TIMKEN

Rail Journal Roller Bearing Grease Weepage Inspection Guide

Forward

This publication serves as a descriptive 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

AAR rules allow grease loss as long as the seal is not damaged, cocked or loose in the cup counterbore. A complication to the AAR rule for bearing removal is 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 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.

The Timken® HDL™ (Figure 2) and EcoTurn® (Figure 2a) seals use 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/EcoTurn 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 could be generated, which degrades the seal elastomer, and wear continues at a rapid rate. Excessive wear generates a wide, flat surface that does not support a stable oil film and reduces sealing effectiveness.

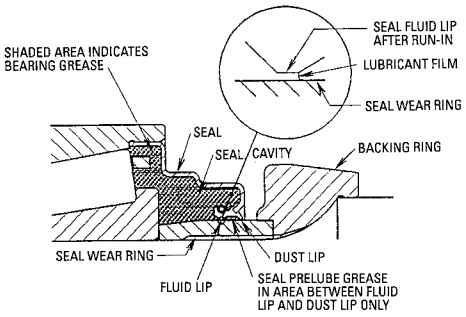

Fig. 1. Radial Lip-Type Seal.

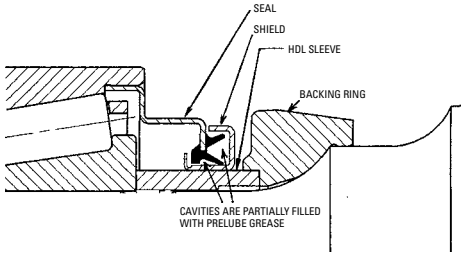

Fig. 2. Hydrodynamic Labyrinth (HDL) Seal.

Seal Prelube

Timken lip-type seals and HDL/EcoTurn seals are prelubricated with proprietary grease, filling the cavity between the seal lips. This black grease provides lubrication to the seal elastomer during the run-in period, minimizing wear and heat generation. Prelubrication grease can weep from the seals during run-in.

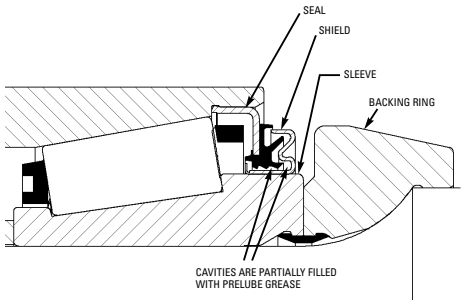

Fig. 2a. EcoTurn Seal.

Bearing Lubrication

The geometry of the tapered roller bearing creates a natural pumping action toward the seals, pumping excess grease into the seal cavity area. During operation, dynamic wheel/rail interaction creates a vibration environment that helps recirculate the grease.

After the initial seal prelube grease dissipates, seal lubrication must be provided by the bearing lubricant. The lip-type seals allow a small, controlled amount of grease to pass the fluid lip and lubricate both lips. Therefore, bearing grease can 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/EcoTurn seals, grease is present in and around the seal element under normal operating conditions.

⚠ WARNING

Failure to observe the following warnings could create a risk of death or serious injury.

Proper maintenance and handling practices are critical. Always follow installation instructions and maintain proper lubrication.

Grease Weepage

Grease weepage from seals is normal (see Figures 3 and 3a). These small quantities may appear to be 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/EcoTurn 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, or N.F.L. (non-field lubricated), 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 cause the seal lip to momentarily separate from the seal wear ring. This may allow 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, causing a small amount of grease weepage.

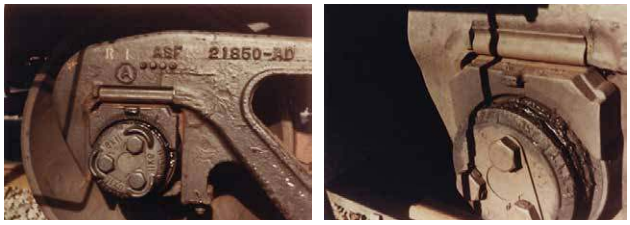

Fig. 3. Examples of Fresh Grease Leakage (Note Shiny/Wet Appearance Grease).

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

Visual Aids

In the mid 80s, 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 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 appear to be a problem. However, it is normal bearing operation and not a concern, provided the proper inspection procedure is followed.

Additional photographs show laboratory test bearings that illustrate various quantities of grease. Figure 5 is a simulation of 10 grams (0.35 ounce) of grease weepage. 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

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

Locomotives

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

Fig. 4b. Examples of Grease Weepage with Dry Coating.

Fig. 5.

Fig. 6.

Fig. 7.

The photographs and explanations in this brochure illustrate the appearance of varying amounts of grease weepage in service. Grease weepage from seals is normal depending on environmental and operating conditions. Typically, Timken rail bearing seals retain an adequate amount of grease for safe bearing operation through the service period. The appearance of grease weepage is not 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 physical damage from impact or contact and for a cocked-out-of-position seal. Check to see if the seal is loose by rotating by hand or 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, follow the wiping guidelines below.

Wiping Guidelines

HDL/EcoTurn Seal – Figure 8

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

LIP Type 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.

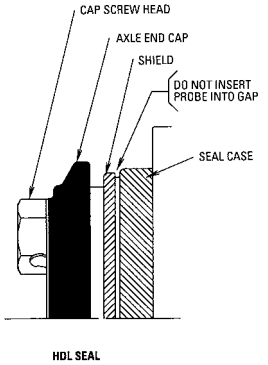

Fig. 8.

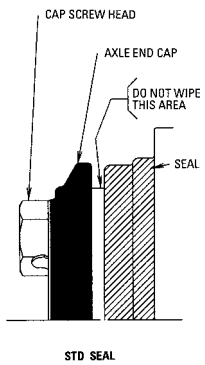

Fig. 9.

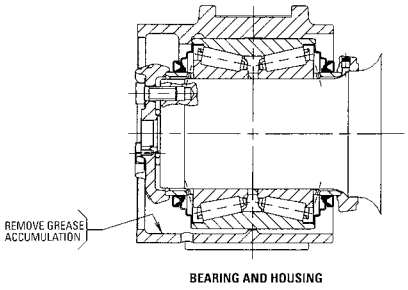

Fig. 10.

Fig. 11.

For additional information, contact your Timken sales representative or visit www.timken.com/rail

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The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets bearings, gear drives, automated lubrication systems, belts, brakes, clutches, chain, couplings, linear motion products and related power transmission rebuild and repair services.

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