Angular-Contact Ball Bearing Assemblies
Series ZKLR...2RS, ZKLR...2Z

Low Cost
Angular-Contact Ball Bearing Assemblies

Angular-Contact Ball Bearing Assemblies
- Consist of a deep-drawn steel flange housing and two radial or angular-contact ball bearings in an “X” arrangement with:
  - optional lip or gap seals on both sides of the bearings
  - axially and radially preloaded bearing arrangement
- Provide ready-to-mount economical systems solutions
- Support radial loads and axial loads in either direction
- Are protected against contamination through integrated seals
- Have low frictional torque:
  - frictional torque is slightly higher in bearings with 2RS seals
- Include lifetime lubrication for most applications due to large grease reservoir
- Come with a corrosion-resistant housing protected by INA’s Corrotect® plating
- Have a simplified mounting procedure with the following advantages:
  - direct mating of the unit, for example to the milled face of the mounting structure, eliminates the need for costly precision fitting and additional parts for seating and axial location of the bearings (Table 2, p. 3)
  - additional components are not required to retain the bearings in the housing
  - the smaller number of parts minimizes assembly defects or errors compared with conventional solutions (Table 2, p. 3)
  - the bearing arrangement self-adjusts through the screw drive nut during assembly, so that warping due to bearing seat misalignment is virtually impossible
  - a set preload is present in the bearing arrangement, eliminating the need for adjustment during assembly that is normally required for lead screw bearings
  - the location of the bearing only requires a shaft locknut for clearance-free axial location
- Are well-suited, based on their dimensions and design, for use as simple, space-saving arrangements in highly dynamic ball or roller screw drive systems for:
  - gauging and measuring equipment
  - small machine tools
  - applications involving semiconductors and precision mechanics
  - any bearing arrangements that can be simplified by using complete assemblies

Housing of deep-drawn steel with Corrotect® plating
Radial or angular-contact ball bearings arranged in pairs, preloaded both axially and radially, with 2RS or 2Z-seals on both sides
For operating temperatures from –20 °C to +120 °C, limited by the lubricating grease
For shafts of 6 mm, 8 mm, 10 mm, 12 mm, 15 mm and 20 mm

Axial load \( F_a \) and radial load \( F_r \)
Clearance-free axial location of the bearing assembly by the locknut
Angular-Contact
Ball Bearing Assemblies

Bearing Size
The selection of the suitable bearing size depends on
the following:

- Basic rating life L or Lh
- Static limiting load diagrams (Figures 1 and 2)

Basic Rating Life
The basic rating life is calculated as follows:

\[ L_h = \frac{16666}{n} \left( \frac{C}{P} \right)^p \]

- \( L_h \) in hours
- \( n \) min\(^{-1}\)
- \( C \) N
- \( P \) N
- \( p \) Life exponent for ball bearings: \( p = 3 \)

Equivalent dynamic bearing load according to Table 1

<table>
<thead>
<tr>
<th>Bearing Assembly Designation</th>
<th>Equivalent Dynamic Load Factor Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZKLR 0624.2Z</td>
<td>( P = 140 +0,13 F_a^{1.4} +0,003 F_r^{1.9} )</td>
</tr>
<tr>
<td>ZKLR 0828.2Z</td>
<td>( P = 210 +0,28 F_a^{1.27} +0,002 F_r^{1.9} )</td>
</tr>
<tr>
<td>ZKLR 1035.2Z</td>
<td>( P = 240 +0,47 F_a^{1.17} +0,0015 F_r^{1.3} )</td>
</tr>
<tr>
<td>ZKLR 1244.2RS</td>
<td>( P = 580 +0,046 F_a^{1.3} +0,076 F_r^{1.28} )</td>
</tr>
<tr>
<td>ZKLR 1547.2RS</td>
<td>( P = 540 +0,011 F_a^{1.3} +0,022 F_r^{1.45} )</td>
</tr>
<tr>
<td>ZKLR 2060.2RS</td>
<td>( P = 960 +0,0082 F_a^{1.5} +0,017 F_r^{1.45} )</td>
</tr>
</tbody>
</table>

Static Limiting Load Diagrams
The easy-to-use diagrams for the static limiting load
(Figures 1 and 2) allow quick verification of the correct bearing
size – regardless of the axial and radial operating loads.
The deciding factor is that the intersection of axial load and
radial load must lie below the curve for the selected bearing.

