Long service life under harsh conditions—tough bearings reflect NSK’s accumulated technological prowess.
The NSK brand, recognized around the world

From home electric appliances, automobiles, and large-scale equipment to the aerospace industry—NSK bearings are used in an extensive range of fields. NSK established its global-scale enterprise on technology that has met the exacting requirements of Japanese industry. We have also established R&D systems and support services to meet the diverse needs of our customers throughout the world.

As a brand recognized around the world, NSK continues to lead the industry with its technical prowess.

NSK is on the move, across the globe

Headquarters

Japan

Europe

North & South America

Asia

Technical offices

Japan

Europe

North & South America

Asia

Plants

Japan

Europe

North & South America

Asia

Sales offices

Japan

Europe

North & South America

Asia

Africa

Solution Provider NSK
Severe environments demand outstanding performance. NSK construction machinery bearings provide the toughness required above all else.

Dust, mud, and tremendous loads—these are the challenging conditions under which construction machinery must operate. Unlike typical passenger cars, construction machinery must first and foremost be tough. Based on proprietary state-of-the-art technology, NSK has exceeded the limits of conventional bearings in terms of long operating life and high limiting speed. NSK continues to deliver the reliability required of construction sites around the world.
HPS. Spherical Roller Bearings

Bearings are expected to reduce maintenance costs and enhance performance for a variety of equipment. HPS spherical roller bearings satisfy these requirements by fully utilizing NSK’s experience and expertise to deliver longer life and higher limiting speed.

**Features**

- **Increased dynamic load rating** in maximum 2 times
- **20% higher** limiting speed
- **Maximum** bearing life

HPS bearings are available with inner bore dimensions ranging from 40 mm to 130 mm. Catalog No: E1359

**HR Series Tapered Roller Bearings**

The HR series of high-load capacity, standard-size tapered roller bearings offer high-load capacity for boosting the performance in diverse applications.

**Features**

- Optimal cage design allows increased size and number of rollers
- **Higher load-carrying capacity and longer operating life**

**TM Series Sealed Deep Groove Ball Bearings**

The TM series delivers longer operating life under environments contaminated with foreign particles by incorporating a special seal that prevents the entry of foreign particles and has been especially effective in automobile transmission systems.

**Features**

- Sealed-in grease with a high affinity for gear oil to aid initial lubrication
- Heat-resistant seal material
- Seal lip structure prevents entry of foreign matter while allowing application of lubricant
- Lower torque than conventional contact seal bearings

Bearing Series: TM90-TM1514, TM281-TM5514. Major dimensions are the same as Series 62 and Series 63 of deep groove ball bearings. Catalog No: E1237

**EW/EM Series Cylindrical Roller Bearings**

The EW and EM series of high-load capacity, standard-size cylindrical roller bearings deliver outstanding performance across a wide range of applications. A high-load capacity is achieved by using more rollers than conventional bearings based on an innovative NSK concept. We also offer standard-size cylindrical roller bearings for today’s needs that provide longer service life and low-noise and low-vibration performance through an optimally designed one-piece cage with high rigidity and low wear. This cage feature is incorporated in the EW series as a pressed steel cage and in the EM series as a one-piece machined brass cage.

**EW Series pressed cage**

**Features**

- Approximately twice the bearing life
- 30% to 40% less noise and vibrations
- Cage strength increased 1.5 to 2 times
- 10% to 25% higher limiting speed

Series offers bearing inner bore dimensions ranging from 25 mm to 65 mm. Catalog No: E1358

**EM Series machined cage**

**Features**

- Approximately twice the bearing life
- 50% to 60% less noise and vibrations
- Enhanced cage strength
- High precision cage
- Advantages of a roller-guided cage
- Improved oil-film
- Greater accuracy of the roller guidance achieved through special pocket profiling
- Large pocket corner radius relieve stress concentrations on the cage

Series offers bearing inner bore dimensions ranging from 25 mm to 200 mm. Catalog No: E1237

**HI-TF Bearings**

Bearings manufactured from NSK’s HI-TF material have been specifically designed for outstanding toughness under harsh operating conditions, surpassing even NSK’s earlier TF bearings. HI-TF bearings incorporating this new material and a new heat-treatment technology provide long service life under contaminated lubrication conditions with superior resistance to wear, seizure, and heat. HI-TF bearings are capable of handling the foreseeable needs of the future as well as meeting today’s requirements.

