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

Véhicules routiers — Roues/jantes pour véhicules utilitaires — Méthodes d'essai

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3894 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 19, *Wheels*.

This third edition cancels and replaces the second edition (ISO 3894:1995), which has been technically revised. The 40° rotary fatigue test was deleted since it is used in limited applications.

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 road vehicles. Only laboratory test methods are given. No minimum performance levels are part of this International Standard.

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.

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

1 Scope

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

The test methods are

a) disc wheel dynamic cornering fatigue test;

b) disc wheels and wheels with demountable rims — dynamic radial fatigue test; and

c) wheels with demountable rims — dynamic cornering fatigue test.

2 Normative references

The following referenced documents are indispensable for the application of this document. 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 General

Only fully processed new wheels/rims which are representative of wheels/rims intended for the vehicle shall be used for the tests. No wheel/rim shall be used for more than one test.

4 Disc wheel dynamic cornering fatigue test

4.1 Equipment

The test machine shall have a driven rotatable device whereby either the wheel rotates under the influence of a stationary bending moment or the wheel is stationary and is subjected to a rotating bending moment.

4.2 Procedure

4.2.1 Preparation

Clamp the rim of the wheel securely to the test fixture in accordance with Figure 1a) or 1b). 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.

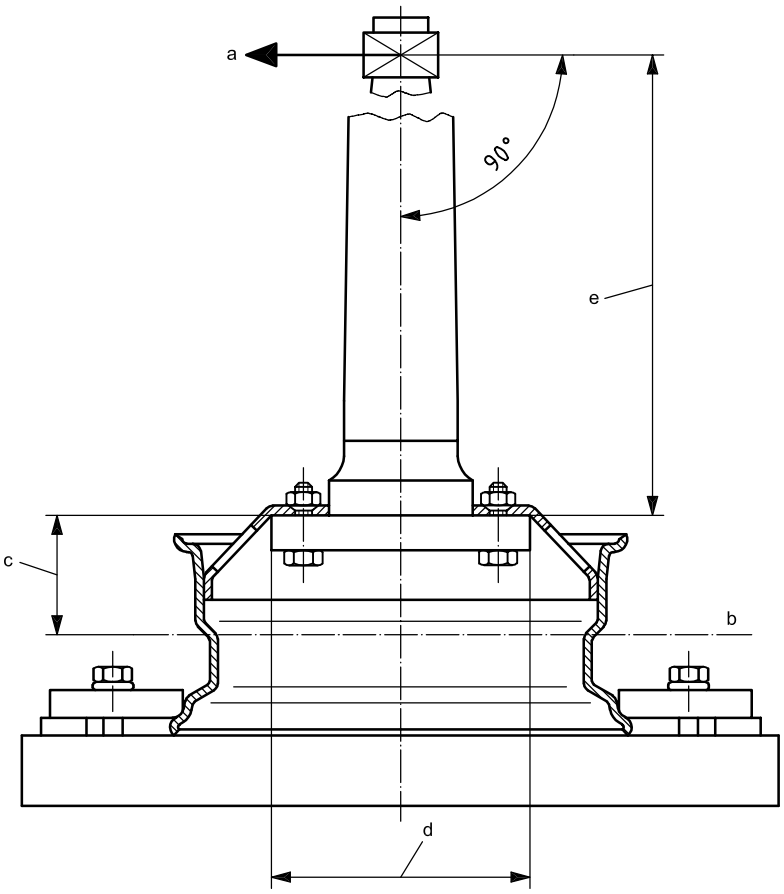
Attach the load arm and adaptor assembly to the mounting surface of the wheel using studs or bolts, and nuts which are in good condition, lubricated or non-lubricated in accordance with the intended vehicle application (as specified by the vehicle manufacturer), and are representative of those used on the vehicle. Assemble and tighten the wheel fixing at the beginning of the test using the procedure specified by the vehicle or wheel manufacturer.

Wheel bolts or nuts may be retorqued during the test.