Example:

- If the operating loads \( F_a \) and \( F_r \) are below the curve,
  then the bearing size is suitable for the application (Figure 3):
  - operating load \( F_a = 300 \) N, operating load \( F_r = 600 \) N
Accuracy

Series ZKLR...2RS and ZKLR...2Z angular-contact ball bearing assemblies have lateral and radial runout accuracy on the inner ring of P5 to DIN 620.

Locating the Bearing Assembly on the Screw/Installation

ZKLR angular-contact ball bearing assemblies are particularly easy to install, as these bearing arrangements:

- Are bolted directly onto the supporting structure
- No longer require preloading after installation

Thus the bearing arrangement can usually be fixed on the screw simply by means of clearance-free clamping – however, the type of axial location required depends on the load to be supported.

A milled, or if necessary even an unmachined flat surface without additional radial location suffices as a supporting structure (see Dimension Table).

Table 2 lists the advantages of the INA ZKLR bearing assemblies over conventional solutions.

Installation (Figure 4)

- Locate the bearing assembly on the screw ⌀ with locknut ⌀ or clearance-free clamping device
- Bolt the bearing assembly onto the supporting structure ⌀:
  - bolts should be only hand-tightened
- Move the screw nut ⌀ to the end positions (the position of the screw is the reference for the linear guidance system; the movable screw nut serves as a functional element for positioning the flanged unit):
  - the bearing adjusts automatically into the optimum radial position (as a result of the constraining forces exerted by the reference)
- Bolt the bearing assembly down on the supporting structure using the tightening torque specified in the assembly drawing ⌀

Table 2 - Comparison of requirements on mounting structure and assembly effort

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>INA ZKLR</th>
<th>Conventional Solutions</th>
</tr>
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<tbody>
<tr>
<td>+ = good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>◦ = satisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– = not satisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No additional housing components required (flange, shield)</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>No additional seals or seal races required</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Low space requirement</td>
<td>++</td>
<td>◦</td>
</tr>
<tr>
<td>Low demands on surrounding structure</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Assembly errors/defects virtually eliminated</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Reduction of overall costs</td>
<td>++</td>
<td>–</td>
</tr>
</tbody>
</table>
Angular-Contact Ball Bearing Assemblies

Double direction, suitable for flange mounting

Series ZKLR...2RS
ZKLR...2Z

Permissible operating temperature: –20 °C to +120 °C for continuous operation, limited by the lubricating grease

Due to constant development of the product range, we reserve the right to make modifications

1) Tightening torque of the mounting bolts to manufacturer recommendations; bolts must be ordered separately
2) Moment of inertia for rotating inner ring
3) Locknuts must be ordered separately
4) Recommended minimum abutment diameters; if these values are not used, the actual bearing shoulder dimension d₁ must be observed
5) Locknuts serve only in the axial location of the bearing assembly and have no influence on the bearing preload; to install the locknuts refer to instructions in INA publication “ZAE”
6) The stated geometric tolerance is required only for diameters ranging from D₁ to D₃a

