4. Bearing Tolerances

Bearing tolerances; i.e., dimensional accuracy, running accuracy, etc., are regulated by standards such as ISO and JIS. For dimensional accuracy these standards prescribe tolerances and allowable error limitations for those boundary dimensions (bore diameter, outside diameter, width, assembled bearing width, chamfer, and taper) necessary when installing bearings on shafts or in housings. For machining accuracy the standards provide allowable variation limits on bore, mean bore, outside diameter, mean outside diameter and raceway width or wall thickness (for thrust bearings). Running accuracy is defined as the allowable limits for bearing runout. Bearing runout tolerances are included in the standards for inner and outer ring radial and axial runout; inner ring side runout with bore; and outer ring outside surface runout with side.

Tolerances and allowable error limitations are established for each tolerance grade or class. For example, JIS standard B 1514 (tolerances for rolling bearings) establishes five tolerance classifications (classes 0, 6, 5, 4, 2).

Starting with class 0 (normal precision class bearings), the bearing precision becomes progressively greater as the class number becomes smaller.

A comparison of relative tolerance class standards between the JIS B1514 standard classes and other standards is shown in the comparative Table 4.1.

Table 4.2 indicates which standard and tolerance class is applicable to each bearing type.

Table 4.1  Comparison of tolerance classifications of national standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Tolerance Class</th>
<th>Bearing Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese Industrial Standard</td>
<td>JIS B 1514</td>
<td>Class 0 Class 6X</td>
</tr>
<tr>
<td>ISO 492</td>
<td>Class 6</td>
<td>Class 5</td>
</tr>
<tr>
<td>ISO 199</td>
<td>Class 6 Class 6X</td>
<td>Class 5 Class 4 Class 2</td>
</tr>
<tr>
<td>ISO 578</td>
<td>Class 4</td>
<td>Class 3</td>
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<td>Deutsches Institut fur Normung</td>
<td>DIN 620</td>
<td>P0 P6 P5 P4 P2</td>
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<td>ABEC-1 ABEC-3</td>
<td>ABEC-5 ABEC-7 ABEC-9</td>
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<td>Class C Class B Class A</td>
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<td>ANSI B 3.19</td>
<td>Class 4 Class 2</td>
<td>Class 3 Class 0 Class 00</td>
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<tr>
<td>ANSI/AFBMA Std. 19</td>
<td>Class 4 Class 2</td>
<td>Class 3</td>
</tr>
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<td>ANTI-FRICATION BEARING MANUFACTURERS (AFBMA)</td>
<td>Class 5P Class 5T Class 7P Class 9P</td>
<td></td>
</tr>
<tr>
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<td>Class 3 Class 3P</td>
<td>Class 5P Class 5T Class 7P Class 9P</td>
</tr>
<tr>
<td>ANSI/AFBMA Sts. 12.2</td>
<td>Class 3 Class 3P</td>
<td>Class 5P Class 5T Class 7P Class 9P</td>
</tr>
</tbody>
</table>

1) “ABEC” is applied for ball bearings and “RBEC” for roller bearings.

Notes:
1. JIS B 1514, ISO 492 and 199, and DIN 620 have the same specification level.
2. The tolerance and allowance of JIS B 1514 are a little different from those of AFBMA standards.
### Table 4.2 Bearing types and applicable tolerance

<table>
<thead>
<tr>
<th>Bearing Type</th>
<th>Applicable standard</th>
<th>Applicable tolerance</th>
<th>Tolerance table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep groove ball bearing</td>
<td></td>
<td>class 0 class 6 class 5 class 4 class 2</td>
<td></td>
</tr>
<tr>
<td>Angular contact ball bearings</td>
<td></td>
<td>class 0 class 6 class 5 class 4 class 2</td>
<td></td>
</tr>
<tr>
<td>Self-aligning ball bearings</td>
<td></td>
<td>class 0 — — — — —</td>
<td></td>
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<tr>
<td>Cylindrical roller bearings ISO 492</td>
<td>ISO 492</td>
<td>class 0 class 6 class 5 class 4 class 2</td>
<td>Table 4.3</td>
</tr>
<tr>
<td>Needle roller bearings</td>
<td></td>
<td>class 0 class 6 class 5 class 4 — —</td>
<td></td>
</tr>
<tr>
<td>Spherical roller bearings</td>
<td></td>
<td>class 0 — — — — —</td>
<td></td>
</tr>
<tr>
<td>Tapered metric ISO 492</td>
<td>metric</td>
<td>class 0,6X class 6 class 5 class 4 —</td>
<td>Table 4.4</td>
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<tr>
<td>Tapered inch AFBMA Std. 19</td>
<td></td>
<td>class 4 class 2 class 3 class 0 class 00</td>
<td>Table 4.5</td>
</tr>
<tr>
<td>Tapered inch ANSI/AFBMA Std.19.1</td>
<td>J series</td>
<td>class K class N class C class B class A</td>
<td>Table 4.6</td>
</tr>
<tr>
<td>Thrust ball bearings ISO 199</td>
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<td>class 0 class 6 class 5 class 4 —</td>
<td>Table 4.7</td>
</tr>
<tr>
<td>Thrust roller bearings NTN standard</td>
<td></td>
<td>class 0 class 6 class 5 class 4 — —</td>
<td>Page B-219</td>
</tr>
<tr>
<td>Spherical roller thrust bearings ISO 199</td>
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<td>class 0 — — — — —</td>
<td>Table 4.8</td>
</tr>
<tr>
<td>Double direction angular contact thrust ball bearings NTN standard</td>
<td>— — — class 5 class 4 —</td>
<td>Table 4.9</td>
<td></td>
</tr>
</tbody>
</table>

The following is a list of codes and symbols used in the bearing tolerance standards tables. However, in some cases the code or symbol definition has been abbreviated.

