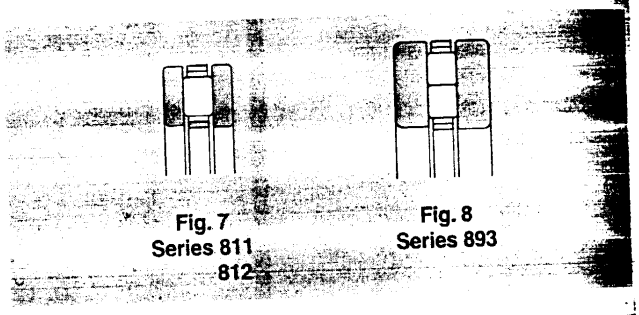


Fig. 7 Series 811 812

Fig. 8 Series 893

## Interpreting bearing numbers

The bearing numbers of **NTN** Roller and Cage Thrust Assemblies, Bearing Rings, and Thrust Roller Bearings comprise a series number, dimension series code, bore diameter number, and suffix.

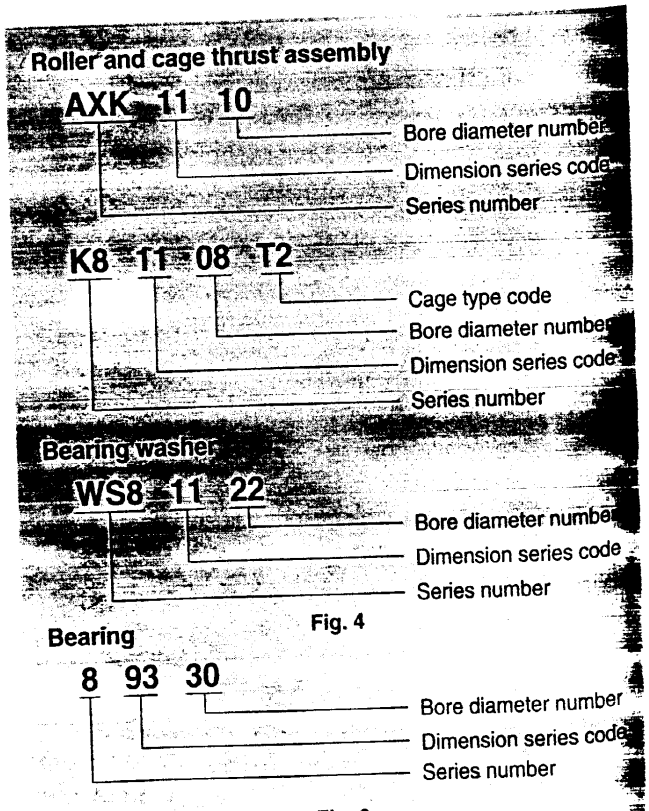



Fig. 4

Fig. 9

## Bearing tolerances

The dimensional accuracy, form accuracy, and running accuracy of **series 811**, **812**, and **893** thrust cylindrical roller bearings are given in **Sec. 6 "Bearing Tolerances," Table 6.3**, page A-30.

The bore ($D_{c1}$) of roller and cage thrust assemblies (**series AXK**, **K811**, **K812**, and **K893**) is machined to a tolerance of E11 (or E12 for bearings having a suffix **T2**). The outside surface ($D_c$) of the **series AXK** is machined to a tolerance of c12, while those of the **series K811**, **K812**, and **K893** are machined to a tolerance of a13.

## Raceway surface requirements

When the shaft and housing are used as a raceway for a roller and cage thrust assembly, the raceway should satisfy the requirements in **Table 1**.

**Table 1 Raceway requirements**

| Characteristics | Requirement |
|---|---|
| Squareness (max.) | IT6 (IT4) |
| Surface roughness | 0.4a |
| Surface hardness | HRC58~64 |
| Effective depth of hardness penetration | See formula (14.1) on page A-59. |

Remarks: Data in parentheses are for applications requiring greater running accuracy.

