

## 17. Bearing Damage and Corrective Measures

While it is of course impossible to directly observe bearings in operation, one can get a good idea of how they

are operating by monitoring noise, vibration, temperature and lubricant condition. Types of damage typically encountered are presented in Table 17.1.

	Description	Causes	Correction
<p><b>Flaking</b></p> 	<p>The surface of the race way wearing away. Conspicuous hills and valleys form soon thereafter.</p>	<ul style="list-style-type: none"> <li>Excessive loads or improper handling.</li> <li>Improper mounting.</li> <li>Improper precision in the shaft or housing.</li> <li>Insufficient clearance.</li> <li>Contamination.</li> <li>Rust.</li> <li>Drop in hardness due to abnormally high temperatures.</li> </ul>	<ul style="list-style-type: none"> <li>Review application conditions.</li> <li>Select a different type of bearing.</li> <li>Reevaluate the clearance.</li> <li>Improve the precision of the shaft and housing.</li> <li>Reevaluate the layout (design) of the area around the bearing.</li> <li>Review assembly procedures.</li> <li>Review lubricant type and lubrication methods.</li> </ul>
<p><b>Seizure</b></p> 	<p>The bearing heats up and becomes discolored. Eventually the bearing will seize up.</p>	<ul style="list-style-type: none"> <li>Insufficient clearance (including clearances made smaller by local deformation).</li> <li>Insufficient lubrication or improper lubricant.</li> <li>Excessive loads (excessive pressure).</li> <li>Skewed rollers.</li> </ul>	<ul style="list-style-type: none"> <li>Check for proper clearance. (Increase clearances.)</li> <li>Review lubricant type and quantity.</li> <li>Review application conditions.</li> <li>Take steps to prevent misalignment.</li> <li>Reevaluate the design of the area around the bearing (including fitting of the bearing).</li> <li>Improve assembly procedures.</li> </ul>
<p><b>Cracking and Notching</b></p> 		<ul style="list-style-type: none"> <li>Excessive shock loads.</li> <li>Excessive interference.</li> <li>Large flaking.</li> <li>Friction cracking.</li> <li>Inadequate abutment or chamfer.</li> <li>Improper handling. (gouges from large foreign objects.)</li> </ul>	<ul style="list-style-type: none"> <li>Review application conditions.</li> <li>Select proper interference and review materials.</li> <li>Improve assembly procedures and take more care in handling.</li> <li>Take measures to prevent friction cracking. (Review lubricant type.)</li> <li>Reevaluate the design of the area around the bearing.</li> </ul>
<p><b>Retainer Damage</b></p> 	<p>Rivets break or become loose resulting in retainer damage.</p>	<ul style="list-style-type: none"> <li>Excessive moment loading.</li> <li>High speed or excessive speed fluctuations.</li> <li>Inadequate lubrication.</li> <li>Impact with foreign objects.</li> <li>Excessive vibration.</li> <li>Improper mounting. (Mounted misaligned)</li> <li>Abnormal temperature rise. (Plastic retainers)</li> </ul>	<ul style="list-style-type: none"> <li>Review of application conditions.</li> <li>Reevaluation of lubrication conditions.</li> <li>Review of retainer type selection.</li> <li>Take more care in handling.</li> <li>Investigate shaft and housing rigidity.</li> </ul>
<p><b>Smearing</b></p> 	<p>The surface becomes rough and some small deposits form. Scuffing generally refers to roughness on the race collar and the ends of the rollers.</p>	<ul style="list-style-type: none"> <li>Inadequate lubrication.</li> <li>Entrapped foreign particles.</li> <li>Roller skewing due to a misaligned bearing.</li> <li>Bare spots in the collar oil film due to large axial loading.</li> <li>Surface roughness.</li> <li>Excessive slippage of the rolling elements.</li> </ul>	<ul style="list-style-type: none"> <li>Reevaluation of the lubricant type and lubrication method.</li> <li>Review of operating conditions.</li> <li>Setting of a suitable pre-load.</li> <li>Improve sealing performance.</li> <li>Take care to handle the bearing properly.</li> </ul>