(1) Dimension

- \( d \): Nominal bore diameter
- \( d_2 \): Nominal bore diameter (double direction thrust ball bearing)
- \( D \): Nominal outside diameter
- \( B \): Nominal inner ring width or nominal center washer height
- \( C \): Nominal outer ring width\(^1\)
  
  Note 1) For radial bearings (except tapered roller bearings) this is equivalent to the nominal bearing width.

- \( T \): Nominal bearing width of single row tapered roller bearing, or nominal height of single direction thrust bearing
- \( T_r \): Nominal height of double direction thrust ball bearing, or nominal effective width of inner ring and roller assembly of tapered roller bearing
- \( T_2 \): Nominal height from back face of housing washer to back face of center washer on double direction thrust ball bearings, or nominal effective outer ring width of tapered roller bearing

- \( r \): Chamfer dimensions of inner and outer rings (for tapered roller bearings, large end of inner ring only)
- \( r_1 \): Chamfer dimensions of center washer, or small end of inner and outer ring of angular contact ball bearing, and large end of outer ring of tapered roller bearing
- \( r_2 \): Chamfer dimensions of small end of inner and outer rings of tapered roller bearing
(2) Dimension deviation

- $\Delta_{d_1}$: Single bore diameter deviation
- $\Delta_{d_{mp}}$: Single plane mean bore diameter deviation
- $\Delta_{d_{2mp}}$: Single plane mean bore diameter deviation (double direction thrust ball bearing)
- $\Delta_{D_1}$: Single outside diameter deviation
- $\Delta_{D_{mp}}$: Single plane mean outside diameter deviation
- $\Delta_{B_1}$: Inner ring width deviation, or center washer height deviation
- $\Delta_{C_1}$: Outer ring width deviation
- $\Delta_{T_1s}$: Overall width deviation of assembled single row tapered roller bearing, or height deviation of single direction thrust bearing
- $\Delta_{T_{1s}}$: Height deviation of double direction thrust ball bearing, or effective width deviation of roller and inner ring assembly of tapered roller bearing
- $\Delta_{T_{2s}}$: Double direction thrust ball bearing housing washer back face to center washer back face height deviation, or tapered roller bearing outer ring effective width deviation

(3) Chamfer boundary

- $r_{s_{\text{min}}}$: Minimum allowable chamfer dimension for inner/outer ring, or small end of inner ring on tapered roller bearing
- $r_{s_{\text{max}}}$: Maximum allowable chamfer dimension for inner/outer ring, or large end of inner ring on tapered roller bearing
- $r_{1s_{\text{min}}}$: Minimum allowable chamfer dimension for double direction thrust ball bearing center washer, small end of inner/outer ring of angular contact ball bearing, large end of outer ring of tapered roller bearing
- $r_{1s_{\text{max}}}$: Maximum allowable chamfer dimension for double direction thrust ball bearing center washer, small end of inner/outer ring of angular contact ball bearing, large end of outer ring of tapered roller bearing
- $r_{2s_{\text{min}}}$: Minimum allowable chamfer dimension for small end of inner/outer ring of tapered roller bearing
- $r_{2s_{\text{max}}}$: Maximum allowable chamfer dimension for small end of inner/outer ring of tapered roller bearing

(4) Dimension variation

- $V_{dp}$: Single radial plane bore diameter variation
- $V_{d_{2p}}$: Single radial plane bore diameter variation (double direction thrust ball bearing)
- $V_{d_{mp}}$: Mean single plane bore diameter variation
- $V_{Dp}$: Single radial plane outside diameter variation
- $V_{D_{mp}}$: Mean single plane outside diameter variation
- $V_{B_1}$: Inner ring width variation
- $V_{C_1}$: Outer ring width variation

(5) Rotation tolerance

- $K_{ia}$: Inner ring radial runout
- $S_{ia}$: Inner ring axial runout (with side)
- $S_{D}$: Face runout with bore
- $K_{ea}$: Outer ring radial runout
- $S_{ea}$: Outer ring axial runout
- $S_{D}$: Outside surface inclination
- $S_{t}$: Thrust bearing shaft washer raceway (or center washer raceway) thickness variation
- $S_{s}$: Thrust bearing housing washer raceway thickness variation
Table 4.3 Tolerance for radial bearings (Except tapered roller bearings) max

### Table 4.3 (1) Inner rings

<table>
<thead>
<tr>
<th>Nominal bore diameter (d) (mm)</th>
<th>(\Delta d) over inc.</th>
<th>(\Delta d_{mp}) max</th>
<th>(V_{dp}) max</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>class 0</td>
<td>class 6</td>
<td>class 5</td>
</tr>
<tr>
<td>0.6 (^{1}) 2.5</td>
<td>0 –8 0 –7</td>
<td>0 –5 0 –4</td>
<td>0 –2.5</td>
</tr>
<tr>
<td>2.5 10</td>
<td>0 –8 0 –7</td>
<td>0 –5 0 –4</td>
<td>0 –2.5</td>
</tr>
<tr>
<td>10 18</td>
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<td>18 30</td>
<td>0 –10 0 –8</td>
<td>0 –6 0 –5</td>
<td>0 –2.5</td>
</tr>
<tr>
<td>30 50</td>
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<td>0 –8 0 –6</td>
<td>0 –2.5</td>
</tr>
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<td>50 80</td>
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<tr>
<td>150 180</td>
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<td>0 –13 0 –10</td>
<td>0 –7</td>
</tr>
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<td>0 –15 0 –12</td>
<td>0 –8</td>
</tr>
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<td>0 –18</td>
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</tr>
<tr>
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<tr>
<td>400 500</td>
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<td>500 630</td>
<td>0 –50 0 –40</td>
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</tr>
<tr>
<td>630 800</td>
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<td></td>
</tr>
<tr>
<td>800 1000</td>
<td>0 –100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000 1250</td>
<td>0 –125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1250 1600</td>
<td>0 –160</td>
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<td></td>
</tr>
<tr>
<td>1600 2000</td>
<td>0 –200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) The dimensional difference \(\Delta d\) of bore diameter to be applied for classes 4 and 2 is the same as the tolerance of dimensional difference \(\Delta d_{mp}\) of average bore diameter. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 against Class 4, and also to all the diameter series against Class 2.

