TIMKEN®
QUALITY RAILROAD PRODUCTS

TECH NOTE
Serving the railroad industry Number 2

Timken® Tapered Roller Bearings for Locomotive Traction Motor Suspension Units

Introduction

Throughout the world, more than 28,000 motor suspension units (MSU's) are operating successfully on Timken tapered roller bearings. In many applications, The Timken Company supplies not only the suspension bearings but also the MSU tube (with labyrinth seal) assemblies.

The Timken Company's Railroad Bearing Business is now focusing its development work on MSU's for North American mainline freight locomotives. We are currently working with U.S. locomotive builders to develop and implement tapered roller bearing MSU's into their traction motor models. Builders successfully tested the MSU equipped with Timken tapered roller bearings in the mid 1970's. Companies with locomotives currently in service with Timken tapered roller bearing MSU designs include Amtrak; Atchison, Topeka & Santa Fe; Burlington Northern; Canadian National; Conrail; CP Rail System; CSX Transportation, and Norfolk Southern.

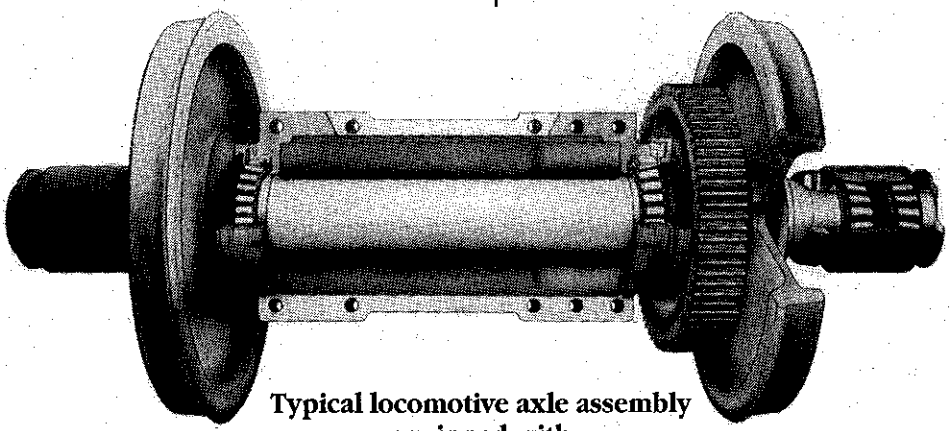
The Timken Company MSU Design

Superior performance accounts for the rapid evolution of the tapered roller bearing MSU design. Improvements have been realized in the areas of:

1. bearing design, selection and fatigue life optimization
2. MSU tube or housing design
3. ease of assembly and bearing setting.

To optimize bearing selection, design and fatigue life, The Timken Company employs various Bearing Systems Analysis™ programs. These programs allow the MSU bearings to be chosen and optimized for various environmental factors, in addition to load and speed criteria. Significant environmental factors accounted for include:

- thermal expansions
- bearing load distribution
- intermittent thrust loading
- lubricant characteristics
- vibrations
- axial deflections
- housing eccentricity
- shock loading.



Typical locomotive axle assembly equipped with Timken MSU bearings and Class GG Timken "AP"™ bearings.

