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# DETERMINING DAMAGE ON AXIAL BOLSTERS OF THE RUNNING ENGINE OF A RAILWAY VEHICLE[1]

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## ABSTRACT
*This paper presents the basic failures that appear on axial bolsters and bearings applied on railway vehicles. It describes the causes of damage on axial bolsters. The aim of this paper is to familiarize oneself with the problems of axial bolster maintenance and their importance from the aspect of railway safety.*
**Key words**: railway vehicle, running engine, axial bolster

## 1. INTRODUCTION
It is known that the condition of any technical system is constantly changing during its operation, which results in a change of its exploitation properties
In addition, changes in the conditions of the technical system depends on several factors, some of which are the natural wear of parts, material quality and processing, structural imperfections of parts, installation, operation conditions, the quality of maintenance and more.
Railway vehicle is a complex technical system consisting of several subsystems (the machine running, stand, case, the braking devices, tensile and repulsive degree, electrical equipment ...), where among other particular role and importance of the running machine, and in its axle bearings..
Wheel bearings and bearing components as an integral axle assemblies are the most burdened segments of the technical system of rail-cars.
Therefore, since their accuracy is not only directly depends on the efficiency of the vehicle as a technical system, but also the safety performance of railway transport.
Therefore, the condition monitoring and diagnosis of roller bearings and related deposits must be given special importance, to the analysis of relevant indicators of beds made proper conclusions about their safety, as well as indicate the malfunction and damage. [5] [6].

## 2. ROLLING BEARINGS LUBRICATED
Depending on the vehicle series, in practice face several different types of lubrication which is essentially differ only in the performance of construction. Common to all types of lubrication that are standardized and uniform disclosures in accordance with UIC. [1] [2] [3] [4]

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In general, the bearing with oil lubrication, rail vehicles (towed) consists of the following elements: sealing ring (4), bearing housings, screws for attaching the lid (with holes for sealing), the outer bearing (2), the inner bearing (1), support of ring (5), sealing ring (powderbumper) (Fig. 1).
In service the bearings are lubricated and sealed to be opened only with the permission of the owner of the vehicle.
Disassembly, inspection and assembly of the bearing are performed later than 4 years after its initial installation or after the final dismantling.
Examination should be performed:

- after 400,000 km flown,
- the determination of damage,
- distortion of the geometry of the wheel profile,
- slippage or other unforeseen events.

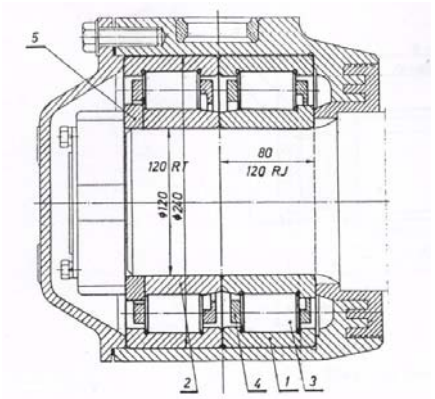


*Figure 1. Switching drawing bearing with lubricator*

## 3. FAILURES AND DAMAGE

The exploitation occurs more than 60 types of failures axle assembly, a good portion of them is related to the anti-friction bearings.
Only proper management, maintenance and supervision to prevent the negative effects of failures beds or prevents their emergence.
Causes of damage to bearings and roller bearings are different and can be: faults in material, manufacturing defects (errors occurring during forging, pressing and annealing, the cracks formed during grinding, the error tolerances), the wrong preparation or installation of bearings, improper lubrication (lack of lubricant) [5] [6]
Table 2 presents the basic types of defects in ball bearings and ležeja and the reasons underlying them.

*Tabela 2.*

| CAUSE | CONSEQUENCE |
|---|---|
| Improper instalation | - Trench rolling path<br>- Cracs |
| Improper clearance in the bearing | - Abrasive wear<br>- Contact corrosion<br>- Damage during installation<br>- Misalignment<br>- Distortion and Destruction |
| Fatigue of material | - Surface damage<br>- Peeling |
| Insufficient lubrication or overdosed | - Seizing beds<br>-Rolling trail encroachment areas<br>- Roller track |
| Inadequate lubricant | - Etching |

| | |
|---|---|
| The passage of current (when electric welding on the vehicle or rotary base) | - Roughness<br>- Craters<br>- The destruction of bearing |
| Poor sealing | - Abrasive wear<br>- Contact corrosion<br>- Grooves on rest platforms |
| Corrosion and Erosion | - Wear<br>- Corrosion scars |
| Laxity of the internal ring and sleeve | - Corrosion of Friction and Wear |
| Interplay of soft and hardened parts | - Wear the soft parts of the cage |
| Contamination bearing | - Wear and tear of hard parts (cylindrical rollers, the path ..) |

### 3.1. Damage deposit corrosion and etching

Corrosion and erosion leading to increased corrosion wear, which results in scarring. Corrosion of friction or corrosion circuit is created, but with a slight displacement between the inner ring and shaft sleeve and between the outer ring and housing (Fig. 2). [6] Loose assembly facilitates the movement of one part to another. Corrosion caused by wear of the bearing acts as a tool for grinding or polishing.