### Table 4.3 (2) Outer rings

<table>
<thead>
<tr>
<th>Nominal outside diameter (D) (mm)</th>
<th>(\Delta D) over inc.</th>
<th>(\Delta D_{mp}) max</th>
<th>(V_{dp}) max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>class 0</td>
<td>class 6</td>
<td>class 5</td>
</tr>
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<td>2.5 (^{1}) 6</td>
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</table>

5) The dimensional difference \(\Delta D\) of outer diameter to be applied for classes 4 and 2 is the same as the tolerance of dimensional difference \(\Delta D_{mp}\) of average outer diameter. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 against Class 4, and also to all the diameter series against Class 2.
<table>
<thead>
<tr>
<th>V_dP</th>
<th>K_ea</th>
<th>S_d</th>
<th>S_ea</th>
<th>ΔB_s</th>
<th>V_Bs</th>
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</table>

2) To be applied for deep groove ball bearings and angular contact ball bearings.
3) To be applied for individual raceway rings manufactured for combined bearing use.
4) Nominal bore diameter of bearings of 0.6 mm is included in this dimensional division.

<table>
<thead>
<tr>
<th>V_dP</th>
<th>V_Dmp</th>
<th>K_ea</th>
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<th>S_ea</th>
<th>ΔC_s</th>
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</tr>
<tr>
<td></td>
<td>94</td>
<td>---</td>
<td>160</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>---</td>
<td>190</td>
<td>---</td>
<td>---</td>
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</tr>
<tr>
<td></td>
<td>150</td>
<td>---</td>
<td>220</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>---</td>
<td>250</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

6) To be applied in case snap rings are not installed on the bearings.
7) To be applied for deep groove ball bearings and angular contact ball bearings.
8) Nominal outer diameter of bearings of 2.5 mm is included in this dimensional division.
### Table 4.4 Tolerance for tapered roller bearings (Metric system)

#### Table 4.4 (1) Inner rings

<table>
<thead>
<tr>
<th>Nominal bore diameter d (mm) over incl.</th>
<th>Δdmp</th>
<th>Vdp</th>
<th>Vdmp</th>
<th>Kla</th>
<th>Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>class 0,6X high</td>
<td>class 5,6 high</td>
<td>class 4 high</td>
<td>class 0,6X max</td>
<td>class 5 max</td>
</tr>
<tr>
<td>10</td>
<td>0 –12</td>
<td>0 –7</td>
<td>0 –5</td>
<td>12 7</td>
<td>5 4</td>
</tr>
<tr>
<td>18</td>
<td>0 –12</td>
<td>0 –7</td>
<td>0 –5</td>
<td>12 8</td>
<td>6 5</td>
</tr>
<tr>
<td>30</td>
<td>0 –12</td>
<td>0 –10</td>
<td>0 –8</td>
<td>12 10</td>
<td>8 6</td>
</tr>
<tr>
<td>50</td>
<td>0 –15</td>
<td>0 –12</td>
<td>0 –9</td>
<td>15 12</td>
<td>9 7</td>
</tr>
<tr>
<td>80</td>
<td>0 –20</td>
<td>0 –15</td>
<td>0 –10</td>
<td>20 15</td>
<td>11 8</td>
</tr>
<tr>
<td>120</td>
<td>0 –25</td>
<td>0 –18</td>
<td>0 –13</td>
<td>25 18</td>
<td>14 10</td>
</tr>
<tr>
<td>180</td>
<td>0 –30</td>
<td>0 –22</td>
<td>0 –15</td>
<td>30 22</td>
<td>17 11</td>
</tr>
<tr>
<td>250</td>
<td>0 –35</td>
<td></td>
<td></td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>315</td>
<td>0 –40</td>
<td></td>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>0 –45</td>
<td></td>
<td></td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>0 –50</td>
<td></td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>630</td>
<td>0 –75</td>
<td></td>
<td></td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>0 –100</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

1) The dimensional difference Δd of bore diameter to be applied for class 4 is the same as the tolerance of dimensional difference Δdmp of average bore diameter.

