BS ISO 3006:2015

BSI Standards Publication

Road vehicles — Passenger car wheels for road use — Test methods

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee AUE/4, Tyres and wheels for motor vehicles.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

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The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 33, *Vehicle dynamics and chassis components*.

This fifth edition cancels and replaces the fourth edition (ISO 3006:2005), which has been technically revised.

Introduction

This International Standard was developed in response to requests to establish uniform test methods to evaluate certain fatigue strength characteristics of wheels used on passenger cars. The standardization of test methods allows manufacturers of vehicles and/or wheels to evaluate their products in a uniform manner. By using these methods, wheels from different parts of the world can be compared and evaluated for use.

INTERNATIONAL STANDARD ISO 3006:2015(E)

Road vehicles — Passenger car wheels for road use — Test methods

1 Scope

This International Standard specifies two laboratory methods for testing certain essential fatigue strength characteristics of wheels intended for road use on passenger cars as defined in ISO 3833.

The test methods are

a) dynamic cornering fatigue test;

b) dynamic radial fatigue test.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3833, *Road vehicles — Types — Terms and definitions*

ISO 3911, *Wheels and rims for pneumatic tyres — Vocabulary, designation and marking*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3911 and the following apply.

3.1
hub bolt (fasteners)
bolt that is attached to the hub before mounting the wheel

3.2
wheel nut (fasteners)
nut for fastening the wheel as a set with the *hub bolts (fasteners)* (3.1)

3.3
wheel bolt
bolt for fastening the wheels as a set into a threaded hole in the hub

3.4
load rating
value obtained by converting the force to mass which can be loaded under defined conditions to the tires which can be applied to the test wheel

3.5
maximum vertical static load
maximum value of the vertical load acting on the tyres

Note 1 to entry: It is specified by the wheel manufacturer or vehicle manufacturer and it derives from the specification of a vehicle which is intended to use the test wheel.

3.6
crack
material separation with a propagation of more than 10 mm occurring during a test

Note 1 to entry: The inspection by method for liquid penetrant that are defined in ISO 3452-1.

4 General requirement

Only fully processed new wheels which are equivalent of wheels intended for the vehicle shall be used for the tests.

5 Dynamic cornering fatigue test

5.1 Equipment

The test machine shall have a driven rotatable device where either the wheel rotates under the influence of a stationary bending moment (see Figure 1) or the wheel is stationary and is subjected to a rotating bending moment (see Figure 2).

5.2 Procedure

5.2.1 Preparation

Clamp the rim of the wheel securely to the test fixture. The adaptor face of the test machine shall have equivalent wheel mounting systems to those used on the vehicle. The mating surfaces of the test adaptor and wheel shall be free of excessive scoring and deformation, and excessive build-up of paint, dirt, or foreign matter.

Attach the load arm and adaptor assembly to the mounting surface of the wheel using hub bolts and wheel nuts or wheel bolts which are as follows:

— equivalent to those used in a vehicle;

— in good condition;

— lubricated or non-lubricated in accordance with the state of being applied to a vehicle (as specified by the vehicle manufacturer).

Tighten these wheel nuts or wheel bolts at the beginning of the test to the vehicle or wheel manufacturer's specified torque values.

In the early stages of the test, to improve the adaptability of the nut contact surface of the wheel and the wheel nut or wheel bolt, the wheel nut or wheel bolt can be re-tightened once.

5.2.2 Bending moment application

To impart a bending moment to the wheel, apply a force, *F*, parallel to the plane of the wheel mounting surface.

Maintain the bending moment within ±2,5 % of the calculated value.

5.3 Bending moment determination

Determine the bending moment M (force F × moment arm l), in newton metres, using Formula (1):

$$M = \left(\mu \times R + d\right) \times F_{\mathrm{v}} \times S \tag{1}$$

where

μ is the assumed coefficient of friction developed between tyre and road (see Table A.1);

R is the radius, in metres, of either of the following:

— the largest value of the static loaded radius of the tyres which can be applied to the wheel;

— the largest value of the static loaded radius of the tyres which is specified by the wheel or the vehicle manufacturer;

d is the inset or outset (positive for inset; negative for outset) of the wheel, in metres (see ISO 3911);

F_{v} is the value, in Newtons, of either of the following:

— the largest value of the load rating of the tires which can be applied to the wheel;

— the maximum vertical static load which is specified by the wheel or the vehicle manufacturer;