4.2.2 Bending moment application

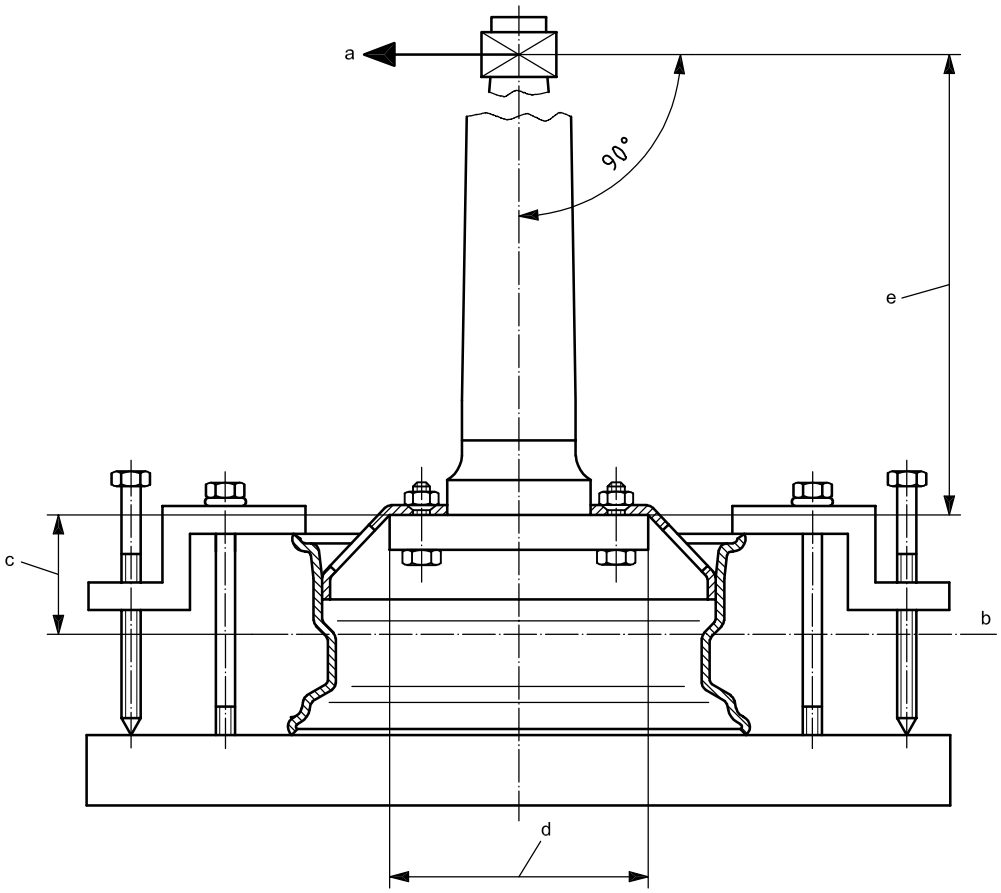
To impart a bending moment to the wheel, apply a force parallel to the plane of the wheel mounting surface at a specified distance with the moment arm as shown in Figures 1a) and 1b).

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



a) 90° loading method example showing bottom clamping

Figure 1 — Dynamic cornering fatigue test



b) 90° loading method example showing top clamping

Key

a Test load.

b Rim centre plane.

c Inset, d.

d Diameter.

e Moment arm, l.

Figure 1 *(continued)*

4.3 Bending moment determination

Determine the bending moment M (force × moment arm), in newton metres, from the formula

$$M = \left(\mu R + d\right) F_{\mathrm{V}} S$$

where

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

R is the static loaded radius, in metres, of the largest tyre to be used on the wheel as specified by the vehicle or wheel manufacturer;

d is the inset or outset (positive for inset; negative for outset), of the wheel, in metres (see ISO 3911). If the wheel may be used as both an inset and outset wheel, then the inset value shall be used;

F_V is the load rating of the wheel, in newtons, as specified by the vehicle or wheel manufacturer;

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

4.4 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.

5 Disc wheels and wheels with demountable rims — dynamic radial fatigue test

5.1 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 (single application) 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.

5.2 Procedure

Tyres selected for this wheel test shall meet the load rating F_V of the wheel or be representative of the maximum load capacity tyre specified by the vehicle or wheel manufacturer, whichever is greater. For disc wheels, the test adaptor shall be representative of production hubs using bolts or studs, and nuts which are in good condition, lubricated or non-lubricated in accordance with the intended vehicle application (as specified by the vehicle manufacturer), and are representative of those used on the vehicle. For demountable rims, the test adaptor shall be representative of production spoke wheels using bolts or studs and nuts and clamps which are in good condition, lubricated or non-lubricated in accordance with the intended vehicle application (as specified by the vehicle manufacturer), and are representative of those used on the vehicle. Torque the wheel nuts to the torque limits specified by the vehicle or wheel manufacturer for the 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 inflation pressures are based on wheel/rim ratings. Test inflation pressures shown in Table 1 are for information only.

Table 1 — Test inflation pressures

Tyre test pressure at usage load kPa[a]	Tyre test pressure kPa[a]
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 selected cold test inflation pressure shall be maintained within ± 5 %. The load system shall maintain the specified load within ± 5 % of the calculated value.