**Features**

- Achieves longer bearing life even under harsh conditions with excellent resistance to wear, seizure, and heat

![Graphs showing bearing life comparison and performance under boundary lubrication conditions](image_url)

Catalog No: E1228

NSK
**HPS Spherical Roller Bearings**

**Dynamic equivalent load**

\[ P_{eq} = P_{F_x} + P_{F_y} \]

Where the values for \( P_x \), \( P_y \), and \( Y_x \) are given in the table below.

**Table 1** Dimensions of oil grooves and holes

<table>
<thead>
<tr>
<th>d (mm)</th>
<th>( d_1 ) (max)</th>
<th>( d_2 ) (max)</th>
<th>( d_3 ) (max)</th>
<th>( d_4 ) (max)</th>
<th>( d_5 ) (max)</th>
<th>( d_6 ) (min)</th>
<th>( d_7 ) (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>24</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>32</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
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</tr>
<tr>
<td>50</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
</tr>
</tbody>
</table>

**Table 2** Number of oil holes

<table>
<thead>
<tr>
<th>d (mm)</th>
<th>( n ) (max)</th>
<th>( n_x ) (max)</th>
<th>( n_y ) (max)</th>
<th>( n_z ) (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>24</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>32</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>40</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>50</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

**Boundary dimensions (mm)**

- Basic load ratings (N)
- Limiting speeds (rev/min)
- Bearing numbers

**Cylindrical bore**

- Grease
- Oil

**Tapered bore**

- Abutment and fillet dimensions (mm)
- Constant
- Axial load factor
- Mass

**Notes**

1. The suffix K indicates that the bearing has a tapered bore ( taper 1:12).
2. The suffix E indicates that the bearing has an oil groove and holes.

**Remainder**

(1) The numbers and dimensions of oil grooves and holes are shown in Tables 1 and 2.)
EW Cylindrical Roller Bearings

<table>
<thead>
<tr>
<th>d</th>
<th>D</th>
<th>B</th>
<th>r₁ (mm)</th>
<th>r₂ (mm)</th>
<th>Fₚ</th>
<th>C₀r</th>
<th>C₀p</th>
<th>Grease</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>52</td>
<td>15</td>
<td>1</td>
<td>0.6</td>
<td>31.5</td>
<td>29 500</td>
<td>27 700</td>
<td>12 000</td>
<td>14 000</td>
</tr>
<tr>
<td>30</td>
<td>62</td>
<td>17</td>
<td>1.1</td>
<td>1.1</td>
<td>34</td>
<td>41 500</td>
<td>37 500</td>
<td>10 000</td>
<td>12 000</td>
</tr>
<tr>
<td>35</td>
<td>72</td>
<td>19</td>
<td>1.1</td>
<td>1.1</td>
<td>46.5</td>
<td>53 000</td>
<td>50 000</td>
<td>8 500</td>
<td>10 000</td>
</tr>
<tr>
<td>40</td>
<td>80</td>
<td>21</td>
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<td>8 500</td>
<td>10 000</td>
</tr>
<tr>
<td>45</td>
<td>85</td>
<td>23</td>
<td>1.1</td>
<td>0.6</td>
<td>46.2</td>
<td>66 500</td>
<td>65 500</td>
<td>7 500</td>
<td>9 500</td>
</tr>
<tr>
<td>50</td>
<td>90</td>
<td>25</td>
<td>1.1</td>
<td>1.1</td>
<td>49.5</td>
<td>55 500</td>
<td>55 500</td>
<td>7 500</td>
<td>9 000</td>
</tr>
<tr>
<td>55</td>
<td>100</td>
<td>27</td>
<td>1.1</td>
<td>1.1</td>
<td>52</td>
<td>83 000</td>
<td>81 500</td>
<td>6 700</td>
<td>8 000</td>
</tr>
<tr>
<td>60</td>
<td>105</td>
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<td>1.1</td>
<td>1.1</td>
<td>54.5</td>
<td>63 000</td>
<td>66 500</td>
<td>6 700</td>
<td>8 000</td>
</tr>
<tr>
<td>65</td>
<td>110</td>
<td>31</td>
<td>1.1</td>
<td>1.1</td>
<td>58.5</td>
<td>97 500</td>
<td>98 500</td>
<td>6 000</td>
<td>7 500</td>
</tr>
<tr>
<td>70</td>
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<td>1.1</td>
<td>59.5</td>
<td>89 500</td>
<td>86 500</td>
<td>6 300</td>
<td>7 100</td>
</tr>
<tr>
<td>75</td>
<td>120</td>
<td>35</td>
<td>1.1</td>
<td>1.1</td>
<td>66</td>
<td>110 000</td>
<td>113 000</td>
<td>5 600</td>
<td>6 600</td>
</tr>
<tr>
<td>80</td>
<td>125</td>
<td>37</td>
<td>1.1</td>
<td>1.1</td>
<td>70.5</td>
<td>86 500</td>
<td>98 500</td>
<td>5 600</td>
<td>7 000</td>
</tr>
<tr>
<td>85</td>
<td>130</td>
<td>39</td>
<td>1.1</td>
<td>1.1</td>
<td>72</td>
<td>137 000</td>
<td>143 000</td>
<td>5 000</td>
<td>6 000</td>
</tr>
<tr>
<td>90</td>
<td>135</td>
<td>41</td>
<td>1.1</td>
<td>1.1</td>
<td>76.5</td>
<td>97 500</td>
<td>107 000</td>
<td>5 300</td>
<td>6 300</td>
</tr>
<tr>
<td>95</td>
<td>140</td>
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<td>1.1</td>
<td>78.5</td>
<td>108 000</td>
<td>118 000</td>
<td>4 800</td>
<td>5 600</td>
</tr>
</tbody>
</table>

