

FAILURE INVESTIGATION OF A STEERING BEARING IN MATIC MOTORCYCLE 125 cc

Nur Aidi Ariyanto, Sri Nugroho, Rifky Ismail

Abstract : A Motorcycle is light vehicles that have a lot of systems that work together and link each other such as chassis system, power train system (engine), brake system, electrical system, suspension system, etc. Bearing is one among other supporting parts of a motorcycle. It's steering bearing and wheel bearing. Steering bearing is usually exchanged faster than wheel bearing. Steering bearing is a thrust bearing type that able to support axial force, transversal force and also impact force. Failure was happened in steering bearing because of miss assembling, overload carrying, bad road condition and lack of grease.

Keywords : Bearing, Failure Analisis, Motorcycle, Transportation, Grease, False Brinelling, Fretting

1 INTRODUCTION

MOST transportation in Indonesia is continent vehicles, one of them is a motorcycle. A motorcycle was produced to made people traveling easily, therefore parts of it were designed to be effective and efficiency by using high-quality materials. [1]

A motorcycle is light vehicles that have a lot of systems that work together and link each other such as chassis system, power train system (engine), brake system, electrical system, suspension system, etc. [2]

While motorcycle being used, there are a lot of components that moving in translation motion, rotating motion or both, also there is a vibration effect because of the motion and the road condition. The component that moves in rotation motion and vibrated is steering bearing. Steering bearing is the component that supports the weight of the motorcycle at the front side and swing to control the drive of the motorcycle.

This study is to reveal the cause of the failure of steering bearing in a motorcycle. In this case, the failure condition happened when the steering is heavy to turn left or turn right because there are some scratch inside the raceway of the steering bearing.

Bearing is one part of the engine element that plays an important role because the function of the bearing is to support a shaft to rotate without excessive friction. The bearing must be strong enough to hold the shaft and also other components while working.

Bearing is a component used to support a loaded shaft so that the rotation can be smooth, safe and resistant. The bearing also separates the rotating part (rotor) from the stationary part (stator). Bearings can carry radial, axial or angular that combination of both, and must be sturdy. If the bearings do not function properly, the performance of the entire system will decrease and may not work properly.

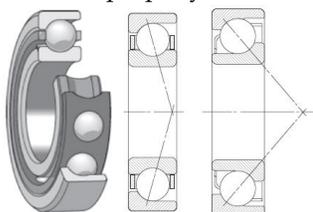


Fig. 1. Angular bearing [3]

2 BACKGROUND

There are some bearing in the motorcycle such as wheel bearing and steering bearing, Steering bearing is usually exchanged faster than wheel bearing. This study is to reveal the cause of the failure of steering bearing in a motorcycle. In this case, the failure condition happened when the steering is heavy to turn left or turn right.

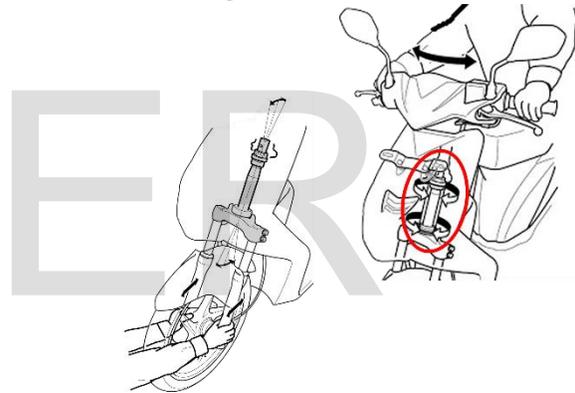


Fig. 2. Position of the steering bearing in a motorcycle [2]

Steering bearing in a motorcycle is an angular bearing type that supports axial and radial load as shown in Figure 2. Steering bearing contains 2 pairs bearing that located above and below steering axle as shown in Figure 3.