#### Table 4.4 (2) Outer rings

<table>
<thead>
<tr>
<th>Nominal bore diameter D (mm) over incl.</th>
<th>ΔDmp</th>
<th>Vdp</th>
<th>Vdmp</th>
<th>Kea</th>
<th>Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>class 0,6X high</td>
<td>class 5,6 high</td>
<td>class 4 high</td>
<td>class 0,6X max</td>
<td>class 5 max</td>
</tr>
<tr>
<td>18</td>
<td>0 –12</td>
<td>0 –7</td>
<td>0 –6</td>
<td>12 8</td>
<td>6 5</td>
</tr>
<tr>
<td>30</td>
<td>0 –14</td>
<td>0 –9</td>
<td>0 –7</td>
<td>14 9</td>
<td>7 5</td>
</tr>
<tr>
<td>50</td>
<td>0 –16</td>
<td>0 –11</td>
<td>0 –9</td>
<td>16 11</td>
<td>8 7</td>
</tr>
<tr>
<td>80</td>
<td>0 –18</td>
<td>0 –13</td>
<td>0 –10</td>
<td>18 13</td>
<td>10 8</td>
</tr>
<tr>
<td>120</td>
<td>0 –20</td>
<td>0 –15</td>
<td>0 –11</td>
<td>20 15</td>
<td>11 8</td>
</tr>
<tr>
<td>150</td>
<td>0 –25</td>
<td>0 –18</td>
<td>0 –13</td>
<td>25 18</td>
<td>14 10</td>
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<td>180</td>
<td>0 –30</td>
<td>0 –20</td>
<td>0 –15</td>
<td>30 20</td>
<td>15 11</td>
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<td>0 –25</td>
<td>0 –18</td>
<td>35 25</td>
<td>19 14</td>
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<td>0 –28</td>
<td>0 –20</td>
<td>40 28</td>
<td>22 15</td>
</tr>
<tr>
<td>400</td>
<td>0 –45</td>
<td></td>
<td></td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>0 –50</td>
<td></td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>630</td>
<td>0 –75</td>
<td></td>
<td></td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>0 –100</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>0 –125</td>
<td></td>
<td></td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>1250</td>
<td>0 –160</td>
<td></td>
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<td>160</td>
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</tr>
</tbody>
</table>

2) The dimensional difference ΔD of outside diameter to be applied for class 4 is the same as the tolerance of dimensional difference ΔDmp of average outside diameter.
### Table 4.4 (3) Effective width of outer and inner rings with roller

<table>
<thead>
<tr>
<th>$S_{ia}$</th>
<th>$\Delta B_s$</th>
<th>$\Delta T_s$</th>
<th>$\Delta B_{1s}, \Delta C_{1s}$</th>
<th>$\Delta B_{2s}, \Delta C_{2s}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>class 4 max</td>
<td>class 0,6</td>
<td>class 6X</td>
<td>class 4, 5</td>
<td>high</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>–120</td>
<td>0</td>
<td>–50</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>–120</td>
<td>0</td>
<td>–50</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>–200</td>
<td>0</td>
<td>–50</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>–400</td>
<td>0</td>
<td>–50</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>–500</td>
<td>0</td>
<td>–80</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>–600</td>
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</tbody>
</table>

### Table 4.4 (3) Effective width of outer and inner rings with roller

<table>
<thead>
<tr>
<th>$S_{ea}$</th>
<th>$\Delta C_s$</th>
<th>$\Delta T_1s$</th>
<th>$\Delta T_2s$</th>
</tr>
</thead>
<tbody>
<tr>
<td>class 4 max</td>
<td>class 0, 6, 5, 4</td>
<td>class 6X</td>
<td>class 0</td>
</tr>
<tr>
<td>5</td>
<td>Identical to</td>
<td>$\Delta B_s$ of inner</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>$\Delta B_s$ of inner</td>
<td>0</td>
<td>–100</td>
</tr>
<tr>
<td>6</td>
<td>ring of same bearing</td>
<td>0</td>
<td>–100</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>–100</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>–100</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>–100</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>–100</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>—</td>
<td>0</td>
<td>–100</td>
<td>0</td>
</tr>
</tbody>
</table>

**Diagram:**

- **Master cup sub-unit**: $T_1$
- **Master cone sub-unit**: $T_2$
### Table 4.5 (1) Inner rings

<table>
<thead>
<tr>
<th>Nominal bore diameter ( d ) (mm, inch)</th>
<th>( \Delta d_s ) class 4</th>
<th>( \Delta d_s ) class 2</th>
<th>( \Delta d_s ) class 3</th>
<th>( \Delta d_s ) class 0</th>
<th>( \Delta d_s ) class 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>76.2 304.8 3 12</td>
<td>+13 0</td>
<td>+13 0</td>
<td>+13 0</td>
<td>+13 0</td>
<td>+8 0</td>
</tr>
<tr>
<td>304.8 609.6 12 24</td>
<td>+25 0</td>
<td>+25 0</td>
<td>+13 0</td>
<td>+13 0</td>
<td>+8 0</td>
</tr>
</tbody>
</table>

### Table 4.5 (2) Outer rings

<table>
<thead>
<tr>
<th>Nominal outside diameter ( D ) (mm, inch)</th>
<th>( \Delta D_s ) class 4</th>
<th>( \Delta D_s ) class 2</th>
<th>( \Delta D_s ) class 3</th>
<th>( \Delta D_s ) class 0</th>
<th>( \Delta D_s ) class 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>304.8 609.6 12 24</td>
<td>+25 0</td>
<td>+13 0</td>
<td>+25 0</td>
<td>+25 0</td>
<td>+8 0</td>
</tr>
</tbody>
</table>

### Table 4.5 (3) Effective width of inner rings with roller and outer rings

<table>
<thead>
<tr>
<th>Nominal bore diameter ( d ) (mm, inch)</th>
<th>Nominal outside diameter ( D ) (mm, inch)</th>
<th>( \Delta T_s ) class 4</th>
<th>( \Delta T_s ) class 2</th>
<th>( \Delta T_s ) class 3</th>
<th>( \Delta T_s ) class 0, 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.6 304.8 4 12</td>
<td>+203 0</td>
<td>+203 0</td>
<td>+203 0</td>
<td>+203 0</td>
<td>+1520 0</td>
</tr>
<tr>
<td>304.8 609.6 12 24</td>
<td>+356 0</td>
<td>+203 0</td>
<td>+203 0</td>
<td>+203 0</td>
<td>+1520 0</td>
</tr>
</tbody>
</table>