Boundary dimensions (mm) Basic load rating (N) Limiting speeds (min⁻¹)
The following are also available: 1. N and NF type bearings  2. Cages with an outside diameter of less than 650 mm (Please contact NSK for details.)
**Bearing Maintenance and Inspection**

**Maintenance**

Bearings and operating conditions must be periodically inspected and maintained to maximize bearing life to prevent mechanical failure, ensure reliable operation, noise productivity, and enhance cost performance.

Maintenance should be performed according to work standards that may vary according to the operating conditions. Operating conditions should be monitored, lubricant replenished or changed, and the machine periodically disassembled and serviced.

1. **Inspection under operating conditions**

   - Review lubricant properties, check operating temperatures, and inspect for any vibrations and bearing noise to determine bearing replacement periods and replenishment intervals of the lubricant.

2. **Inspection of the bearing**

   - Be sure to thoroughly examine the bearings during periodic machine inspections and part replacement. Check the raceway for any damage and confirm if the bearing can be reused or should be replaced.

**Table 1 Bearing irregularity causes and countermeasures**

<table>
<thead>
<tr>
<th>Irregularities</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loud metallic sound</strong></td>
<td>Abnormal load</td>
<td>Improve the fit, internal clearance, preload, or position of housing shoulder.</td>
</tr>
<tr>
<td></td>
<td>Incorrect mounting</td>
<td>Improve machining accuracy, alignment accuracy or mounting accuracy of shaft and housing, or use the correct mounting method.</td>
</tr>
<tr>
<td></td>
<td>Insufficient or improper lubricant</td>
<td>Replenish the lubricant or select another lubricant.</td>
</tr>
<tr>
<td></td>
<td>Contact of rotating parts</td>
<td>Modify the labyrinth seal.</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Flaws, corrosion, or scratches on raceways caused by foreign particles</td>
<td>Replace or clean the bearing, improve sealing conditions, or use clean lubricant.</td>
</tr>
<tr>
<td><strong>Loud regular sound</strong></td>
<td>Brinelling</td>
<td>Replace the bearing and use care when handling.</td>
</tr>
<tr>
<td></td>
<td>Flaking on raceway</td>
<td>Replace the bearing.</td>
</tr>
<tr>
<td><strong>Irregular sound</strong></td>
<td>Excessive clearance</td>
<td>Improve the fit, clearance, or preload.</td>
</tr>
<tr>
<td></td>
<td>Contamination by foreign particles</td>
<td>Replace or clean the bearing, improve the seals, and use clean lubricant.</td>
</tr>
<tr>
<td></td>
<td>Flaws or flaking on balls</td>
<td>Replace the bearing.</td>
</tr>
<tr>
<td><strong>Abnormal temperature rise</strong></td>
<td>Excessively small clearance</td>
<td>Improve the fit, clearance, or preload.</td>
</tr>
<tr>
<td></td>
<td>Excessive amount of lubricant</td>
<td>Reduce amount of lubricant and select stiffer grease.</td>
</tr>
<tr>
<td></td>
<td>Insufficient or improper lubricant</td>
<td>Replenish lubricant or select a proper one.</td>
</tr>
<tr>
<td></td>
<td>Abnormal load</td>
<td>Improve the fit, internal clearance, preload, or position of housing shoulder.</td>
</tr>
<tr>
<td></td>
<td>Incorrect mounting</td>
<td>Improve machining accuracy, alignment accuracy or mounting accuracy of shaft and housing, or use the correct mounting method.</td>
</tr>
<tr>
<td></td>
<td>Creep on fitted surface, or excessive seal friction</td>
<td>Correct the seals, replace the bearing, and correct the fitting or mounting.</td>
</tr>
<tr>
<td><strong>Vibration (Axial runout)</strong></td>