## Guiding of cages

To respond to the centering phenomenon during running, the roller and cage thrust assemblies (**series AXK**, **K811**, **K812**, and **K893**) must be guided with their bore (shaft side) or outside surface (housing side).

Generally, the bore is often employed for guiding because of lower velocity relative to the cage. In particular, guiding with the bore should be selected for high-speed applications. To guide a cage, the dimensional tolerances for the shaft and housing should be h8 with the shaft diameter (bore guide) and H9 with the housing bore diameter (outside surface guide). The guide surface must be finish-ground.

## Bearing washer fits

The fits of the shafts and housing that mount the thrust bearing washers (**AS**, **WS**, and **GS** models) are given in **Table 2** below.

**Table 2 Fit to shaft and housing**

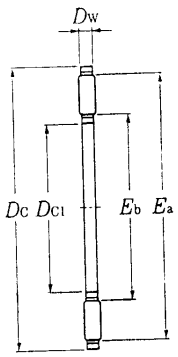
| Bearing washer | Shaft | Housing |
|---|---|---|
| Series AS | h10 | H11 |
| Series WS | h6 | — |
| Series GS | — | H7 |

## Mounting dimensions

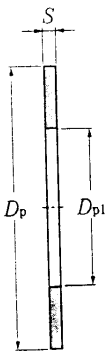
The mounting dimensions for a shaft and housing to which model **WS** and **GS** bearing washers are installed are summarized in the associated bearing tables.

The surface to which an **AS** model bearing ring is mounted must be uniformly flat and rigid enough to support the whole bearing ring face.

**Type AXK11**
**Type AS11**
**Type WS811**
**Type GS811**




Type AXK
(Thrust needle roller and cage assembly)



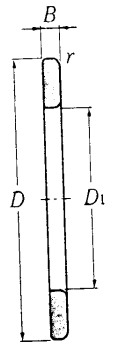

Type AS race rings
(Washer)


Type WS race rings
(Inner ring)