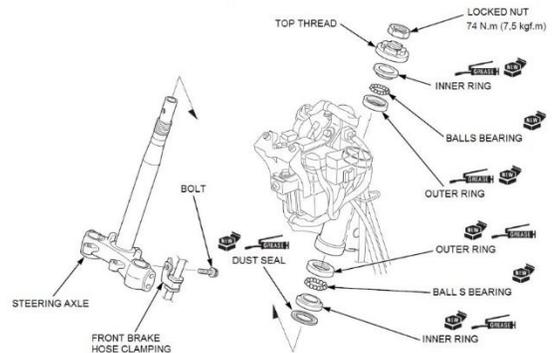


Fig. 3. The component of the steering system [2]

3 CASE STUDY

A study on failed bearing was made including visual examination, microhardness. Visual examination was taken from several motorcycle that had failure on steering bearing. Those motorcycle are different type and specification but using the same type of steering bearing.

Bakelite mounted and polished cut sections were used for microhardness measurements. Microhardness measurements were taken from one motorcycle for every ring at each bearing (outer and inner ring) also for the new bearing, then made the comparison.

4 RESULT

4.1 Visual Examination

Visual examination was carried out using a 3 Megapixel Camera, there were 5 motorcycle's steering bearing had been examine. The condition of steering bearings for each motorcycle as shown below



Fig. 4. Failed Steering Bearing several motorcycles.

TABLE 1. MOTORCYCLE CONDITION BEFORE STEERING BEARING EXCHANGE

No	Motorcycle type	Production year	Mileage (km)	Steering problem
1	Matic 125 cc	2012	57247,5	Heavy Steering, as if there is a stopper in middle position
2	Matic 150 cc	2018	58180,3	Heavy steering, often carry heavy loads, a convection business operations
3	Matic 125 cc	2016	41572,5	Heavy steering, when turning like a traffic jam in the middle position
4	Matic 100 cc	2011	33032,9	Single accident, bent front shock
5	Matic 100 cc	2017	27766,2	Steering is often jammed in the middle, often carrying heavy loads, metal business operations (black smith)

4.2 Micro Hardness

Microhardness measurements were taken along the cut section within 0,25 mm until 1,5 mm from the raceway surface. The result is shown in Table 2 and Table 3.

The result of microhardness measurements made into a chart, shown in Fig. 5 and Fig. 6.

TABLE 2. MICRO HARDNESS RESULT IN HARDNESS VICKERS NUMBER (HVN) FOR NEW BEARING

Distance from race way surface	Upper Outer ring	Upper Inner Ring	Bottom Outer ring	Bottom Inner Ring
0,25	710,83	780,80	629,77	667,27
0,5	678,67	717,93	597,87	638,97
0,75	656,13	663,83	588,63	615,90
1	632,97	662,20	585,03	607,13
1,25	621,37	647,73	566,17	590,27
1,5	607,50	643,33	558,20	587,40

TABLE 3. MICRO HARDNESS RESULT IN HARDNESS VICKERS NUMBER (HVN) FOR FAILED BEARING

Distance from race way surface	Upper Outer ring	Upper Inner Ring	Bottom Outer ring	Bottom Inner Ring
0,25	612,5	639,7	702,2	661,4
0,5	599,3	611,7	684,0	621,8
0,75	580,6	599,3	677,0	599,3
1	577,3	593,6	654,6	580,0
1,25	568,4	590,1	643,6	575,3
1,5	564,2	580,8	631,3	573,9

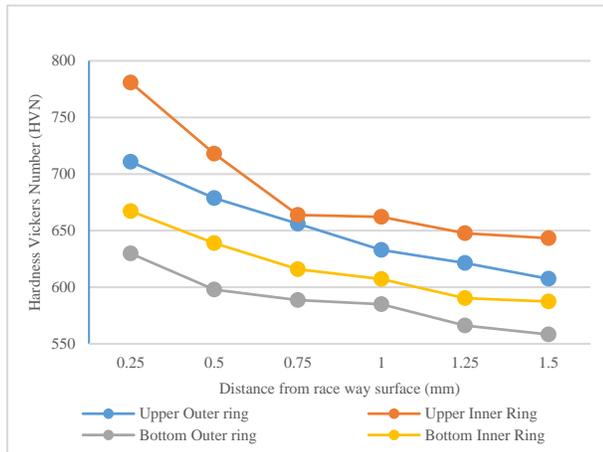


Fig. 5. Chart of micro hardness for New Bearing.