<td>Brinelling</td>
<td>Replace the bearing, and use care when handling bearings.</td>
</tr>
<tr>
<td></td>
<td>Flaking</td>
<td>Replace the bearing.</td>
</tr>
<tr>
<td></td>
<td>Incorrect mounting</td>
<td>Correct the squareness between the shaft and housing shoulder or side of spacer.</td>
</tr>
<tr>
<td></td>
<td>Penetration of foreign particles</td>
<td>Replace or clean the bearing components and improve sealing.</td>
</tr>
<tr>
<td></td>
<td>Leakage or discoloration of lubricant</td>
<td>Reduce the amount of lubricant. Select a stiffer grease. Replace the bearing or lubricant. Clean the housing and adjacent parts.</td>
</tr>
</tbody>
</table>

**Running Traces and Applied Loads**

As the bearing rotates, the raceways of the inner ring and the outer ring make contact with the rolling elements. This results in a darkening of both the rolling elements and raceways. It is normal for the running trace to be marked on the raceway, and the extent and shape of this running trace provides a useful indication of loading conditions.

It is possible to determine from careful observation of the running traces whether the bearing is carrying a radial load, a large axial load, or a moment load, or if there are extreme rigidity variations of the housing. Unexpected load applied to the bearing, excessive mounting error, or others can also be determined, providing a clue to the investigation of causes for bearing failure.

Typical running traces of deep groove ball bearings are shown in Fig. 1, and representative running traces of roller bearings are shown in Fig. 2.
## Bearing Damage and Countermeasures

### Flaking

<table>
<thead>
<tr>
<th>Damage condition</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
</table>
| Flaking occurs when fragments of bearing material chip off from the smooth surface of the raceway or rolling elements due to rolling fatigue, thereby creating regions having rough and coarse texture. | • Excessive load  
• Incorrect mounting (misalignment)  
• Moment load  
• Entry of foreign matter, water penetration  
• Poor lubrication, improper lubricant  
• Unsuitable bearing clearance  
• Improper precision for shaft or housing, uneveness in housing rigidity, large shaft bending  
• Progression from rust, corrosion pits, smearing, dents (brinelling) | • Reconfirm the bearing application and check the load conditions  
• Improve the mounting method  
• Improve the sealing mechanism, prevent rust during non-running  
• Use a lubricant with a proper viscosity, improve the lubrication method  
• Check the precision of shaft and housing  
• Check the bearing internal clearance |

### Cracks

<table>
<thead>
<tr>
<th>Damage condition</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
</table>
| Cracks in the raceway ring and rolling elements. Continued use under this condition leads to larger cracks or fractures. | • Excessive interference  
• Excessive load, shock load  
• Progression of flaking  
• Heat generation and fretting caused by contact between mounting parts and raceway ring  
• Heat generation due to creep  
• Improper taper angle of tapered shaft  
• Improper cylindrically of shaft  
• Interference with bearing chamfer due to a shaft corner radius that is larger than bearing chamfer dimension | • Correct the interference  
• Check the load conditions  
• Improve the mounting method  
• Use an appropriate shaft shape |

---

Part: Inner ring of an angular contact ball bearing  
Symptom: Flaking occurs around half of the circumference of the raceway  
Cause: Incorrect lubrication due to entry of cutting coolant into bearing