## $D_{c1}$ 10～140mm

| Boundary dimensions mm | | | | | | | | | | | Basic load ratings dynamic / static N | | dynamic / static kgf | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $D_{c1}$ E11 | $D_c$ c12 | $D_w$ 0 -0.01 | $D_p$ e13 | $D_{p1}$ E12 | $S$ 2) ±0.05 | $d$ | $d_1$ -0.2 -0.5 | $D$ | $D_1$ +0.5 +0.2 | $B$ | $r_{s\,min}$ 1) | $C_a$ | $C_{oa}$ | $C_a$ | $C_{oa}$ |
| **10** | 24 | 2 | 24 | 10 | 1 | 10 | 24 | 24 | 10 | 2.75 0 -0.060 | 0.3 | 9 150 | 25 300 | 935 | 2 580 |
| **12** | 26 | 2 | 26 | 12 | 1 | 12 | 26 | 26 | 12 | 2.75 0 -0.060 | 0.3 | 9 850 | 28 900 | 1 010 | 2 940 |
| **15** | 28 | 2 | 28 | 15 | 1 | 15 | 28 | 28 | 16 | 2.75 0 -0.060 | 0.3 | 11 300 | 36 000 | 1 150 | 3 700 |
| **17** | 30 | 2 | 30 | 17 | 1 | 17 | 30 | 30 | 18 | 2.75 0 -0.060 | 0.3 | 11 900 | 39 500 | 1 220 | 4 050 |
| **20** | 35 | 2 | 35 | 20 | 1 | 20 | 35 | 35 | 21 | 2.75 0 -0.060 | 0.3 | 13 200 | 46 500 | 1 340 | 4 750 |
| **25** | 42 | 2 | 42 | 25 | 1 | 25 | 42 | 42 | 26 | 3 0 -0.060 | 0.6 | 14 600 | 58 000 | 1 490 | 5 900 |
| **30** | 47 | 2 | 47 | 30 | 1 | 30 | 47 | 47 | 32 | 3 0 -0.060 | 0.6 | 16 300 | 69 500 | 1 660 | 7 100 |
| **35** | 52 | 2 | 52 | 35 | 1 | 35 | 52 | 52 | 37 | 3.5 0 -0.075 | 0.6 | 17 800 | 81 500 | 1 820 | 8 300 |
| **40** | 60 | 3 | 60 | 40 | 1 | 40 | 60 | 60 | 42 | 3.5 0 -0.075 | 0.6 | 27 400 | 110 000 | 2 790 | 11 300 |
| **45** | 65 | 3 | 65 | 45 | 1 | 45 | 65 | 65 | 47 | 4 0 -0.075 | 0.6 | 29 800 | 128 000 | 3 050 | 13 100 |
| **50** | 70 | 3 | 70 | 50 | 1 | 50 | 70 | 70 | 52 | 4 0 -0.075 | 0.6 | 31 500 | 143 000 | 3 250 | 14 500 |
| **55** | 78 | 3 | 78 | 55 | 1 | 55 | 78 | 78 | 57 | 5 0 -0.075 | 0.6 | 38 000 | 186 000 | 3 850 | 19 000 |
| **60** | 85 | 3 | 85 | 60 | 1 | 60 | 85 | 85 | 62 | 4.75 0 -0.075 | 1 | 44 500 | 234 000 | 4 550 | 23 900 |
| **65** | 90 | 3 | 90 | 65 | 1 | 65 | 90 | 90 | 67 | 5.25 0 -0.075 | 1 | 46 500 | 254 000 | 4 750 | 25 900 |
| **70** | 95 | 4 | 95 | 70 | 1 | 70 | 95 | 95 | 72 | 5.25 0 -0.075 | 1 | 53 500 | 253 000 | 5 500 | 25 800 |
| **75** | 100 | 4 | 100 | 75 | 1 | 75 | 100 | 100 | 77 | 5.75 0 -0.075 | 1 | 55 000 | 266 000 | 5 650 | 27 100 |
| **80** | 105 | 4 | 105 | 80 | 1 | 80 | 105 | 105 | 82 | 5.75 0 -0.075 | 1 | 56 500 | 279 000 | 5 750 | 28 400 |
| **85** | 110 | 4 | 110 | 85 | 1 | 85 | 110 | 110 | 87 | 5.75 0 -0.075 | 1 | 57 500 | 291 000 | 5 900 | 29 700 |
| **90** | 120 | 4 | 120 | 90 | 1 | 90 | 120 | 120 | 92 | 6.5 0 -0.090 | 1 | 71 000 | 390 000 | 7 250 | 39 500 |
| **100** | 135 | 4 | 135 | 100 | 1 | 100 | 135 | 135 | 102 | 7 0 -0.090 | 1 | 90 500 | 550 000 | 9 200 | 56 500 |
| **110** | 145 | 4 | 145 | 110 | 1 | 110 | 145 | 145 | 112 | 7 0 -0.090 | 1 | 93 500 | 590 000 | 9 550 | 60 500 |
| **120** | 155 | 4 | 155 | 120 | 1 | 120 | 155 | 155 | 122 | 7 0 -0.090 | 1 | 99 000 | 650 000 | 10 100 | 66 500 |
| **130** | 170 | 5 | 170 | 130 | 1 | 130 | 170 | 170 | 132 | 9 0 -0.090 | 1 | 140 000 | 900 000 | 14 300 | 92 000 |
| **140** | 180 | 5 | 180 | 140 | 1 | 140 | 178 | 180 | 142 | 9.5 0 -0.090 | 1 | 145 000 | 960 000 | 14 800 | 97 500 |

2) The minimum dimensions of the chamfer dimension $r$.




