FATIGUE DURABILITY OF STEERING ROD TIP

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Steering rods are a subassembly of the vehicle, thanks to which it is possible to maneuver it in various operating conditions. The key components are: ball joint and two rods [1], Fig. 1a. One of the rods is directly connected to the steering column, the other to the wheel. In order to protect the ball joint against the influence of water, sand and mud, and due to maintaining the nominal friction conditions the rubber covers are used. The steering rod during operation is subjected to an alternating cyclic loading resulted from unevenness of the roads and driver maneuvers. Such conditions lead to multiple rotations of the ball with respect to cup of the ball joint, causing progressive wear of these components, leading even to the disconnection of the subassembly into two parts. Therefore, many component manufacturers of the automotive industry indicate the mechanical tests as the most important to achieve the required quality of components [2]. They pointing out the following types of tests: hardness test, tensile test, fatigue test (in particular after 40,000 km). Although each of the mentioned tests is important, the last one is particularly necessary for checking the behaviour of parts subjected to cyclic loading. Therefore, just this test was selected to check durability of the steering rod end (Fig. 1a) in a vehicle with the maximum admissible weight above 3.5 tonnes. The test was carried out to obtain 2×10^6 loading cycles. A state of the object was monitored by means of the macro photography (Fig. 1a). Additionally, angular inclination changes of the pin (Fig. 1b) and moment due the friction force versus the number of cycles (Fig. 1c) were taken into account. The failure of the rubber cover appeared after 3.1×10^5 loading cycles in the case of steering rod end tested. A predicted number of cycles after which the moment due to friction force attains a critical value (1.0 Nm) was equal to 1×10^7 for this type of joints.

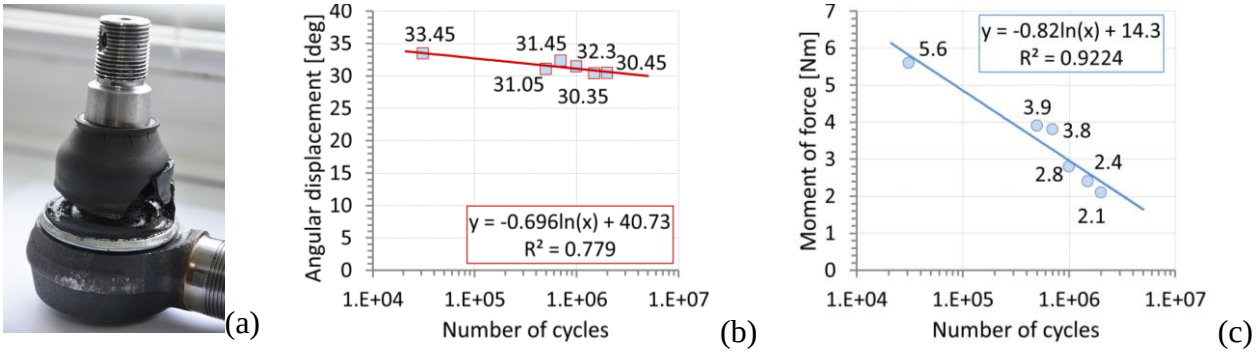

Fig. 1. Steering rod tip examinations: (a) view of the component, (b) angular displacement of the joint versus number of cycles for selected direction, (c) moment of force versus number of cycles

[1] Technical details of XZS143, TRW-Safety, 3 pages.
[2] SERVOTEST, Steering Test Rigs, 12 pages.