Part: Inner ring of an angular contact ball bearing  
Symptom: Flaking occurs diagonally along raceway  
Cause: Improper alignment between shaft and housing during mounting

Part: Inner ring of a spherical roller bearing  
Symptom: Flaking of only one row of raceway  
Cause: Incorrect lubrication

Part: Outer ring of a double-row cylindrical roller bearing  
Symptom: Thermal cracks occur on the outer ring side face  
Cause: Abnormal heat generation due to contact sliding between mating part and face of outer ring

Part: Inner ring of a spherical roller bearing  
Symptom: Axial cracks occur on raceway surface  
Cause: Large fitting stress due to temperature difference between shaft and inner ring

Part: Cross section of a fractured inner ring in a spherical roller bearing  
Symptom: Origin is directly beneath the raceway surface

Part: Roller of a spherical roller bearing  
Symptom: Axial cracks occurs on rolling surface
**Smearing**

<table>
<thead>
<tr>
<th>Damage condition</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smearing is surface damage</td>
<td>• High speed and light load</td>
<td>• Improve the preload</td>
</tr>
<tr>
<td>which occurs from a collection of small seizures between bearing components</td>
<td>• Sudden acceleration/deceleration</td>
<td>• Improve the bearing clearance</td>
</tr>
<tr>
<td>caused by oil film rupture and/or sliding. Surface roughening occurs along with</td>
<td>• Improper lubricant</td>
<td>• Use a lubricant with good oil film formation ability</td>
</tr>
<tr>
<td>melting.</td>
<td></td>
<td>• Improve the lubrication method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve the sealing mechanism</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Seizure**

<table>
<thead>
<tr>
<th>Damage condition</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>When sudden overheating occurs during rotation, the bearing becomes discolored,</td>
<td>• Incorrect lubrication</td>
<td>• Investigate the lubricant and lubrication method</td>
</tr>
<tr>
<td>and the raceway rings, rolling elements, and cage soften, melt, and deform as</td>
<td>• Excessive load (excessive preload)</td>
<td>• Reinvestigate the suitability of the bearing type selected</td>
</tr>
<tr>
<td>damage accumulates.</td>
<td>• Excessively small internal clearance</td>
<td>• Investigate the preload, bearing clearance, and fitting</td>
</tr>
<tr>
<td></td>
<td>• Entry of water and foreign matter</td>
<td>• Improve the sealing mechanism</td>
</tr>
<tr>
<td></td>
<td>• Poor precision of shaft and housing, excessive shaft bending</td>
<td>• Check the precision of the shaft and housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve the mounting method</td>
</tr>
</tbody>
</table>

**Possible causes**

- High speed and light load
- Sudden acceleration/deceleration
- Improper lubricant
- Entry of water
- Excessive load (excessive preload)
- Excessively small internal clearance
- Entry of water and foreign matter
- Poor precision of shaft and housing, excessive shaft bending
- Incorrect lubrication
- Reinvestigate the suitability of the bearing type selected
- Investigate the preload, bearing clearance, and fitting
- Improve the sealing mechanism
- Check the precision of the shaft and housing
- Improve the mounting method

**Countermeasures**

- Improve the preload
- Improve the bearing clearance
- Use a lubricant with good oil film formation ability
- Improve the lubrication method
- Improve the sealing mechanism

**Part:** Inner ring of a cylindrical roller bearing  
**Symptom:** Smearing occurs circumferentially on raceway surface  
**Cause:** Roller slipping due to excessive grease filling

**Part:** Outer ring of a cylindrical roller bearing  
**Symptom:** Smearing occurs circumferentially on raceway surface  
**Cause:** Roller slipping due to excessive grease filling

**Part:** Inner ring of a spherical roller bearing  
**Symptom:** Partial smearing occurs circumferentially on raceway surface  
**Cause:** Incorrect lubrication

**Part:** Convex rollers of a spherical roller bearing  
**Symptom:** Smearing occurs at the center of the rolling surface  
**Cause:** Incorrect lubrication

**Part:** Convex rollers of a spherical roller bearing  
**Symptom:** Discoloration and melting of roller rolling surface, adhesion of abrasion fragments from cage  
**Cause:** Insufficient lubrication

**Part:** Balls and cage of an angular contact ball bearing  
**Symptom:** Cage is damaged by melting; balls becomes discolored and melted  
**Cause:** Excessive preload
# Bearing Damage and Countermeasures

