The photographs and preceding explanations illustrate for inspectors the appearance of varying amounts of grease weepage in service. Grease weepage from seals is normal depending upon the environmental and operating conditions discussed. Experience has shown that Timken rail bearing seals will retain an adequate amount of grease for safe bearing operation through service period. The appearance of grease weepage is not in itself an indication of a problem if inspection shows the seal is not damaged, loose or cocked out of position.

Inspection Procedure

Visually inspect the seal for any indication of physical damage from impact or contact and for a cocked-out-of-position seal. Check the seal for looseness by attempting to rotate by hand or with a suitable probe. Any damage or looseness is cause for bearing removal.

If wiping of grease weepage is necessary for adequate inspection of the seal, the wiping guideline should be followed.

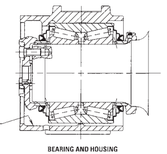

Figure 10

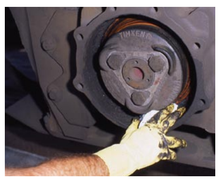

Figure 11

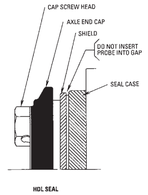

Figure 8

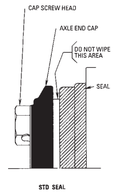

Figure 9

Wiping Guideline

HDL Seal – Figure 8

DO NOT use solvents to remove grease. DO NOT insert any probe into the HDL Seal gap; a probe can damage the seal elastomer inside the gap.

LIP Type Seal Seal – Figure 9

DO NOT use solvents or a probe to remove weepage, so as not to damage the seal elastomer. DO NOT wipe in the area near the elastomer seal lips.

Bearing Housings – Figures 10 and 11

Remove the accumulation of grease in the bottom of the bearing housing.

Conclusion

Experience has shown that Timken rail bearing seals will retain an adequate amount of grease for safe bearing operation through a service period.

The appearance of grease weepage is not in itself an indication of a problem if inspection shows the seal is not damaged, loose or cocked out of position.

For additional information, contact your Timken sales representative at 1-800-964-2626 or 1-800-368-4401 or fax 330-471-7032 or visit www.timken.com/rail

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Rail Journal Roller Bearing Grease Weepage Inspection Guide

Rail Bearing Service

Forward

This publication is a description and visual guide to understanding grease weepage. It is not intended to substitute or circumvent the rules of the Association of American Railroads (AAR) or the Federal Railroad Administration (FRA) regarding Journal Roller Bearing Seals and Grease Leakage.

When grease weepage is noted, the seal should be inspected according to AAR Field Manual Rule 36.A. Damaged, cocked or loose seals are an indication that a bearing should be removed from service.

Introduction

The AAR rules, based on long experience, allow grease loss as long as the seal is not damaged, cocked or loose in the cup counterbore. A complication to the judgment for bearing removal is the FRA Rule 215.115(a)(3), which states that a roller bearing may not continue in service if the seal "permits leakage of lubricant in clearly formed droplets."

Seal Function

Seals perform two important functions:

1. They retain a quantity of grease inside the bearing to provide adequate lubrication through the bearing service period.
2. They prevent water and other contaminants from entering the bearing.

Conventional lip-type seals have an initial contact between the seal lips and rotating seal wear ring. An initial prelube grease is supplied between the seal lips (Figure 1) to lubricate the lips during the run-in period.

The Timken® HDL™ Seal (Figure 2) uses close-clearance seal lips and prelube grease in the cavities to lubricate the lips and form a dam to enhance the seal function.

For satisfactory seal performance, a stable oil film is desirable between the surfaces of relative motion (Figure 1). The film then separates the seal from the rotating seal wear ring (or HDL shield) and contact occurs only at start-up or under severe dynamic conditions. Therefore, effective sealing is provided over the operating period of the bearing. Without an oil film, excessive heat would be generated, which would degrade the seal elastomer, and wear would continue at a rapid rate. Excessive wear generates a wide, flat surface that will not support a stable oil film and reduces sealing effectiveness.

Seal Prelube

Timken lip-type seals and HDL Seals are prelubricated with proprietary grease that initially fills the cavity between the seal lips. This proprietary grease, which is black in color, was selected to provide lubrication to the seal elastomer during the run-in period to minimize wear and heat generation. It is not uncommon for prelube grease to weep from the seals during run-in.