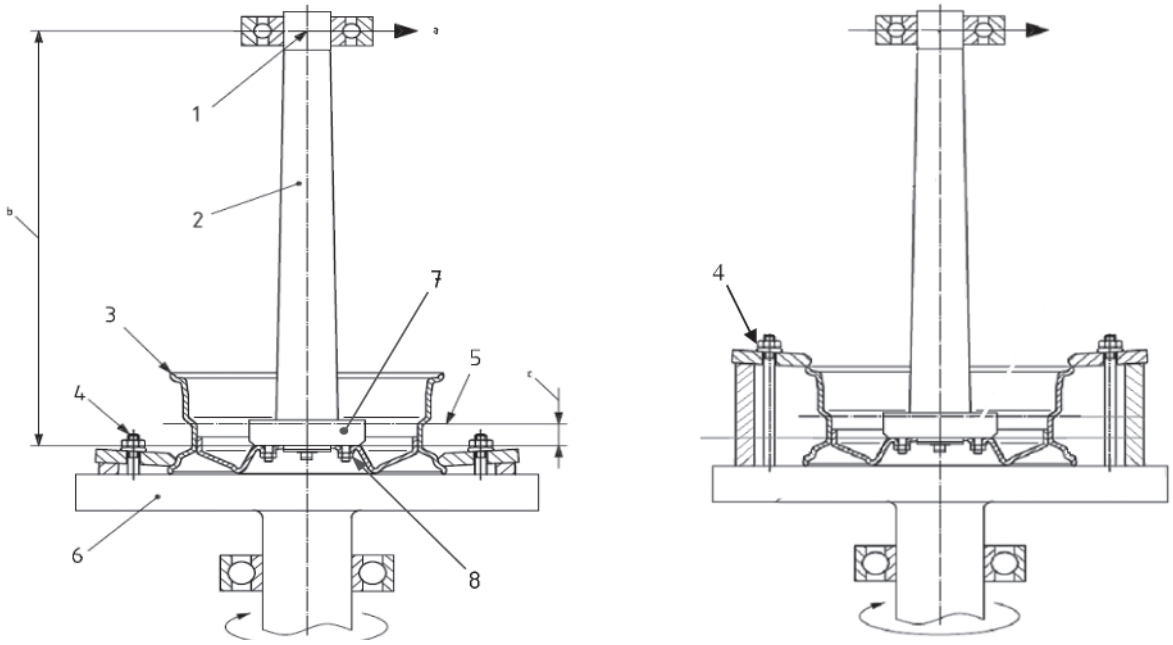
S is the accelerated test factor (see Table A.1).

5.4 Test termination

The test shall be terminated in either of the two following circumstances:

— inability of wheel to sustain load;

— propagation of a crack or cracks existing prior to test or new visible stress-caused cracks penetrating through a section of the wheel.

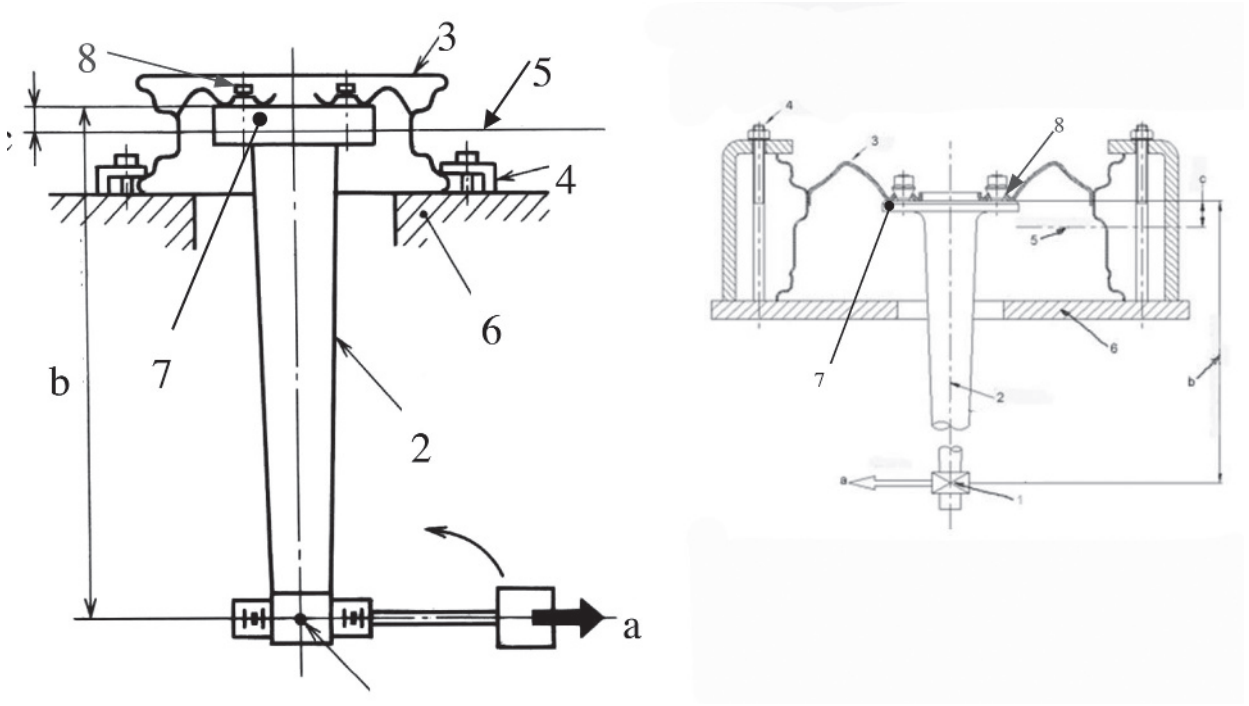


a) Bottom clamping method **b) Top clamping method**

Key

1 pivot point
2 loading arm
3 wheel
4 fastener
5 rim centre plane
6 rotary disc
7 adaptor
8 wheel nuts or wheel bolts
a Load, *F*.
b Moment arm, *l* (0,5 m to 1,4 m).
c Inset, *d*.

