Bearings for Wind turbine generators
Bearings for Wind turbine generators

Application and location

- Asynchronous or Synchronous
- AC or DC
- 50 or 60 Hz (1.500 or 1.800 rpm)
- Permanent Magnets or Multipole Generators

DGBB with spring + DGBB
## Application and location

### Bearings for Wind turbine generators

#### Examples

<table>
<thead>
<tr>
<th>ODE</th>
<th>DE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DGBB (+ spring)</td>
<td>DGBB</td>
</tr>
<tr>
<td>2x ACBB</td>
<td>CRB</td>
</tr>
<tr>
<td>CRB</td>
<td>CRB + DGBB</td>
</tr>
<tr>
<td>SRB</td>
<td>CRB</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Bearing for Wind turbine generators

Current Insulation basics/ appearance

Ball/race damage mechanism

- Resistance is lower at low speeds resulting in an increase of current flow
- Lower oil viscosities result in an increase of current going thru the bearing

Source: LUBCON
1. Ball-to-race contact

2. High temperature generated in contact area. Welding of two surfaces.
3. Ball motion breaks welded surfaces generating metal particles (contamination) → grease life + denting

4. Craters and welding beads are created. A new ball-to-race contact starts.
5. Grease contamination. Metal particles settle on race track creating a new layer (red line) on the raceway (frosted, dull appearance)

6. Damage caused by vibrations (resonance)
Bearing for Wind turbine generators

Ball/race damage mechanism

Damages due to excessive voltage

- False brinelling due to a continuous excessive voltage
- Craters and welding beads in a raceway due to disruptive discharge
Bearing damage mechanism

Damages due to disruptive discharge

Crater with a welding bead
Bearings for Wind turbine generators

Current Insulation

Possible current passage in a generator

Insulation required

J20AA
Outer ring ceramic coated

J20C
Inner ring ceramic coated

HC
Ceramic ball
Current Insulation

Layer thickness: 100 – 200 µm
Breakdown voltage: 500 – 1,000 Volt
Surface hardness: > 2,000 HV
Possible dimensions (OD): 80 – 1,400 mm
Schaeffler suffixes: J20AA or J20C

Dimensions, capacities and calculated bearing lifetimes are identical with uncoated bearings.
For ball and roller bearings.
Steel vs. Ceramic

- Micro-Welding
- Higher Friction
- Surface Asperities
- Higher Temps. Between Ball & Raceway

Steel

- Dissimilar Material
- Fine Surface Finish
- Low Surface Asperities
- Low Friction Coefficient

Ceramic
Surface topography, Steel vs. Ceramic

<table>
<thead>
<tr>
<th>STEEL AND CERAMIC BALLS ON STEEL RACEWAYS</th>
<th>Steel balls</th>
<th>Ceramic balls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface asperity contact</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Micro-welding &amp; adhesive</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Operating temp</td>
<td>Higher</td>
<td>Lower</td>
</tr>
</tbody>
</table>
Bearings for Wind turbine generators

Steel vs. Ceramic

Steel vs. Silicon Nitride Balls: Wear rate

Silicon Nitride Balls
Substantially
Reduce Raceway Wear

Friction vs. Speed: Steel & ceramic

Steel Bearing
Hybrid Bearing

Friction vs. Moment

STEEL

CERAMIC
Grease life, Steel vs. Ceramic

Ceramic Rolling Element
- Smaller Contact Area
- Higher Contact Pressure
- Lower Friction Moment
- Significantly lower Shear Stress of the Grease

Increased Grease Life Time

- Arcanol Temp90 grease  ➔ Operating temp ≤ 90C
- Arcanol Temp110 grease  ➔ Operating temp > 90C
Hybrid ceramic benefits

- Increase speed limit = 30%
- Lower friction & temp at same speed
- Grease life increase = x3 to x5
- Less wear for borderline lubrication
- No current passage

Ideal Solution
Core products available

- HC6326
- HC6328
- HC6330
- HC6332
- HC6334
- 6328-M-J20C
- 6330-M-J20C
- 6330-M-J20AA
- 6332-M-J20C
Additional resources

Current insulated bearings

Bearings for generators

Bearing Solutions for Wind Turbines

Mainshaft bearings for Wind Turbines

For more information:
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