### Table 4.5 (4) Radial deflection of inner and outer rings

<table>
<thead>
<tr>
<th>Nominal outside diameter ( D ) (mm, inch)</th>
<th>( K_{ia} ), ( K_{ea} ) class 4</th>
<th>( K_{ia} ), ( K_{ea} ) class 2</th>
<th>( K_{ia} ), ( K_{ea} ) class 3</th>
<th>( K_{ia} ), ( K_{ea} ) class 0</th>
<th>( K_{ia} ), ( K_{ea} ) class 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>304.8 609.6 12 24</td>
<td>51 20</td>
<td>38 15</td>
<td>8 15</td>
<td>4 15</td>
<td>— 7</td>
</tr>
</tbody>
</table>
### ΔT<sub>1s</sub>

<table>
<thead>
<tr>
<th>Class 4 high</th>
<th>Class 4 low</th>
<th>Class 2 high</th>
<th>Class 2 low</th>
<th>Class 3 high</th>
<th>Class 3 low</th>
</tr>
</thead>
<tbody>
<tr>
<td>+102</td>
<td>0</td>
<td>+102</td>
<td>0</td>
<td>+102</td>
<td>−102</td>
</tr>
<tr>
<td>+40</td>
<td>0</td>
<td>+40</td>
<td>0</td>
<td>+40</td>
<td>−40</td>
</tr>
<tr>
<td>+152</td>
<td>−152</td>
<td>+102</td>
<td>0</td>
<td>+102</td>
<td>−102</td>
</tr>
<tr>
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<td>−60</td>
<td>+40</td>
<td>0</td>
<td>+40</td>
<td>−40</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>+178</td>
<td>−178&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>+102</td>
<td>−102&lt;sup&gt;1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>+70</td>
<td>−70</td>
<td>+40</td>
<td>−40</td>
</tr>
</tbody>
</table>

#### 1)
To be applied for nominal bore diameters of 406.400 mm 16 inch or less.

### ΔT<sub>2s</sub>

<table>
<thead>
<tr>
<th>Class 4 high</th>
<th>Class 4 low</th>
<th>Class 2 high</th>
<th>Class 2 low</th>
<th>Class 3 high</th>
<th>Class 3 low</th>
</tr>
</thead>
<tbody>
<tr>
<td>+102</td>
<td>0</td>
<td>+102</td>
<td>0</td>
<td>+102</td>
<td>−102</td>
</tr>
<tr>
<td>+40</td>
<td>0</td>
<td>+40</td>
<td>0</td>
<td>+40</td>
<td>−40</td>
</tr>
<tr>
<td>+203</td>
<td>−102</td>
<td>+102</td>
<td>0</td>
<td>+102</td>
<td>−102</td>
</tr>
<tr>
<td>+80</td>
<td>−40</td>
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<td>0</td>
<td>+40</td>
<td>−40</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>+203</td>
<td>−203&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>+102</td>
<td>−102&lt;sup&gt;1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>+80</td>
<td>−80</td>
<td>+40</td>
<td>−40</td>
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</table>

#### 1)
To be applied for nominal bore diameters of 406.400 mm 16 inch or less.
### Table 4.6  Tolerance of tapered roller bearings of J series (Metric system)

#### Table 4.6 (1)  Inner rings

<table>
<thead>
<tr>
<th>Nominal bore diameter d (mm)</th>
<th>( \Delta_d )</th>
<th>( V_{dp} )</th>
<th>( V_{dmp} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>10 18</td>
<td>0 –12</td>
<td>0 –12</td>
<td>0 –7</td>
</tr>
<tr>
<td>18 30</td>
<td>0 –12</td>
<td>0 –12</td>
<td>0 –8</td>
</tr>
<tr>
<td>30 50</td>
<td>0 –12</td>
<td>0 –12</td>
<td>0 –10</td>
</tr>
<tr>
<td>50 80</td>
<td>0 –15</td>
<td>0 –15</td>
<td>0 –12</td>
</tr>
<tr>
<td>80 120</td>
<td>0 –20</td>
<td>0 –20</td>
<td>0 –15</td>
</tr>
<tr>
<td>120 180</td>
<td>0 –25</td>
<td>0 –25</td>
<td>0 –18</td>
</tr>
<tr>
<td>180 250</td>
<td>0 –30</td>
<td>0 –30</td>
<td>0 –22</td>
</tr>
</tbody>
</table>

Note: Please consult NTN for bearings of Class A.

### Table 4.6 (2)  Outer rings

<table>
<thead>
<tr>
<th>Nominal outside diameter D (mm)</th>
<th>( \Delta_D )</th>
<th>( V_D )</th>
<th>( V_{dmp} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>18 30</td>
<td>0 –12</td>
<td>0 –12</td>
<td>0 –8</td>
</tr>
<tr>
<td>30 50</td>
<td>0 –14</td>
<td>0 –14</td>
<td>0 –9</td>
</tr>
<tr>
<td>50 80</td>
<td>0 –16</td>
<td>0 –16</td>
<td>0 –11</td>
</tr>
<tr>
<td>80 120</td>
<td>0 –18</td>
<td>0 –18</td>
<td>0 –13</td>
</tr>
<tr>
<td>120 150</td>
<td>0 –20</td>
<td>0 –20</td>
<td>0 –15</td>
</tr>
<tr>
<td>150 180</td>
<td>0 –25</td>
<td>0 –25</td>
<td>0 –18</td>
</tr>
<tr>
<td>180 250</td>
<td>0 –30</td>
<td>0 –30</td>
<td>0 –20</td>
</tr>
<tr>
<td>250 315</td>
<td>0 –35</td>
<td>0 –35</td>
<td>0 –25</td>
</tr>
<tr>
<td>315 400</td>
<td>0 –40</td>
<td>0 –40</td>
<td>0 –28</td>
</tr>
</tbody>
</table>

Note: Please consult NTN for bearings of Class A.