5.3 Radial load determination

Determine the radial load F_r in newtons, from the formula

$$F_r = F_v K$$

where

F_v is the load rating of the wheel/rim, in newtons, as specified by the vehicle or wheel/rim manufacturer;

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

5.4 Test termination

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

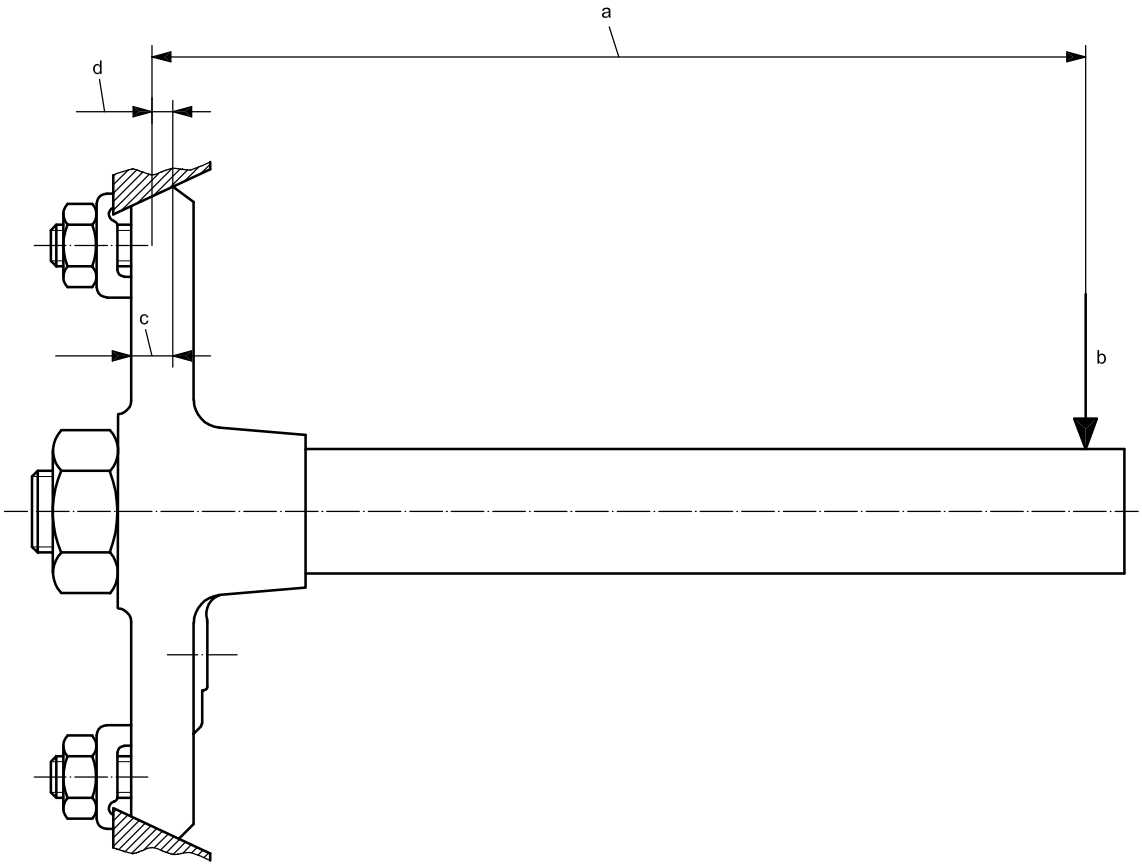
— inability of wheel/rim to sustain the load or tyre pressure;