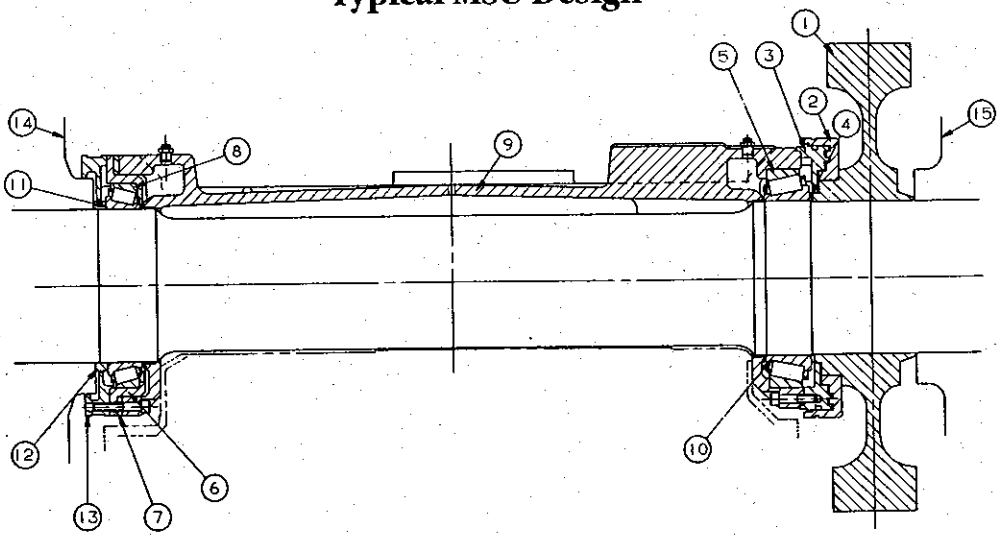
This design and performance evolution of the Timken bearing-equipped motor suspension unit is very closely linked to improvements in the MSU tube design and mounting procedures. The MSU tube design is provided with level one radiography inspection in certain critical areas as determined through years of application experience. Many of the present state-of-the-art principles incorporated into the "U" tube design suggested for North American applications were developed and field-tested overseas by British Timken.

The most recent Timken Company MSU designs are received enthusiastically. The MSU tube, sealing components and bearings are assembled on the axle while positioned in a vertical support fixture. The bearing adjustment procedure uses a cup carrier at the commutator end. The final adjustment spacer is ground from supplied spacer blanks to provide a most accurate bearing setting range. All phases of the assembly and bearing setting procedure flow smoothly and efficiently.

With the increasing demands on quality and performance, the technical benefits of the MSU equipped with tapered roller bearings have become more and more significant. Tapered roller bearings hold distinct advantages over both friction bearings and cylindrical bearings.

Timken MSU bearings, along with the Class GG Timken "AP" bearing, continue to contribute greatly to excellent performance of mainline locomotives.

Typical MSU Design



Commutator end (CE)

Item Number	Part Description
1	Axle Gear
2	PE Enclosure
3	PE Flinger
4	PE Spacer
5	PE Bearing Cup
6	Cup Carrier
7	Adjustment Spacer
8	CE Bearing Cup

Pinion end (PE)

Item Number	Part Description
9	MSU Tube
10	PE Bearing Cone
11	CE Bearing Cone
12	CE Spacer
13	CE Enclosure/ Flinger
14	CE Wheel
15	PE Wheel

Feature	Benefit
HIGHER RELIABILITY	a. reduced overall maintenance requirements b. increased bearing life—replacement estimated at 1,000,000 miles c. reduced inspection requirements—inspect bearings at wheel life approaching 250,000 mile intervals d. improved performance e. improved thrust capacity f. reduced locomotive downtime
GREASE LUBRICATION	a. no oil levels to maintain b. contamination and sealing concerns minimized c. no oil wick replacement and inspection d. relubrication required only at wheel change
REDUCED RADIAL CLEARANCE	a. reduced gear teeth wear—as proper gear meshing maintained b. reduced gear case and motor support bearing sealing problems c. reduced motor vibrations which may lead to motor insulation, breakdown and commutator problems d. improved bearing load zone— as more rollers share the bearing load, the load on the heaviest loaded roller is reduced. The resulting bearing fatigue life can be optimized by controlling radial clearances.
MSU AS A SELF-CONTAINED UNIT	a. no additional maintenance of bearings or wheelset when the traction motor is separated from the MSU assembly for repairs
LOW STARTING TORQUE	a. conserves energy b. minimized burnoff possibilities c. encourages higher horsepower designs

About The Timken Company

The Timken Company, the world's largest manufacturer of tapered roller bearings, has been producing journal roller bearings for locomotive and railroad rolling stock worldwide for decades. Trained bearing specialists, located around the world, support the railroad industry by providing professional engineering and technical services. For additional information about Timken® bearings and services, call 1-800-223-1954.

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