
Motorcycle tyres — Test methods for verifying tyre capabilities

*Pneumatiques pour motocycles — Méthodes d'essai pour la
vérification de l'aptitude des pneumatiques*

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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Test equipment	2
5 Testing	3
5.1 Strength test	3
5.1.1 General	3
5.1.2 Preparation of tyre	3
5.1.3 Test procedure	3
5.2 Endurance test	4
5.2.1 Preparation of tyre	4
5.2.2 Test procedure	4
5.3 High-speed test	5
5.3.1 General	5
5.3.2 Preparation of tyre	5
5.3.3 Test method	5
5.4 Centrifugal growth test	6
5.4.1 General	6
5.4.2 Preparation of tyre	6
5.4.3 Test procedure	6
6 Requirements	7
6.1 Test sample	7
6.2 Strength test	7
6.3 Endurance test	8
6.4 High-speed test	8
6.5 Centrifugal growth test	8
Annex A (normative) Enveloping curve for contour of tyre for centrifugal growth test	9
Annex B (informative) Tyres suitable for speeds over 240 km/h	10
Bibliography	11

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 10, *Cycle, moped, motorcycle tyres and rims*.

This fourth edition cancels and replaces the third edition (ISO 10231:2003), which has been technically revised. It also incorporates the Amendment ISO 10231:2003/Amd 1:2015.

The main changes are as follows:

- definitions have been clarified.
- strength and high-speed tests have been revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Motorcycle tyres — Test methods for verifying tyre capabilities

1 Scope

This document specifies test methods for verifying the capabilities of tyres for motorcycles. Of the test methods presented, only some can be required depending on the type of tyre to be tested.

The tests are carried out in the laboratory under controlled conditions. This document includes a strength test for assessing the capability of the tyre structure, with respect to breaking energy. A second test, the endurance test, assesses the resistance of the tyre with respect to service at full load and moderate speed over long distances. The third test, the high-speed test, assesses the capability of the tyre as related to service at the maximum speed capability of the tyre. The centrifugal growth test assesses the maximum growth of the tyre under the influence of centrifugal forces at the maximum speed capability of the tyre.

The test methods presented in this document are not intended for gradation of tyre performance or quality levels.

This document is applicable to all motorcycle tyres.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4223-1, *Definitions of some terms used in the tyre industry — Part 1: Pneumatic tyres*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4223-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 bead separation

breakdown of bond between components in the bead area

3.2 belt separation

parting of rubber compound between belt layers or between belts and plies

3.3 chunking

breaking away of pieces of the tread

3.4 cord separation

cord parting from adjacent rubber compounds

3.5

cracking

parting within the tread, sidewall or inner liner of the tyre extending to cord material

3.6

inner liner separation

parting of inner liner from cord material in the carcass

3.7

open splice

parting at any junction of tread, sidewall or inner liner that extends to cord material

3.8

ply separation

parting of rubber compound between adjacent plies

3.9

separation

parting of the rubber compound from the cord material in the sidewall

3.10

tread separation

pulling away of the tread from the tyre carcass

3.11

test rim

rim on which the tyre may be fitted that conforms to the dimensions of the recommended rims for the particular tyre designation and type

3.12

test drum speed

peripheral speed of the steel test drum

3.13

maximum load rating

load carrying capacity corresponds to load index on the tyre

4 Test equipment

The test equipment consists of items [4.1](#) to [4.5](#).

For the tyre centrifugal growth test (see [5.4](#)), the measurement equipment accuracy shall be within ± 1 % of full scale.

4.1 Test drum, cylindrical driven flywheel (drum) having a diameter of $1,7 \text{ m} \pm 0,017 \text{ m}$ or $2,0 \text{ m} \pm 0,02 \text{ m}$.

The surface of the drum shall be of smooth steel. The width of the test surface shall exceed the overall width of the test tyre.

For the test drum, the loading device may be a dead-weight cantilevered system with a hydraulic system or with any other equivalent system. The loading capacity shall be adequate for the requirements of the procedure and the accuracy shall be within $\pm 1,5$ % of the full scale.

For the test drum, the speed capability of the equipment shall be adequate for the requirements of the test methods. The accuracy of the test drum speed shall be within ± 3 % of the full scale.

