

Methods of Tests of Wheel Hub Bearings for Heavy Commercial Vehicles

FOREWORD

This Test Standard was proposed by The Automotive Research Association of India as guideline for testing of heavy commercial vehicles (HCV) wheel hub bearings

Recently there have been changes in axle load norms by government of India in which the axle loads have been increased by around 10-15 percent. The outcomes mentioned in this standard are derived from experiments conducted on actual vehicles and data and results derived thereof.

METHODS OF TESTS FOR WHEEL HUB BEARINGS FOR HEAVY COMMERCIAL VEHICLES

1 SCOPE

This standard specifies a laboratory test Method for evaluating certain essential fatigue life characteristics of Wheel Hub Bearings intended for road use on Heavy Commercial Vehicles. The test is a Rotating-Bending Type of Test

2 REFERENCES

ISO 281:2007

SAE J2562

EUWA ES-3.23

3 TERMS AND DEFINITIONS

For the purpose of this standard the following terms and definitions shall apply.

3.1 Wheel Hub

Wheel Hub is the rotating part of the wheel, mounted on the spindle, whose outer periphery is connected to the wheel Rim.

3.2 Static Loaded Radius

The measurement in meters in loaded condition from the wheel axle centre line to the ground when the tyre is properly inflated corresponding to the rated load.

3.3 Wheel Hub Bearing

The Wheel Hub Bearings are the taper roller bearings mounted on the axle which support the wheel hub and allow rotation of wheel

4 GENERAL

Only fully processed new wheel hub bearings which are representative of wheel hub bearings intended for the vehicle shall be used for the tests.

5 TEST

5.1 Dynamic Cornering Fatigue Test

5.1.1 Equipment

The Test machine shall be as suitable to provide a constant radial load along the centreline, and a constant cornering load at a point signifying the tyre contact patch (at a distance equal to the rolling radius of the tyre from the centreline of the axle). Additionally, the machine shall be capable of providing constant rotational motion representative of the wheel rotations along with the required reaction forces. Refer Figure 1

5.1.2 Test Load Block Cycle

The test load block cycle is made up of a series of combinations of vertical and lateral loads with a fixed number of revolutions for each combination. The test

load block cycle is given in **Error! Reference source not found.**. The test load block cycle is to be repeated for number of rotations corresponding to 96000kms of accelerated running for a target life of 10 Lakh kms. e.g. for a wheel radius of 0.51, one test block completes 1922 kms, hence 50 repeats of block are required for accelerated running of 96000 kms

Test loads are given for the entire wheel hub load on each side of the axle and will be appropriately divided among the multiple bearings by using a hub test setup similar to as mounted on the vehicle. Test Loads are specified in terms of 'G' where 1G is equal to the static load on each side of the axle. The test loads to be derived for the wheel hub bearing considering the maximum corner load based on front or rear axle corner loads, whichever is maximum.

e.g.) For an 11 Ton Axle, $1G = 1 * 0.5 * 11 * 1000 * 9.81 = 54kN$

Load Sign Convention for Lateral Loads is as follows

-Inward Loads (Towards the vehicle) are negative

-Outwards Loads (Away from the vehicle) are positive

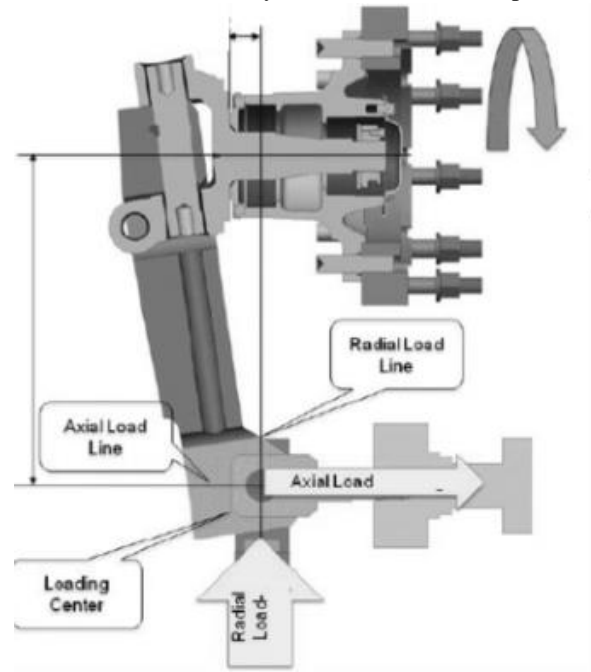


Figure 1 : Representative Test Setup

5.1.3 Test Procedure

The Wheel hub along with the bearing shall be mounted on the test machine similar to its mounting on the vehicle axle spindle using suitable mounting adaptations as specified by the vehicle manufacturer. The Mounting type can be different for driven and non-driven wheel hubs. The Spindle (Actual or a dummy

Spindle) shall be connected to a loading arm which is coupled to the loading actuators providing the Radial and Axial loads. The Radial and Axial Load shall be applied on the moment arm towards and perpendicular the wheel centreline respectively at a point representative of the tyre contact patch. The outer edge of the hub shall be coupled to a rotary input adapter connected to a motor that is capable of providing rotational motion similar to wheel rotations and the required reaction to the cornering and radial load. Test is to be carried out at a rotational speed of 1000RPM or as recommended by the manufacturer.

Sufficient cooling arrangement shall be provided so as to maintain the temperature of the bearing below 60°C. In case a water-based cooling mechanism is used, care should be taken to prevent water contamination of bearing lubricants. Suitable oil and dirt seals can be used as recommended by the manufacturer.

5.1.4 Acceptance Criteria

The wheel hub bearing assembly should not show any visible cracks at the end of the test. There should not be any deformation, or wear in the bearing races such as to inhibit the normal desired operation of the bearing.

Block Number	Vertical Load (G)	Lateral Load (G)	Vertical Load (N)*	Lateral Load (N)*	Cycles** in 1 Block
1	1.03	-0.61	55517	-32879	792
2	1.03	-0.44	55517	-23716	1674
3	1.03	-0.36	55517	-19404	25643
4	1.41	-0.53	75999	-28567	163
5	1.41	-0.44	75999	-23716	587
6	1.41	-0.36	75999	-19404	2443
7	1.41	-0.28	75999	-15092	11612
8	1.6	-0.44	86240	-23716	1447
9	1.6	-0.36	86240	-19404	13225
10	1.6	-0.28	86240	-15092	4724
11	1.6	0.14	86240	7546	1079
12	1.8	-0.7	97020	-37730	101
13	1.8	-0.44	97020	-23716	2729
14	1.8	-0.36	97020	-19404	11222
15	1.8	-0.28	97020	-15092	17946
16	1.8	-0.19	97020	-10241	37567
17	1.8	-0.11	97020	-5929	231103
18	1.8	-0.02	97020	-1078	181819
19	1.99	-0.86	107261	-46354	633
20	2.18	-0.44	117502	-23716	6404
21	2.18	-0.28	117502	-15092	5722
22	2.18	-0.02	117502	-1078	34274
23	2.55	0	137445	0	7140

**Note: 1G load for the wheel bearing is considered as 5.5t = 53.9kN. (Considering corner load of the rear axle having the rated load capacity 11t)*

***Note: The indicated cycles are the minimum number of cycles to be tested per block, and the same can be adjusted as per practical limitations of the test speed*