## Fretting

<table>
<thead>
<tr>
<th>Damage condition</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear occurs due to repeated sliding between two surfaces (bore, shaft, roller, etc.) Fretting occurs at fitting surface and also at contact areas between raceway and rolling elements. Fretting corrosion is another term used to describe the reddish brown or black wear debris.</td>
<td>• Incorrect lubrication • Vibration with a small amplitude • Insufficient interference</td>
<td>• Use a proper lubricant • Apply preload • Check the interference fit • Apply a film of lubricant to the fitting surface</td>
</tr>
</tbody>
</table>

### Part: Inner ring of a deep groove ball bearing
Symptom: Fretting occurs on the bore surface
Cause: Vibration

### Part: Inner ring of an angular contact ball bearing
Symptom: Notable fretting occurs over entire circumference of bore surface
Cause: Insufficient interference fit

### Part: Outer ring of a double-row cylindrical roller bearing
Symptom: Fretting occurs on the raceway surface at roller pitch intervals

## Creep

<table>
<thead>
<tr>
<th>Damage Condition</th>
<th>Possible causes</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creep is a phenomenon in bearings where relative slipping occurs at the fitting surfaces and thereby creates a clearance at the fitting surface. Creep causes a shiny appearance, occasionally with scoring or wear.</td>
<td>• Insufficient interference or loose fit • Insufficient sleeve tightening</td>
<td>• Check the interference, and prevent rotation • Correct the sleeve tightening • Investigate the shaft and housing precision • Preload in the axial direction • Prevent axial movement of ring • Apply adhesive to the fitting surface • Apply a film of lubricant to the fitting surface</td>
</tr>
</tbody>
</table>

### Part: Inner ring of a spherical bearing
Symptom: Creep accompanied by scoring of bore surface
Cause: Insufficient interference fit

### Part: Outer ring of a spherical bearing
Symptom: Creep occurs over entire circumference of outside surface
Cause: Loose fit between outer ring and housing

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Possible causes:
- Incorrect lubrication
- Vibration with a small amplitude
- Insufficient interference

Countermeasures:
- Use a proper lubricant
- Apply preload
- Check the interference fit
- Apply a film of lubricant to the fitting surface
Bearing Damage and Countermeasures

**Wear**

<table>
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</tr>
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| Wear is surface deterioration due to sliding friction at the surface of the raceway, rolling elements, roller end faces, rib face, cage pockets, etc. | • Entry of foreign matter  
• Progression from rust and electrical corrosion  
• Incorrect lubrication  
• Sliding due to irregular motion of rolling elements | • Improve the sealing mechanism  
• Clean the housing  
• Filter the lubrication oil thoroughly  
• Check the lubricant and lubrication method  
• Prevent misalignment |

Part: Inner ring of a cylindrical roller bearing  
Symptom: Many pits occurs due to electrical corrosion; wave-shaped wear on raceway surface  
Cause: Electrical corrosion

Part: Outer ring of a spherical roller bearing  
Symptom: Wear having a wavy or concave-and-convex texture on loaded side of raceway surface  
Cause: Entry of foreign matter under repeated vibration while stationary

Part: Inner ring of a double-row tapered roller bearing  
Symptom: Fretting wear of raceway and stepped wear on the rib face  
Cause: Fretting progression due to excessive load while stationary

Part: Tapered rollers of a double-row tapered roller bearing  
Symptom: Stepped wear on the roller end face  
Cause: Fretting progression due to excessive load while stationary

**Reference catalog**

Please refer to the following catalogs for details of each product.

- **HPS** Spherical Roller Bearings (CAT. No. E1259)
- **Cylindrical Rolling Bearings EW Series** (CAT. No. E1238)
- **Cylindrical Rolling Bearings EM Series** (CAT. No. E1237)
- **Large Hi-TF Bearings** (CAT. No. E1202)
- **Rolling Bearings** (CAT. No. E1102)
- **Large-Size Rolling Bearings** (CAT. No. E125)
- **Needle Roller Bearings** (CAT. No. E1419)
- **Handling Instructions for Rolling Bearings** (CAT. No. E3010)
- **Handling Instructions for Spherical Roller Bearings** (CAT. No. E9000)
- **New Bearing Doctor** (CAT. No. E7005)
Bearing}

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