### Table 4.6 (3)  Effective width of inner and outer rings

<table>
<thead>
<tr>
<th>Nominal bore diameter d (mm)</th>
<th>( \Delta_T1s )</th>
<th>( \Delta_T2s )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>10 80</td>
<td>+100</td>
<td>0</td>
</tr>
<tr>
<td>80 120</td>
<td>+100 –100</td>
<td>+50</td>
</tr>
<tr>
<td>120 180</td>
<td>+150 –150</td>
<td>+50</td>
</tr>
<tr>
<td>180 250</td>
<td>+150 –150</td>
<td>+50</td>
</tr>
</tbody>
</table>

Note: 1) “*” mark are to be manufactured only for combined bearings.
2) Please consult NTN for the bearings of Class A.
<table>
<thead>
<tr>
<th>$K_{ia}$</th>
<th>$K_{ea}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$K_{ia}$</strong></td>
<td><strong>$K_{ea}$</strong></td>
</tr>
<tr>
<td>Class K</td>
<td>Class N</td>
</tr>
<tr>
<td>Class B</td>
<td>Class B</td>
</tr>
<tr>
<td>max</td>
<td>max</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>25</td>
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<td>30</td>
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<td>35</td>
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**Unit μm**

<table>
<thead>
<tr>
<th>$\Delta T_s$</th>
<th>$S_{ea}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$\Delta T_s$</strong></td>
<td><strong>$S_{ea}$</strong></td>
</tr>
<tr>
<td>Class B</td>
<td>Class B</td>
</tr>
<tr>
<td>max</td>
<td>max</td>
</tr>
</tbody>
</table>

![Diagram](image-url)
### Technical Data

#### Table 4.7  Tolerance of thrust ball bearings

**Table 4.7 (1) Inner rings**

<table>
<thead>
<tr>
<th>Nominal bore diameter</th>
<th>$\Delta_d$, $\Delta d_2$</th>
<th>$V_d$, $V d_2$</th>
<th>$S_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d$ or $d_2$ (mm)</td>
<td>Class 0, 6, 5</td>
<td>Class 4</td>
<td>Class 0, 6, 5</td>
</tr>
<tr>
<td>---</td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1) The division of double direction type bearings will be in accordance with division “$d$” of single direction type bearings corresponding to the identical nominal outer diameter of bearings, not according to division “$d_2$”.

**Table 4.7 (2) Outer rings**

<table>
<thead>
<tr>
<th>Nominal outside diameter $D$ (mm)</th>
<th>$\Delta D$, $V_D$</th>
<th>$S_e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D$ over</td>
<td>Class 0, 6, 5</td>
<td>Class 4</td>
</tr>
<tr>
<td>---</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>45</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

2) To be applied only for bearings with flat seats.
Table 4.7 (3) Height of bearings center washer

<table>
<thead>
<tr>
<th>Nominal bore diameter d (mm)</th>
<th>Single direction type</th>
<th>ΔTS</th>
<th>ΔT1s 3)</th>
<th>ΔT2s 3)</th>
<th>ΔCس 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0 –100</td>
<td>0</td>
<td>–75</td>
<td>0 –100</td>
<td>0 –75</td>
</tr>
<tr>
<td>50</td>
<td>0 –150</td>
<td>+50</td>
<td>–150</td>
<td>0 –75</td>
<td>0 –50</td>
</tr>
<tr>
<td>80</td>
<td>0 –200</td>
<td>+75</td>
<td>–200</td>
<td>0 –100</td>
<td>0 –75</td>
</tr>
<tr>
<td>120</td>
<td>0 –225</td>
<td>+100</td>
<td>–250</td>
<td>0 –125</td>
<td>0 –100</td>
</tr>
<tr>
<td>180</td>
<td>0 –250</td>
<td>+125</td>
<td>–300</td>
<td>0 –150</td>
<td>0 –125</td>
</tr>
<tr>
<td>250</td>
<td>0 –300</td>
<td>+175</td>
<td>–400</td>
<td>0 –200</td>
<td>0 –175</td>
</tr>
<tr>
<td>315</td>
<td>0 –350</td>
<td>+200</td>
<td>–450</td>
<td>0 –225</td>
<td>0 –200</td>
</tr>
<tr>
<td>400</td>
<td>0 –400</td>
<td>+250</td>
<td>–600</td>
<td>0 –300</td>
<td>0 –250</td>
</tr>
<tr>
<td>500</td>
<td>0 –450</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

3) To be in accordance with division “d” of single direction type bearings corresponding to the identical outer diameter of bearings in the same bearing series.

Note: The specifications will be applied for the bearings with flat seats of Class 0.