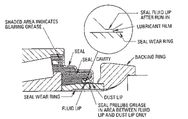

Figure 1
Radial Lip-Type Seal

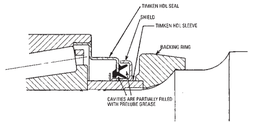

Figure 2
Hydrodynamic Labyrinth (HDL) Seal

⚠ WARNING Proper bearing maintenance and handling practices are critical. Failure to follow installation instructions and to maintain proper lubrication can result in equipment failure, creating a risk of bodily harm.

Bearing Lubrication

The geometry of the tapered roller bearing creates a natural pumping action toward the seals so that excess grease is pumped into the seal cavity area (Figure 1). During operation, dynamic wheel/rail interaction creates a vibration environment that promotes recirculation of the grease.

Once the initial seal prelube grease is dissipated, seal lubrication must be provided by the bearing lubricant. The lip-type seals are designed to allow a small, controlled amount of grease to pass the fluid lip to lubricate both lips. Therefore, it is not uncommon for bearing grease to weep from the seals during long-term operation. This grease maintains an additional barrier against contaminants and should not be wiped from the seal dust lip/seal wear ring interface area.

Although a different mechanism is at work with HDL Seals, grease is present in and around the HDL Seal element under normal operating conditions.

Grease Weepage

Grease weepage from seals is normal (see Figures 3 and 3a). These small quantities of grease weepage may give the appearance of a problem, but are normal in the absence of any visual damage. The amount of weepage depends on several factors:

- Temperature. Grease softens with increasing temperature; the softer or more fluid the grease, the greater the tendency toward weepage. Bearing operating temperature is influenced by ambient temperature, air flow, load, speed and length of operation. Truck and vehicle design also plays a major role in providing adequate air flow to the bearings. These variables all affect the consistency of the grease. (HDL Seals run cooler and tend to reduce softening of grease.)
- Bearing Internal Pressure. The higher the bearing operating temperature, the greater the internal pressure due to air expansion. Non-vented bearing assemblies or assemblies with clogged vent passages have the potential for greater internal pressure, which promotes grease weepage.
- Dynamic Operating Conditions. The dynamic wheel/ rail interaction transmits vibration and shock loads to the bearing that can be great enough to cause the seal lip to momentarily separate from the seal wear ring. This separation provides opportunity for a small amount of grease to pass under the seal fluid lip, especially if the bearing is operating under internal thermally induced pressure. Thus, the bearing vents through the seal lips; in venting, it causes a small amount of grease weepage.

Rail Cars

Figure 3
Examples of Fresh Grease Leakage (Note Shiny/Wet Appearance Grease)

Locomotives

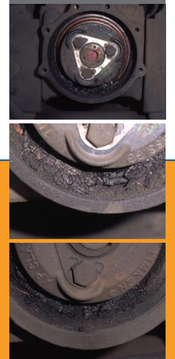

Figure 3a
Examples of Fresh Grease Leakage (Note Shiny/Wet Appearance Grease)

Visual Aids

In 1986-87, the FRA conducted an investigation of grease loss from roller bearings on double-stack container cars. Figure 3 shows examples of fresh grease weepage, which the FRA inspectors noted and allowed to continue in service.

Figures 4, 4a and 4b show examples of old grease accumulations (grease covered with road dirt) once weepage had slowed and/or subsided.

Figure 4b shows grease weepage (2 oz.) with a dry coating – grease covered with road dirt. This quantity of grease weepage may give the appearance of a problem, but it is normal to bearing operation and is not a concern, provided the proper inspection procedure is followed.

Additional photographs are included showing laboratory test bearings that illustrate various quantities of grease. Figure 5 is a simulation of 10 grams (0.35 ounce) of grease weepage and Figure 6 shows the same quantity of grease. Figure 7 is a simulation of 57 grams (2 ounces) of grease weepage. These small quantities of grease weepage may give the appearance of a problem, but are normal in the absence of any visual seal damage.

Rail Cars

Figure 4
Old Grease Accumulations (Dried and Covered with Road Dirt)

Locomotives

Figure 4a
Examples of Old Grease Accumulations (Dried and Covered with Road Dirt)

Figure 4b
Examples of Grease Weepage with Dry Coating

Figure 5
10 Grams (0.35 Ounce) Grease Applied to Outside of Seal

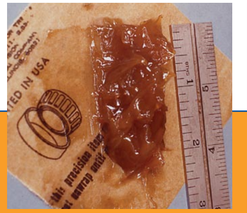

Figure 6
10 Grams (0.35 Ounce) Grease

Figure 7
2 Ounces (57 Grams) Applied Between Seal and Axle End Cap