BS ISO 3894:2015

BSI Standards Publication

Road vehicles — Wheels/rims for commercial vehicles — Test methods

National foreword

This British Standard is the UK implementation of ISO 3894:2015. It supersedes BS ISO 3894:2005 which is withdrawn.

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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INTERNATIONAL STANDARD

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Road vehicles — Wheels/rims for commercial vehicles — Test methods

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

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

This fourth edition cancels and replaces the third edition (ISO 3894:2005), which has been technically revised with the following changes:

— the Annex has been changed to informative;

— 5.2 clarifies the test adapter;

— Figures 2 and 3 are added for the cornering test;

— Figure 1 title is corrected;

— the test factors and cycles agreed to in TC22/SC19/WG3 N151 Resolution 65 are included in the Annex.

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 commercial vehicles.

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 3894:2015(E)

Road vehicles — Wheels/rims for commercial vehicles — Test methods

1 Scope

This International Standard specifies two laboratory methods for testing certain essential strength characteristics of disc wheels intended for road use on commercial vehicles, buses, trailers, and multipurpose passenger vehicles, as defined in ISO 3833.

The test methods are

— dynamic cornering fatigue test and

— 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
test bolt (fasteners)
test bolt is a bolt that is attached to the hub/test fixture before mounting the wheel

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

3.3
load rating
value obtained by converting the force to mass which can be loaded under defined conditions to the tyres which can be applied to the test wheel

3.4
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 the vehicle manufacturer and it derives from the specifications of a vehicle which is intended to use the test wheel.

3.5
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 Wheels — Dynamic cornering fatigue test

5.1 Equipment

The test machine shall have a driven rotatable device whereby 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 mounting systems to those used on the vehicle. The mating surface 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 test bolts and wheel nuts. The test bolt and wheel nuts used shall be

— equivalent to those used in a vehicle,

— in good condition, and

— 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 at the beginning of the test to the vehicle or wheel manufacturer's specified torque values.

Wheel bolts or nuts can be retightened during the test.

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 at a specified distance, I (moment arm), as shown in Figures 1 and 2.

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). If the wheel can be used as both an inset and outset wheel, then the inset value shall be used;

F_{v} is the maximum vertical static load which is specified by the wheel or the vehicle manufacturer;

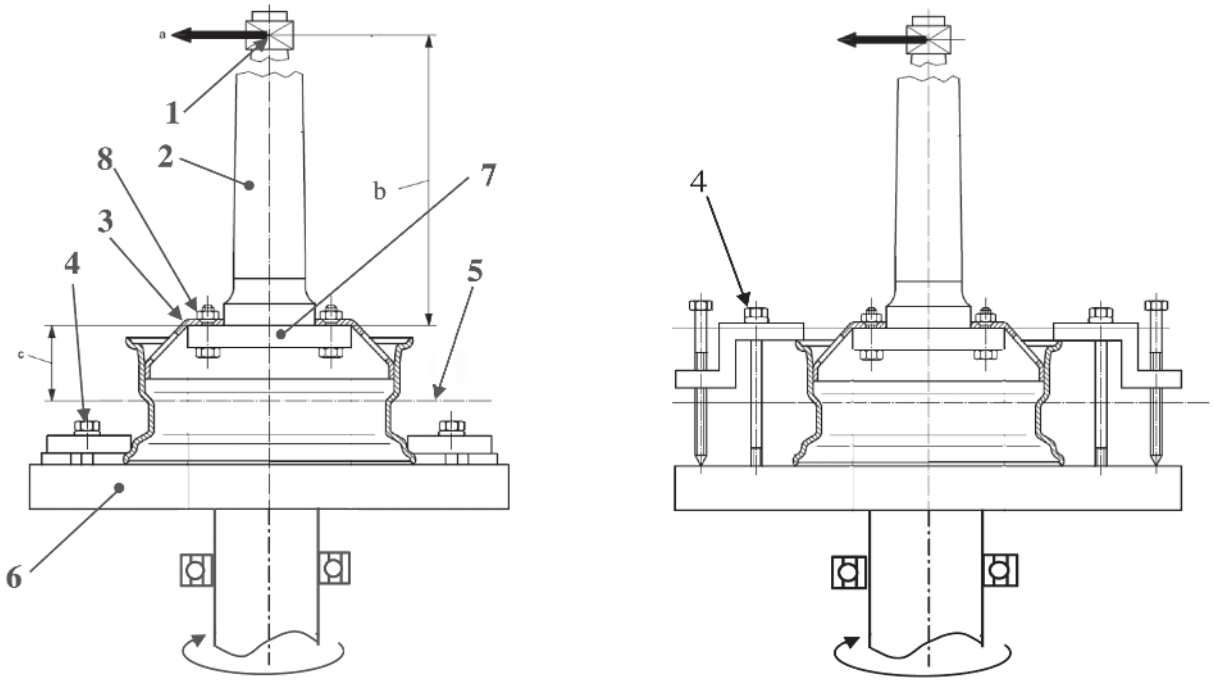
S is the accelerated test factor (see Table A.1).

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.