Table 4.8 Tolerance of spherical thrust roller bearings

Table 4.8 (1) Inner rings

<table>
<thead>
<tr>
<th>Nominal bore diameter d (mm)</th>
<th>Δdmp</th>
<th>Vdp</th>
<th>Sd</th>
<th>ΔTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0</td>
<td>11</td>
<td>25</td>
<td>+150</td>
</tr>
<tr>
<td>80</td>
<td>0</td>
<td>15</td>
<td>25</td>
<td>+200</td>
</tr>
<tr>
<td>120</td>
<td>0</td>
<td>19</td>
<td>30</td>
<td>+250</td>
</tr>
<tr>
<td>180</td>
<td>0</td>
<td>23</td>
<td>30</td>
<td>+300</td>
</tr>
<tr>
<td>250</td>
<td>0</td>
<td>26</td>
<td>35</td>
<td>+350</td>
</tr>
<tr>
<td>315</td>
<td>0</td>
<td>30</td>
<td>40</td>
<td>+400</td>
</tr>
<tr>
<td>400</td>
<td>0</td>
<td>34</td>
<td>45</td>
<td>+450</td>
</tr>
</tbody>
</table>

Table 4.8 (2) Outer rings

<table>
<thead>
<tr>
<th>Nominal bore diameter D (mm)</th>
<th>ΔDmp</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>0</td>
</tr>
<tr>
<td>180</td>
<td>0</td>
</tr>
<tr>
<td>250</td>
<td>0</td>
</tr>
<tr>
<td>315</td>
<td>0</td>
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<td>400</td>
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<tr>
<td>500</td>
<td>0</td>
</tr>
<tr>
<td>630</td>
<td>0</td>
</tr>
<tr>
<td>800</td>
<td>0</td>
</tr>
</tbody>
</table>

Unit μm
Table 4.9  Tolerance of double direction type angular contact thrust ball bearings

### Table 4.9 (1) Inner rings and bearing height

<table>
<thead>
<tr>
<th>Nominal bore diameter d (mm)</th>
<th>$\Delta_{dmp}$, $\Delta_{ds}$</th>
<th>$S_{d}$</th>
<th>$S_{ia}$</th>
<th>$V_{Bs}$</th>
<th>$\Delta_{Ts}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>over incl.</td>
<td>Class 5 high</td>
<td>Class 4 low</td>
<td>Class 5 high</td>
<td>Class 4 low</td>
<td>Class 5 max</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>–6</td>
<td>0</td>
<td>–5</td>
<td>8</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>–8</td>
<td>0</td>
<td>–6</td>
<td>8</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
<td>–9</td>
<td>0</td>
<td>–7</td>
<td>8</td>
</tr>
<tr>
<td>80</td>
<td>0</td>
<td>–10</td>
<td>0</td>
<td>–8</td>
<td>9</td>
</tr>
<tr>
<td>120</td>
<td>0</td>
<td>–13</td>
<td>0</td>
<td>–10</td>
<td>10</td>
</tr>
<tr>
<td>180</td>
<td>0</td>
<td>–15</td>
<td>0</td>
<td>–12</td>
<td>11</td>
</tr>
<tr>
<td>250</td>
<td>0</td>
<td>–18</td>
<td>0</td>
<td>–15</td>
<td>13</td>
</tr>
<tr>
<td>315</td>
<td>0</td>
<td>–23</td>
<td>0</td>
<td>–18</td>
<td>15</td>
</tr>
</tbody>
</table>

### Table 4.9 (2) Outer rings

<table>
<thead>
<tr>
<th>Nominal outside diameter D (mm)</th>
<th>$\Delta_{Dmp}$, $\Delta_{Ds}$</th>
<th>$S_{D}$</th>
<th>$S_{ea}$</th>
<th>$V_{Cs}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>over incl.</td>
<td>Class 5 high</td>
<td>Class 4 low</td>
<td>Class 5 high</td>
<td>Class 4 low</td>
</tr>
<tr>
<td>30</td>
<td>50</td>
<td>–30</td>
<td>–40</td>
<td>8</td>
</tr>
<tr>
<td>50</td>
<td>80</td>
<td>–40</td>
<td>–50</td>
<td>8</td>
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<tr>
<td>80</td>
<td>120</td>
<td>–50</td>
<td>–60</td>
<td>9</td>
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<tr>
<td>120</td>
<td>150</td>
<td>–60</td>
<td>–75</td>
<td>10</td>
</tr>
<tr>
<td>150</td>
<td>180</td>
<td>–60</td>
<td>–75</td>
<td>10</td>
</tr>
<tr>
<td>180</td>
<td>250</td>
<td>–75</td>
<td>–90</td>
<td>11</td>
</tr>
<tr>
<td>250</td>
<td>315</td>
<td>–90</td>
<td>–105</td>
<td>13</td>
</tr>
<tr>
<td>315</td>
<td>400</td>
<td>–110</td>
<td>–125</td>
<td>13</td>
</tr>
<tr>
<td>40</td>
<td>500</td>
<td>–120</td>
<td>–140</td>
<td>15</td>
</tr>
</tbody>
</table>
Table 4.10 Allowable critical-value of bearing chamfer

Table 4.10 (1) Radial bearings
(Except tapered roller bearings)

<table>
<thead>
<tr>
<th>( r_s ) min 1)</th>
<th>Nominal bore diameter ( d )</th>
<th>( r_s ) max</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r_s ) min or ( r_{1s} ) min</td>
<td>( d ) over incl.</td>
<td>Radial direction</td>
</tr>
<tr>
<td>0.05</td>
<td>— —</td>
<td>0.1</td>
</tr>
<tr>
<td>0.08</td>
<td>— —</td>
<td>0.16</td>
</tr>
<tr>
<td>0.1</td>
<td>— —</td>
<td>0.2</td>
</tr>
<tr>
<td>0.15</td>
<td>— —</td>
<td>0.3</td>
</tr>
<tr>
<td>0.2</td>
<td>— —</td>
<td>0.5</td>
</tr>
<tr>
<td>0.3</td>
<td>— 40</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>40</td>
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</tr>
<tr>
<td>0.6</td>
<td>— 40</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>— 50</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>1.1</td>
<td>— 120</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>—</td>
</tr>
<tr>
<td>1.5</td>
<td>— 120</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>— 80</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>80 220</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>220</td>
<td>—</td>
</tr>
<tr>
<td>2.1</td>
<td>— 280</td>
<td>4</td>
</tr>
<tr>
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<td>280</td>
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</tr>
<tr>
<td></td>
<td>— 100</td>
<td>3.8</td>
</tr>
<tr>
<td>2.5</td>
<td>100 280</td>
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<td>280</td>
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<td>3</td>
<td>— 280</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>280</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>— —</td>
<td>6.5</td>
</tr>
<tr>
<td>5</td>
<td>— —</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>— —</td>
<td>10</td>
</tr>
<tr>
<td>7.5</td>
<td>— —</td>
<td>12.5</td>
</tr>
<tr>
<td>9.5</td>
<td>— —</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>— —</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td>— —</td>
<td>21</td>
</tr>
<tr>
<td>19</td>
<td>— —</td>
<td>25</td>
</tr>
</tbody>
</table>