	Description	Causes	Correction
<p><b>Rust and Corrosion</b></p> 	<p>The surface becomes either partially or fully rusted, and occasionally rust even occurs along the rolling element pitch lines.</p>	<ul style="list-style-type: none"> <li>• Poor storage conditions.</li> <li>• Poor packaging.</li> <li>• Insufficient rust inhibitor.</li> <li>• Penetration by water, acid, etc.</li> <li>• Handling with bare hands.</li> </ul>	<ul style="list-style-type: none"> <li>• Take measures to prevent rusting while in storage.</li> <li>• Improve sealing performance.</li> <li>• Periodically inspect the lubricating oil.</li> <li>• Take care when handling the bearing.</li> </ul>
<p><b>Fretting</b></p> 	<p>There are two types of fretting. In one, a rusty wear powder forms on the mating surfaces. In the other, brinelling indentations form on the raceway at the rolling element pitch.</p>	<ul style="list-style-type: none"> <li>• Insufficient interference.</li> <li>• Small bearing oscillation angle.</li> <li>• Insufficient lubrication.</li> <li>• Fluctuating loads.</li> <li>• Vibration during transport.</li> </ul>	<ul style="list-style-type: none"> <li>• Review the interference and apply a coat of lubricant.</li> <li>• Pack the inner and outer rings separately for transport.</li> <li>• When the two cannot be separated, apply a pre-load.</li> <li>• Select a different kind of lubricant.</li> <li>• Select a different type of bearing.</li> </ul>
<p><b>Wear</b></p> 	<p>The surfaces wear and dimensional deformation results. Wear is often accompanied by roughness and scratches.</p>	<ul style="list-style-type: none"> <li>• Entrapment of foreign particles in the lubricant.</li> <li>• Inadequate lubrication.</li> <li>• Skewed rollers.</li> </ul>	<ul style="list-style-type: none"> <li>• Review lubricant type and lubrication methods.</li> <li>• Improve sealing performance.</li> <li>• Take steps to prevent misalignment.</li> </ul>
<p><b>Electrical Pitting</b></p> 	<p>Pits form on the raceway. The pits gradually grow into ripples.</p>	<ul style="list-style-type: none"> <li>• Electric current flowing through the rollers.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a bypass circuit for the current.</li> <li>• Insulate the bearing so that current does not pass through it.</li> </ul>
<p><b>Dents and scratches</b></p> 	<p>Scoring during assembly, gouges due to hard foreign objects, and surface denting due to mechanical shocks.</p>	<ul style="list-style-type: none"> <li>• Entrapment of foreign objects.</li> <li>• Bite-in on the flaked-off side.</li> <li>• Dropping or other mechanical shocks due to careless handling.</li> <li>• Assembled misaligned.</li> </ul>	<ul style="list-style-type: none"> <li>• Improve handling and assembly methods.</li> <li>• Take measures to prevent the entrapment of foreign objects.</li> <li>• Should the damage have been caused by little pieces of metal, thoroughly check all other locations.</li> </ul>
<p><b>Slipping or Creep</b></p> 	<p>Slipping is accompanied by mirrorlike or discolored surfaces on the ID and OD. Scuffing may also occur.</p>	<ul style="list-style-type: none"> <li>• Insufficient interference in the mating section.</li> <li>• Sleeve not fastened down properly.</li> <li>• Abnormal temperature rise.</li> <li>• Excessive loads.</li> </ul>	<ul style="list-style-type: none"> <li>• Reevaluate the interference.</li> <li>• Reevaluate usage conditions.</li> <li>• Review the precision of the shaft and housing.</li> </ul>

	Description	Causes	Correction
<p><b>Peeling</b></p>	<p>Patches of minute flaking or peeling (size, approx. 10 <math>\mu</math> m). Innumerable hair-line cracks visible though not yet peeling. (This type of damage frequently seen on roller bearings.)</p>	<ul style="list-style-type: none"> <li>• Infiltration of bearing by foreign matter.</li> <li>• Insufficient lubrication.</li> </ul>	<ul style="list-style-type: none"> <li>• Reevaluation of lubricant type and lubrication method.</li> <li>• Improve sealing performance. (to prevent infiltration of foreign matter)</li> <li>• Take care to operate smoothly.</li> </ul>
			