*Figure 2. Damage deposit (sleeve), corrosion and etching*

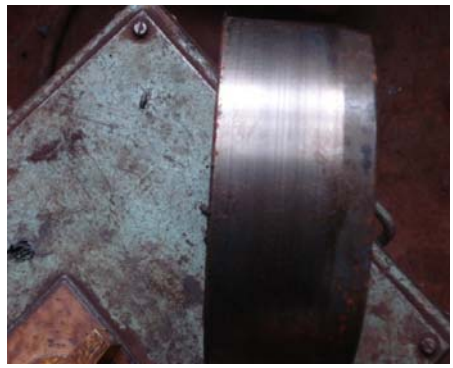

*Figure 3. The damaged surface and flaking*

### 3.2. The damaged surface and flaking

Roughness and listing on the path and cylindrical rollers is referred to as scaling.
It occurs due to fatigue, faulty installation of the bearing or the presence of foreign bodies.
Foreign bodies during assembly due to bearing the imprint of the path and cylindrical rollers and cause the formation of fine cracks from which the logs.[6]

### 3.3. Cracks

Cracks occur when putting on and removing incompetent beds, as a result of hammering and beating on the rings and rollers.
The cause of transverse cracks on the inner ring is often too tight to the shaft sleeve assembly (Fig. 4)

*Figure 4. Cracks in the ring*

*Figure 5. The consequences of lack of lubrication*

### 3.4. The creation of furrows

Furrows damage paths that arise from microscopic chips of steel. There are rare occurrences of ball bearings for rail vehicles.

In addition, the grooves formed due to shock loads greater than 0.7 A/mm2 (or alternating one-way) and to depths of 16 m and a width of about 2mm. [6]

### 3.5. Damage to the cage roller bearings

When insufficient lubrication occurs very wear pockets in the cage roller bearings, due to the cylindrical rollers which occupy an inclined position and cause damage to the bearing surface of the ring back and loosening of the joint with rivets. [6]

The wear of the bearing cage eventually leads to fracture of the spacer and bearing damage (Fig. 5).

## 4. CONCLUSIONS

Rolling bearings from the lubricator to be used in railway vehicles are vital elements of the machine and are the basis for safe transport.

Damage to the bearings lead to mechanical damage and heating of the machine, which ultimately results in the case of blocking the shaft (or in severe cases, its failure), which inevitably occurs due to slippage of the vehicle.

Knowledge of the irregularities in the bed, their monitoring, analysis and taking measures to prevent their occurrence, achieves the goal of maintenance, which is technically efficient system with minimal participation in the work of cancellation.

## 5. REFERENCES


[1] Gosa, Uputstvo za odrzavanje i opravku osovinskog sklopa sa kotrljajnim ležzištima (Guidelines for maintenance and repair of the axle assembly with roller bearing), Gosa 1987.

[2] Vladimir Aleksandrov, Održavanje željezničkih vozila, Naučna knjiga Beograd 2000.(Maintenance of railway vehicles, Scientific Books Belgrade 2000th)

[3] ZJZ, Uputstvo o održavanju osovinskih sklopova 260 (Instructions on maintenance shaft assembly 260), ZJZ Beograd 2000.

[4] ZJŽ, Uputstvo za korišćenje i održavanje vagonskih mazalica sa kotrljajućim ležajima (Instructions for use and maintenance of wagon grease nipple with a rolling element bearings), Beograd 1964

[5] Bulatović,M., Održavanje i efektivnost tehničkih sistema, Monografija, Mašinski fakultet, Podgorica,2008. (Maintenance and effectiveness of technical systems, Monograph, Mechanical Engineering Faculty, Podgorica, 2008).

[6] Nuhodžić, S., Istraživanje postupaka montaže i obnavljanja željezničkih kolskih slogova, Magistarski rad, Mašinski fakultet, Podgorica, 2010.( Research procedures and renewal of rail assembly school records, Master thesis, Mechanical Engineering Faculty, Podgorica, 2010)