Tapered Roller Bearings
for axle drive pinions
Compact & Lightweight, Low-torque, High-capacity & High-durability. JTEKT’s TRBs support enhancement of vehicle’s environmental performance.

In automobile axles, various stresses are caused by acceleration, deceleration, and cornering forces in a complex manner from all directions. They’re truly a key mechanical part of every vehicle. In response to the demand for ever more advanced bearings that support high performance, JTEKT goes one step beyond making proposals. Every element of technology imaginable is rethought from scratch to ensure products with unequalled levels of low friction loss and high capacity.

Tapered roller bearings for axle drive pinions

Drive pinion bearings support the drive pinion gear shaft of the hypoid gear, which facilitates a 90° directional change of the driving force transmitted from the propeller shaft. This bearing is used in pairs to simultaneously ensure smooth rotation and the rigidity of gear meshing points.

Tapered roller bearing development timeline (for automobile drivelines)

<table>
<thead>
<tr>
<th>Bearing trends and needs</th>
<th>Enhanced reliability</th>
<th>Enhanced seizure resistance</th>
<th>Responding to needs for more compact size and lower torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low torque</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lower service life</td>
<td></td>
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</tbody>
</table>

**Development initiatives**


**LFT-I bearing:** 10% lower torque
- Special processing of inner ring rib surface
- Low friction torque bearing

**LFT-II bearing:** 20% lower torque
- Special raceway crowning
- Optimized internal design
- Reduced lubricant churning resistance
- Size reduction by adopting KE or KEI heat treatment

**LFT-III bearing:** 80% lower torque
- Compared to HC bearings

**KEI bearings:** 15-fold longer service life
- Patent No. 2733656
- High surface hardness
- Optimization of amount of residual austenite
- KE bearings
- High-strength (EXTRA LIFE Bearing)

**Development of TRBs**

- HC bearing became a standard for TRB
- Near net shape cold-forging
- High capacity bearing
Tapered Roller Bearings  Torque reduction technologies LFT

To reduce bearing rotational torque by focusing on friction loss caused by sliding, rolling and lubricant churning.

For axle drive pinion application, we are pleased to propose a model specially designed for that purpose as a recommended model. In addition, we can offer LFT-Ⅲ as its option since LFT-Ⅲ has a premium specification including the control of lubricating oil flow.

Applied technologies

<table>
<thead>
<tr>
<th>LFT-Ⅱ</th>
<th>Recommended</th>
<th>LFT-Ⅲ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimized surface roughness and shape of sliding parts</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Optimized raceway crowning profile</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Optimized internal design</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Size reduction enabled by excellent heat-treatment technologies</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Control of lubricating oil flow</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Recommended” models significantly contribute to torque reduction compared to standard TRBs.

For axle drive pinion application, we are pleased to propose a model specially designed for that purpose as a recommended model. In addition, we can offer LFT-Ⅲ as its option since LFT-Ⅲ has a premium specification including the control of lubricating oil flow.

Performance

“Recommended” models significantly contribute to torque reduction compared to standard TRBs.
**Example Technology Review**

**CAE analysis**

JTEKT's design and development are conducted utilizing the latest equipment in an advanced CAE environment.

As JTEKT developed its own high-precision tapered roller bearing’s torque calculation formula based on accumulated data, research and analysis, rotational torque can be easily obtained and used for examination. JTEKT considers the rigidity of whole axle system, which supports the axle, bearing service life, contact stress, etc. and propose the best TRBs for your applications.

**Calculation is possible as axle system.**

- Service life calculation
- Surface pressure calculation
- Simulation test equipment

In response to customers' requests, we conduct evaluations utilizing various vehicle driving conditions.

At JTEKT, prior to evaluations in actual vehicles, evaluations simulating various driving conditions are possible (such as oil flow check and torque loss measurement), which enables the reduction of development and evaluation periods.

Simulation of mountain road driving, high-speed cornering, driving in urban areas, etc.

**Example Evaluation**

CAE analysis result is verified by using an actual final reduction gear unit with an actual drive pinion.

**Pinion bearing torque measurement results**

- Recommended: Max. 55% torque reduction
- LFT-III: Max. 80% torque reduction

**Oil temperature measurement results of differential gears**

- Recommended: Max. temp. rise controlled to 11°C
- LFT-III: Max. temp. rise controlled to 20°C

**Pinion gear**

- Drive motor
- No engagement of pinion gear with ring gear

**Differential carrier**

- Test bearings
- Schematic diagram of test equipment

**Ring gear**

- Drive motor
- No engagement of ring gear with pinion gear

**Test equipment**

- Recommended: Max. 55% torque reduction
- LFT-III: Max. 80% torque reduction

- Compared to Standard TRB
- Compared to LFT-II

Testing methods:

- "Pinion bearing torque measurement results" for torque reduction
- "Oil temperature measurement results of differential gears" for temperature rise.
Technical centers located around the world ensure quick response and technical support for customers’ needs.

Iga Proving Ground Enables Testing / Evaluations Simulating Roads Worldwide

Fully utilizing our knowledge as a world-leading systems supplier, JTEKT conducts driving evaluations and analyses of products installed in vehicles. We exhaustively pursue the highest standards in product safety and operation on a test course capable of simulating various road and weather conditions around the world. As a total systems supplier, our highest value is to provide our customers with products that deliver outstanding performance and the best quality that help to make automobiles that are more than just fun to drive.

Recommended Series Bearing Numbers

Please select from the recommended bearing numbers when considering axle drive pinion bearings.

<table>
<thead>
<tr>
<th>Boundary dimensions (mm)</th>
<th>Basic load rating (kN)</th>
<th>Fatigue-load rating (kN)</th>
<th>Representative bearing number</th>
<th>ABMA bearing number</th>
<th>Steel center position</th>
<th>Steel center</th>
<th>Axial load factor (Ref)</th>
<th>Mass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>50</td>
<td>50</td>
<td>KEST7072C1FT</td>
<td>G885729/10</td>
<td>15</td>
<td>16.4</td>
<td>0.70</td>
<td>0.64</td>
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<tr>
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</tbody>
</table>

Boundary dimensions can be changed upon request.
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