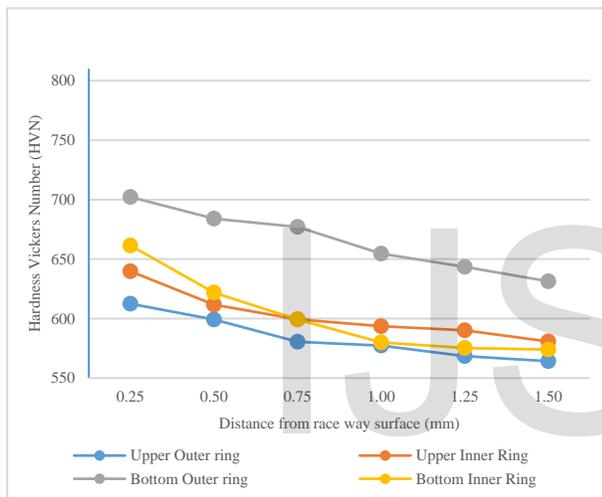


Fig. 6. Chart of micro hardness for Failed Bearing.

5 DISCUSSION

The steering system for motorcycle Matic 100 cc, 125 cc, and 150 cc used an even steering bearing. Even though the specification of each motorcycle is different in engine capacity, weight and also load capacity.

The result of the visual examination at specimens appears that there are some dent marks or fretting or false brinelling effect on the bearing raceways, generally caused by vibration.

Steering bearing does not work in continuous rotation, but only in oscillating motion. Its increase in the probability of false

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brinelling happens.

At specimen number 4, the dent marks are severe. These happen because of the accident of this motorcycle that bent the front shock breaker.

Fig. 6 shows that there was a slight increase in hardness for the bottom bearing and there was a slight decrease in hardness for upper bearing. This may happen because of the difference force load between the upper and bottom bearing during operation for a long time period.

6 CONCLUSION

From the results of the analysis and discussion conclusions can be drawn namely:

1. Steering bearings are bearings whose movements do not rotate but only move back and forth (Oscillating).
2. When the motorcycle is running, the bearing movement will be less, especially when the road is straight. This has a great chance the bearing will experience false brinelling, where there is a vibration in the bearing but there is no movement of the ball bearing. This will also cause the lubricant to move out of the bearing.
3. Damage can also be caused by overloading received by the bearing, where the type of bearing is for several types of motorbikes, namely the 100 cc Matic motorcycle type, 125 cc Matic motorcycle, and 150 cc Matic motorbike. The bearings analyzed are those used on 125 cc Matic motorcycles. In some motorbike repair shops, the majority of those who replace steering bearings are 125 cc Matic type motorcycles, which have a size large enough so that the ability to carry loads is quite large, but the steering bearing mounted on the steering axle is the same as a motorcycle which has a much smaller size.

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8 REFERENCES

- [1] Ariestyanto Arvian, "Failure Analisis on 2 Stroke Motorcycle's Connecting Rod," MT Thesis, Diponegoro University, 2011
- [2] AHM, Manual Book Service Honda Vario 125 PGM-Fi, 2017
- [3] Harris TA, Kotzalas MN. 2006, Essential concepts of bearing technology, USA: Taylor & Francis Group; 2006
- [4] Gurumoorthy K, Ghosh Arindam, Failure investigation of a taper roller bearing: A case study, 2013
- [5] Upadhyay. R. K., dkk, 2013, Rolling element bearing failure analysis: A case study, Case Studies in Engineering Failure Analysis 1 (2013) 15-17
- [6] Gurumoorthy K, Faye Bradley D., Ghosh Arindam, Handling abuse causes premature bearing failures, 2013
- [7] SKF, SKF Bearing Maintenance Handbook, 2018