Figure 1 — Example of dynamic cornering fatigue test fixture — the wheel rotates under the influence of a stationary bending moment



a) Bottom clamping method **b) Top clamping method**

Key

1 pivot point
2 loading arm
3 wheel
4 fastener
5 rim centre plane
6 fixing base
7 adaptor
8 wheel nuts or wheel bolts
a Load, *F*.
b Moment arm, *l* (0,5 m to 1,4 m).
c Inset, *d*.

Figure 2 — Example of dynamic cornering fatigue test — rotating bending moment

6 Dynamic radial fatigue test

6.1 Equipment

The test machine shall be equipped with a means of imparting a constant radial load as the wheel rotates. There are many means of imparting radial loads: the suggested equipment incorporates a driven rotatable drum which presents a smooth surface wider than the loaded test tyre section width. The recommended minimum external diameter of the drum is 1 700 mm.

The test wheel and tyre fixture shall provide loading normal to the drum external surface and in line radially with the centre of the test wheel and the drum. The axes of the drum and test wheel shall be parallel (see Figure 3). For dual application wheel, it shall be tested as a single application wheel.

The mating surfaces of the test adaptor and wheel shall be free of excessive scoring and deformation, and excessive build-up of paint, dirt, or foreign matter.

6.2 Procedure

Tyres used in this test shall meet the following:

— tyre which have load rating of maximum value in the tyres which are applied to the test wheel;

— tyre which is specified by the wheel or vehicle manufacturer. Select the tyre of maximum load rating if there is more than one tyre which is specified by the vehicle or wheel manufacturer.

Adapter for testing shall be equivalent of the hub the mass production.

Hub bolt and wheel nuts or wheel bolt shall be used as follows:

— equivalent to those used in a vehicle;

— in good condition;

— lubricated or non-lubricated in accordance with the state being applied to a vehicle (as specified by the vehicle manufacturer).

Tighten these wheel nuts or wheel bots at the beginning of the test to the vehicle or wheel manufacturer's specified torque values.

The cold inflation pressure of the test tyre shall be in accordance with the values in Table 1.

Table 1 — Test inflation pressures

Unit kPa

Tyre pressure at usage load	Test pressure
up to 160	280
161 to 280	450
281 to 450	550
a) 100 kPa = 1 bar.	

There will be an increase in pressure during the test. This increase is normal and no adjustment is necessary. The loading system shall maintain the specified load within ±2,5 % of the calculated value.

6.3 Radial load determination

Determine the radial load, F_r, in Newtons, using Formula (2):

$$F_r = F_v \times K \tag{2}$$

where

F_V is the value, in Newtons, of either of the following:

— the largest value of the load rating of the tires which can be applied to the wheel;

— the maximum vertical static load which is specified by the wheel or the vehicle manufacturer;

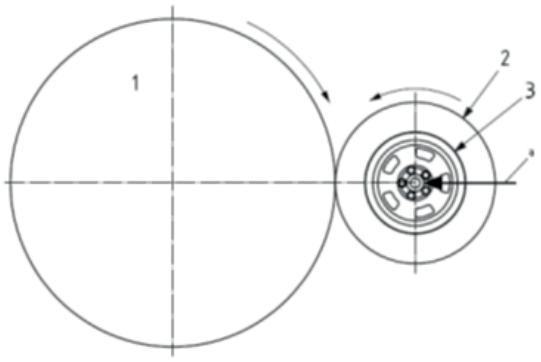
K is the accelerated test factor (Table A.2).

6.4 Test termination

The test shall be terminated in either of the two following circumstances:

— inability of the wheel to sustain the load or tyre pressure;

— propagation of a crack or cracks existing prior to test or new visible stress-caused cracks penetrating through a section of the wheel.



Key

1 driven drum
2 tyre
3 wheel
a Radial load, F_r.

Figure 3 — Example of dynamic radial fatigue test fixture

Annex A
(informative)

Recommended test factors and test cycles

Accelerated test factors and cycle life requirements shall be determined by the vehicle or wheel manufacturer based on vehicle application and expected severity of usage. To permit uniform application of the test methods specified, one or more of the accelerated test factors shown in Table A.1 or A.2 are recommended when conducting tests.

Table A.1 — Test factors for dynamic cornering fatigue test

Material	Accelerated test factor S	Minimum cycles X1000	Coefficient of friction μ
Steel	1,60	18	0,7
	1,50	22	
	1,45	24	
	1,33	30	
Aluminium	2,00	50	
	1,63	80	
	1,50	100	
	1,35	250	

Table A.2 — Test factors for dynamic radial fatigue test

Material	Accelerated test factor[a] K	Minimum test cycles X1000
Steel	2,25	400
	2,20	500
	2,00	700
	1,80	1000
Aluminium	2,8	150
	2,5	300
	2,25	500
	2,00	800

[a] Use load factor to achieve adequate Tyre life to run the test.

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