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

6 Wheels with demountable rims — dynamic cornering fatigue test

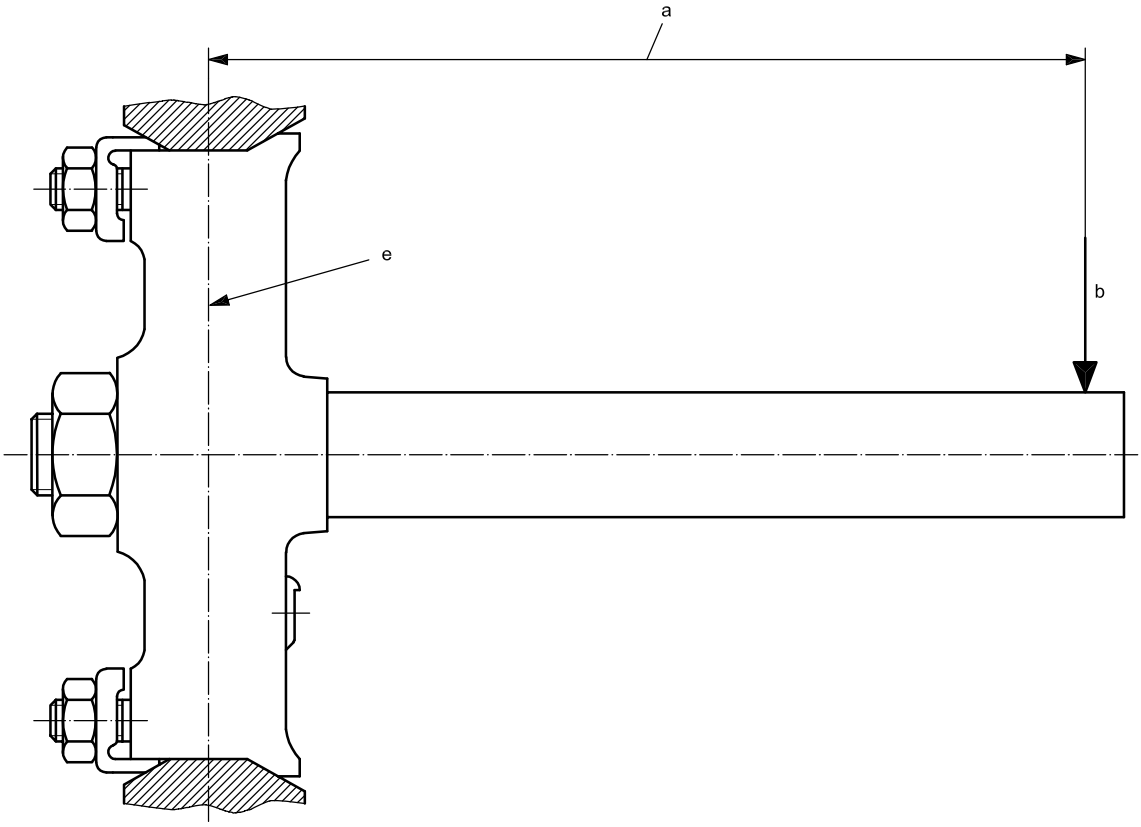
6.1 Equipment

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



a) Front wheel

Figure 2 — Wheels with demountable rims — dynamic cornering fatigue test



b) Rear wheel

Key

a Moment arm.

b Test load.

c Bevel width, b.

d $b/2$.

e Centre plane of spacer used for specified assembly.

Figure 2 *(continued)*

6.2 Procedure

6.2.1 Preparation

Clamp the wheel securely to the test fixture. To ensure this, assemble and tighten the wheel fixing at the beginning of the test using the procedures specified by the vehicle or wheel manufacturer. Attach a rigid load-arm shaft with a test hub adaptor to the hub of the wheel. The mating surfaces of the test adaptor and wheel shall be free of excessive build-up of paint, dirt or foreign material. Use studs, nuts and clamps which are in good condition, lubricated or non-lubricated in accordance with the intended vehicle application (as specified by the vehicle manufacturer), and are representative of those used on the vehicle or specified for the rim.

If the wheel application is always used with a brake drum, the wheel may be tested with a brake drum attached. If the wheel application is ever to be used without a brake drum, the wheel shall be tested without a brake drum attached.

6.2.2 Bending moment application

To impart a bending moment to the wheel, apply a force, parallel to the plane of the mounting surface of the wheel at a specified distance with the moment arm.

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

6.3 Bending moment determination

Determine the bending moment M (force × moment arm), in newton metres, from the formula

$$M = \mu R F_{\mathrm{V}} S$$

where

μ is the assumed coefficient of friction developed between tyre and road (see Table A.3);

R is the static loaded radius, in metres, of the largest tyre to be used on the wheel as specified by the vehicle or wheel manufacturer;

F_{V} is the load rating of the wheel, in newtons, as specified by the vehicle or wheel manufacturer;

S is the accelerated test factor (see Table A.3).

6.4 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.

Annex A
(normative)

Test factors

To permit uniform application of the test methods specified, the test factors shown in Tables A.1 to A.3 shall be used when conducting the tests.

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

Material	Designated rim diameter size code	Inset or outset mm	Accelerated test factor S	Coefficient of friction μ
Ferrous or aluminum	13, 14, 15	Less than 100 inset and all outset	1,75 1,6 1,5 1,35 1,33 1,26	0,7
Ferrous or aluminum	16 and larger [a]	Less than 100 inset and all outset	1,6 1,5 1,45 1,35 1,33 1,1	
Ferrous or aluminium	any diameter [a]	100 or more inset	1,6 1,5 1,35 1,33 1,1	

[a] Excluding diameter 17.5 size code and larger with rim width of 266,7 mm and wider (wide-base truck/bus wheels).

Table A.2 — Test factors for dynamic radial fatigue test: disc wheels or wheels with demountable rims

Material	Designated rim diameter size code	Accelerated test factor [a] K
Ferrous or aluminium	17.5 and less	2,8 2,5 2,25 2,2 2 1,8 1,43 1,4
Ferrous or aluminium	Greater than 17.5	2,8 2,2 2 1,9 1,8 1,7 1,6 1,43 1,4

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

Table A.3 — Test load factors for wheels with demountable rims: dynamic cornering fatigue test

Material	Accelerated test factor S	Coefficient of friction μ
Ferrous	1,9 1,5	0,7

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