Dimension Table: Dimensions in mm

<table>
<thead>
<tr>
<th>Shaft diameter</th>
<th>Designation</th>
<th>Weight</th>
<th>d₁</th>
<th>A₁</th>
<th>A₂</th>
<th>D₁</th>
<th>B₁</th>
<th>d₂</th>
<th>B</th>
<th>d₁₁</th>
<th>d₁₂</th>
<th>m</th>
<th>n</th>
<th>M</th>
<th>H</th>
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<tr>
<td>6</td>
<td>ZKLR 0624.2Z</td>
<td>23</td>
<td>6</td>
<td>24</td>
<td>35</td>
<td>20,5</td>
<td>12</td>
<td>10,4</td>
<td>0,3</td>
<td>4,5</td>
<td>6,6</td>
<td>26</td>
<td>15</td>
<td>32</td>
<td>13</td>
</tr>
<tr>
<td>8</td>
<td>ZKLR 0828.2Z</td>
<td>30</td>
<td>8</td>
<td>28</td>
<td>35</td>
<td>23,9</td>
<td>14</td>
<td>11,8</td>
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<td>4,5</td>
<td>6,6</td>
<td>26</td>
<td>20</td>
<td>35</td>
<td>15,5</td>
</tr>
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<td>10</td>
<td>35</td>
<td>35</td>
<td>28,14</td>
<td>16</td>
<td>14,7</td>
<td>0,3</td>
<td>4,5</td>
<td>–</td>
<td>26</td>
<td>26</td>
<td>–</td>
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<tr>
<td>12</td>
<td>ZKLR 1244.2RS</td>
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<td>12</td>
<td>44</td>
<td>50</td>
<td>35,45</td>
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<td>38</td>
<td>32</td>
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<td>22</td>
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<td>15</td>
<td>ZKLR 1547.2RS</td>
<td>140</td>
<td>15</td>
<td>47</td>
<td>51</td>
<td>38,45</td>
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<td>18</td>
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<td>24</td>
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<td>20</td>
<td>ZKLR 2060.2RS</td>
<td>300</td>
<td>20</td>
<td>60</td>
<td>60</td>
<td>50,45</td>
<td>28</td>
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<td>–</td>
<td>47</td>
<td>47</td>
<td>–</td>
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Axial support area for the outer ring
<table>
<thead>
<tr>
<th>dₐₐ(1)</th>
<th>Dₐₐ(1)</th>
<th>Dₐ(1)</th>
<th>dₐ(1)</th>
<th>dₐ(2)</th>
<th>daₐ(2)</th>
<th>dyn.</th>
<th>stat.</th>
<th>dyn.</th>
<th>stat.</th>
<th>Mₘ</th>
<th>Mₐ</th>
<th>Tightening torque</th>
<th>Designation</th>
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<tbody>
<tr>
<td>8</td>
<td>16</td>
<td>19</td>
<td>3150</td>
<td>1840</td>
<td>1340</td>
<td>1250</td>
<td>4xM4 or 2xM6</td>
<td>0.0014</td>
<td>ZM 06</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.4</td>
<td>18</td>
<td>22</td>
<td>4900</td>
<td>2280</td>
<td>1810</td>
<td>1520</td>
<td>4xM4 or 2xM6</td>
<td>0.0028</td>
<td>ZM 08</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.4</td>
<td>22</td>
<td>26</td>
<td>7400</td>
<td>3600</td>
<td>2550</td>
<td>2420</td>
<td>4xM4</td>
<td>0.0075</td>
<td>ZM 10</td>
<td>6</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>27</td>
<td>32</td>
<td>13600</td>
<td>8500</td>
<td>13200</td>
<td>17900</td>
<td>4xM6</td>
<td>0.0102</td>
<td>ZM 12</td>
<td>8</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.5</td>
<td>29</td>
<td>35</td>
<td>16700</td>
<td>10700</td>
<td>16400</td>
<td>22400</td>
<td>4xM6</td>
<td>0.0178</td>
<td>ZM 15</td>
<td>10</td>
<td>15</td>
<td></td>
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</tr>
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<td>24</td>
<td>39</td>
<td>47</td>
<td>28000</td>
<td>19100</td>
<td>27500</td>
<td>40000</td>
<td>4xM6</td>
<td>0.263</td>
<td>ZM 20</td>
<td>18</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1) Basic load ratings
2) Moment of inertia
3) Recommended INA locknut
4) Shaft diameter
5) Tolerances for the mounting structure
6) DIN 912
7) DIN 912
8) DIN 912

**Tolerances for the mounting structure:**
- A
- B
- C
- D
- E
- F
- G
- H
- I
- J
- K
- L
- M
- N
- O
- P
- Q
- R
- S
- T
- U
- V
- W
- X
- Y
- Z

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5
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