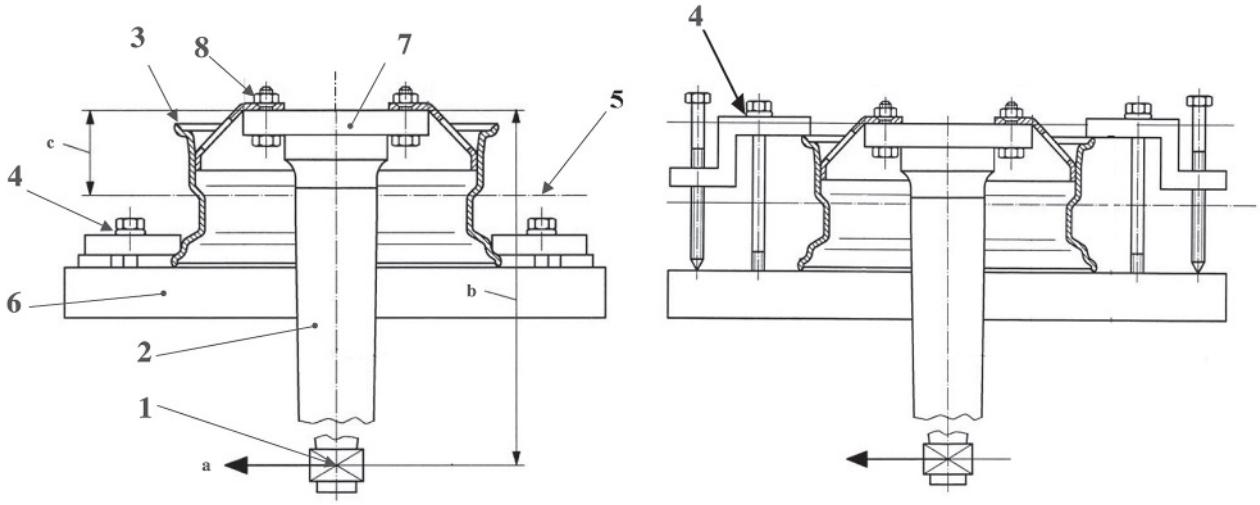


a) Bottom clamping method **b) Top clamping method**

Key

1 pivot point
2 loading arm
3 wheel
4 fastener
5 rim centre plane
6 rotary disc
7 adaptor
8 wheel nuts
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**

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1 pivot point
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6 rotary disc
7 adaptor
8 wheel nuts
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 fixture — rotating bending moment

6 Wheels — 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 set 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 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.

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

The test bolts and wheel nuts used shall be

— equivalent to those used in a vehicle,

— in good condition, and

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

Tighten the wheel nuts to the torque limits specified by the vehicle or wheel manufacturer for stud size and type of nut used.

Check nut torque values and reset them periodically during the course of the test in order to compensate for the wearing-in of mating surfaces of nuts and bolt holes.

The test load and tyre inflation pressures are based on wheel ratings. Test inflation pressures are shown in Table 1.

Table 1 — Tyre test inflation pressures

Unit kPa

Tyre test pressure at usage load	Tyre test pressure
up to 310	450
320 to 450	550
460 to 580	690
590 to 720	900
730 to 830	1 000

a) 100 kPa = 1 bar.

The load system shall maintain the specified load within ±5 % of the calculated value.

6.3 Radial load determination

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

$$F_r = F_v \, x \, K \tag{2}$$

where

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

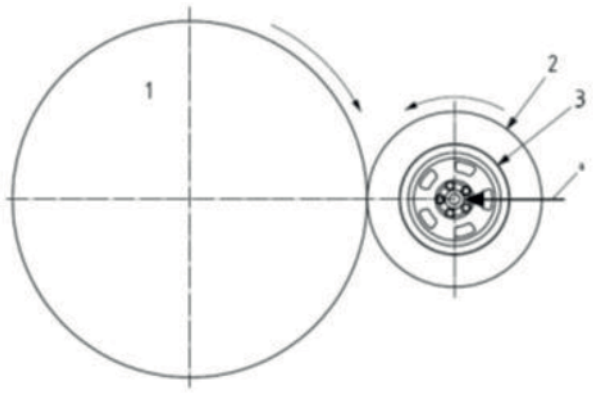
K is the accelerated test load factor (see Table A.2).

6.4 Test termination

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

— inability of 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

To permit uniform application of the test methods specified, the test factors and minimum test cycles shown in Tables A.1 and A.2 are recommended when conducting the tests.

Table A.1 — Test factors for wheels — Dynamic cornering fatigue test

Material	Accelerated test factor S	Minimum test cycles X1000	Coefficient of friction μ
Steel[a]	1,60	18	0,7
	1,50	22	
	1,45	24	
	1,33	30	
	1,30	32	
	1,10	50	
Aluminium[a]	2,00	50	
	1,80	60	
	1,63	80	
	1,50	100	
	1,40	200	
	1,35	250	

[a] Excluding diameter 17,5 size cod and larger with rim width of 266,7 mm and wider (wide base truck/bus wheels).

Table A.2 — Test factors for wheels — Dynamic radial fatigue test

Material	Accelerated test factor[a] K	Minimum test cycles X1000
Steel		
	2,0	500
	1,9	600
	1,8	700
	1,7	850
	1,6	1 000
Aluminium	2,8	100
	2,6	140
	2,0	100

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

Bibliography

[1] ISO 4107, *Commercial vehicles — Wheel-hub attachment dimensions*

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