1) These are the allowable minimum dimensions of the chamfer dimension \( r_s \) and are described in the dimensional table.
### Technical Data

#### Table 4.10 (2) Tapered roller bearings of metric system

<table>
<thead>
<tr>
<th>$r_s \min$ or $r_{1s} \min$</th>
<th>Nominal bore diameter of bearing “d” or nominal outside diameter “D” over incl.</th>
<th>$r_s \max$ or $r_{1s} \max$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial direction</td>
<td>Axial direction</td>
</tr>
<tr>
<td>0.3</td>
<td>—</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>0.9</td>
</tr>
<tr>
<td>0.6</td>
<td>—</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>1.3</td>
</tr>
<tr>
<td>1</td>
<td>—</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>1.9</td>
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<tr>
<td>1.5</td>
<td>—</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>3.5</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
<td>2.8</td>
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<tr>
<td></td>
<td>120</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
<td>—</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>4.5</td>
</tr>
<tr>
<td>3</td>
<td>—</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>5.5</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
<td>5.5</td>
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<tr>
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<td>120</td>
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<td>250</td>
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<td>400</td>
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<td>—</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>180</td>
<td>7.5</td>
</tr>
<tr>
<td>6</td>
<td>—</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>180</td>
<td>9</td>
</tr>
</tbody>
</table>

2) These are the allowable minimum dimensions of the chamfer dimension “$r$” or “$r_1$,” and are described in the dimensional table.

3) Inner rings shall be in accordance with the division of “$d$” and outer rings with that of “$D$”.

Note: This standard will be applied to the bearings whose dimensional series (refer to the dimensional table) specified in the standard of ISO 355 or JIS B 1512. Further, please consult NTN for bearings other than those represented here.

#### Table 4.10 (3) Thrust bearings

<table>
<thead>
<tr>
<th>$r_s \min$ or $r_{1s} \min$</th>
<th>$r_s \max$ or $r_{1s} \max$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial and axial direction</td>
</tr>
<tr>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>0.08</td>
<td>0.16</td>
</tr>
<tr>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>1</td>
<td>1.2</td>
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<td>2.7</td>
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<td>10</td>
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<tr>
<td>9.5</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>19</td>
<td>25</td>
</tr>
</tbody>
</table>

4) These are the allowable minimum dimensions of the chamfer dimension “$r$” or “$r_1$,” and are described in the dimensional table.
Table 4.11 Tolerance and allowable values (Class 0) of tapered bore of radial bearings

<table>
<thead>
<tr>
<th>Nominal bore diameter ( d ) (mm)</th>
<th>( \Delta_{d_{mp}} ) high</th>
<th>( \Delta_{d_{mp}} ) low</th>
<th>( \Delta_{d_{1mp}} ) - ( \Delta_{d_{mp}} ) high</th>
<th>( \Delta_{d_{1mp}} ) - ( \Delta_{d_{mp}} ) low</th>
<th>( V_{d_{p}} ) max</th>
</tr>
</thead>
<tbody>
<tr>
<td>— ( 10 )</td>
<td>+15 0</td>
<td>+15 0</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>10 ( 18 )</td>
<td>+18 0</td>
<td>+18 0</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>18 ( 30 )</td>
<td>+21 0</td>
<td>+21 0</td>
<td>13</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>30 ( 50 )</td>
<td>+25 0</td>
<td>+25 0</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>50 ( 80 )</td>
<td>+30 0</td>
<td>+30 0</td>
<td>19</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>80 ( 120 )</td>
<td>+35 0</td>
<td>+35 0</td>
<td>25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>120 ( 180 )</td>
<td>+40 0</td>
<td>+40 0</td>
<td>31</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>180 ( 250 )</td>
<td>+46 0</td>
<td>+46 0</td>
<td>38</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>250 ( 315 )</td>
<td>+52 0</td>
<td>+52 0</td>
<td>44</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>315 ( 400 )</td>
<td>+57 0</td>
<td>+57 0</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>400 ( 500 )</td>
<td>+63 0</td>
<td>+63 0</td>
<td>56</td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

1) To be applied for all radial flat surfaces of tapered bore.

Note:
1. To be applied for tapered bores of 1/12.
2. Symbols of quantity or values
   \( d_{i} \): Basic diameter at the theoretically large end of the tapered bore
   \( d_{1} = d + \frac{1}{12} B \)

\( \Delta_{d_{mp}} \): Dimensional difference of the average bore diameter within the flat surface at the theoretical small-end of the tapered bore.

\( \Delta_{d_{1mp}} \): Dimensional difference of the average bore diameter within the flat surface at the theoretical large-end of the tapered bore.

\( V_{d_{p}} \): Inequality of the bore diameter within the flat surface

\( B \): Nominal width of inner ring

\( \alpha \): Half of the nominal tapered angle of the tapered bore

\( \alpha = 2\degree 23'9.4" = 2.38594\degree = 0.041643 \text{ RAD} \)