Type GS race rings
(Outer ring)

| Limiting speeds rpm grease | oil | Bearing numbers thrust needle roller and cage assembly (*consistant with cylindrical) | washer | inner ring | outer ring | Reference dimensions mm $E_b$ | $E_a$ | Mass kg (approx.) AXK11 | AS11 | WS811 GS811 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 500 | 14 000 | **AXK1100** | **AS1100** | **WS81100** | **GS81100** | 11 | 21 | 0.0028 | 0.003 | 0.008 |
| 3 300 | 13 000 | **AXK1101** | **AS1101** | **WS81101** | **GS81101** | 13 | 23 | 0.003 | 0.0033 | 0.009 |
| 2 800 | 11 000 | **AXK1102** | **AS1102** | **WS81102** | **GS81102** | 17 | 27 | 0.0035 | 0.0035 | 0.01 |
| 2 500 | 10 000 | **AXK1103** | **AS1103** | **WS81103** | **GS81103** | 19 | 29 | 0.004 | 0.0038 | 0.011 |
| 2 100 | 8 500 | **AXK1104** | **AS1104** | **WS81104** | **GS81104** | 22 | 34 | 0.005 | 0.0051 | 0.014 |
| 1 800 | 7 000 | **AXK1105** | **AS1105** | **WS81105** | **GS81105** | 29 | 41 | 0.007 | 0.007 | 0.021 |
| 1 500 | 6 000 | **AXK1106** | **AS1106** | **WS81106** | **GS81106** | 35 | 46 | 0.008 | 0.008 | 0.025 |
| 1 400 | 5 500 | **AXK1107** | **AS1107** | **WS81107** | **GS81107** | 40 | 51 | 0.001 | 0.0091 | 0.033 |
| 1 200 | 4 700 | **AXK1108** | **AS1108** | **WS81108** | **GS81108** | 45 | 58 | 0.0185 | 0.0123 | 0.044 |
| 1 100 | 4 300 | **AXK1109** | **AS1109** | **WS81109** | **GS81109** | 50 | 63 | 0.0205 | 0.0136 | 0.055 |
| 1 000 | 3 900 | **AXK1110** | **AS1110** | **WS81110** | **GS81110** | 55 | 68 | 0.0235 | 0.0148 | 0.06 |
| 900 | 3 500 | **AXK1111** | **AS1111** | **WS81111** | **GS81111** | 60 | 76 | 0.0308 | 0.0189 | 0.095 |
| 800 | 3 200 | **AXK1112** | **AS1112** | **WS81112** | **GS81112** | 65 | 83 | 0.0390 | 0.0223 | 0.101 |
| 750 | 3 000 | **AXK1113** | **AS1113** | **WS81113** | **GS81113** | 70 | 88 | 0.04 | 0.0239 | 0.125 |
| 750 | 2 900 | **AXK1114** | **AS1114** | **WS81114** | **GS81114** | 74 | 93 | 0.06 | 0.0254 | 0.134 |
| 700 | 2 700 | **AXK1115** | **AS1115** | **WS81115** | **GS81115** | 79 | 98 | 0.061 | 0.027 | 0.155 |
| 650 | 2 600 | **AXK1116** | **AS1116** | **WS81116** | **GS81116** | 84 | 103 | 0.063 | 0.0284 | 0.163 |
| 600 | 2 400 | **AXK1117** | **AS1117** | **WS81117** | **GS81117** | 89 | 108 | 0.0668 | 0.0301 | 0.175 |
| 600 | 2 300 | **AXK1118** | **AS1118** | **WS81118** | **GS81118** | 94 | 118 | 0.086 | 0.0388 | 0.25 |
| 500 | 2 000 | **AXK1120** | **AS1120** | **WS81120** | **GS81120** | 105 | 133 | 0.112 | 0.0505 | 0.35 |
| 480 | 1 900 | **AXK1122** | **AS1122** | **WS81122** | **GS81122** | 115 | 143 | 0.122 | 0.0549 | 0.385 |
| 430 | 1 700 | **AXK1124** | **AS1124** | **WS81124** | **GS81124** | 125 | 153 | 0.131 | 0.0592 | 0.415 |
| 400 | 1 600 | **AXK1126** | **AS1126** | **WS81126** | **GS81126** | 136 | 167 | 0.205 | 0.074 | 0.663 |
| 380 | 1 500 | **AXK1128** | **AS1128** | **WS81128** | **GS81128** | 146 | 177 | 0.219 | 0.079 | 0.749 |