4.2 Plunger, cylindrical steel plunger of sufficient length with a hemispherical end and a diameter of $8 \text{ mm} \pm 0,6 \text{ mm}$.

For the plunger equipment, the loading device shall be of hydraulic type or an equivalent system with a maximum load capacity adequate for the requirements of the test methods. Indicators of displacement and of force shall be provided with an accuracy within $\pm 1 \%$ of full scale.

For the plunger equipment, the speed of the displacement shall be controlled with an accuracy within $\pm 3 \%$ of the full scale.

4.3 Inflation pressure gauges, with a maximum scale value of at least 500 kPa and an accuracy within $\pm 5 \text{ kPa}$.

4.4 Test axle, for the tyre centrifugal growth test, the test axle and the rim shall be controlled in order to ensure a radial run-out of less than $\pm 0,5 \text{ mm}$ and a lateral run-out of less than $\pm 0,5 \text{ mm}$ when measured respectively at the bead seat and the vertical part of the inner flange of the rim immediately above the bead seat radius.

4.5 Contour outline device, such as a projecting grid or camera, which permits the distinct outlining of the external contour of the tyre cross-section normal to the tyre equator, at the point of the maximum deformation of the tread.

The device shall reduce to a minimum any distortion and ensure a constant (known) ratio between the plotted contour and the actual dimensions.

The device shall permit the reference of the tyre contour to the wheel axis.

5 Testing

5.1 Strength test

5.1.1 General

This test does not apply to radial-ply tyres.

5.1.2 Preparation of tyre

5.1.2.1 Mount the tyre on a test rim and inflate it to the pressure specified in relation to the maximum load rating.

5.1.2.2 Maintain the assembly at test room temperature for at least 3 h.

5.1.3 Test procedure

5.1.3.1 Readjust the tyre pressure to that specified in [5.1.2.1](#) before or after the mounting of the assembly on a fixture.

5.1.3.2 Position the plunger as near to the centreline as possible, avoiding penetration into the tread grooves, and force the plunger perpendicularly into the tread at a rate of $50 \text{ mm/min} \pm 2,5 \text{ mm/min}$.

5.1.3.3 Record the force and penetration at the moment of breaking (see also [5.1.3.7](#)) at each of five test points approximately equally spaced around the circumference of the tyre. In the case of tyres mounted on rim diameter codes 10 and smaller, test the tyre at three points.

5.1.3.4 If the tyre fails to break before the plunger is stopped on reaching the rim, then the tyre is deemed to have passed the test at that point.

5.1.3.5 Compute the breaking energy, E , in joules for each test point, except those considered by 5.1.2.4, by means of the following [Formula \(1\)](#):

$$E = \frac{F \times P}{2\,000} \quad (1)$$

where

F is the force, in newtons;

P is the penetration, in millimetres.

5.1.3.6 Determine the breaking energy value for the tyre by computing the average of the values obtained.

5.1.3.7 When an appropriate device which automatically evaluates the value of the energy, E , is available, the penetration may be stopped shortly after having achieved the prescribed value.

5.1.3.8 In the case of tubeless tyres, means may be provided to ensure the retention of the inflation pressure for the duration of the test.

5.2 Endurance test

5.2.1 Preparation of tyre

5.2.1.1 Mount the tyre on a test rim and inflate to the pressure corresponding to the maximum load rating.

5.2.1.2 Maintain the assembly at a temperature not less than 35 °C for at least 3 h.

5.2.2 Test procedure

5.2.2.1 Readjust the tyre pressure to the value specified in [5.2.1.1](#) immediately before testing.

5.2.2.2 Mount the tyre and rim assembly on a test axle and press it against the outer face of a test drum.

5.2.2.3 During the test, the ambient temperature at a distance of not less than 150 mm and not more than 1 m from the tyre shall be at least 35 °C. No provision shall be made for cooling the tyre during the test.

5.2.2.4 Conduct the test without interruptions at a speed of not less than 80 km/h and with loads and test periods in accordance with [Table 1](#).

Table 1 — Test parameters for endurance

Test period	Minimum duration h	Minimum load as a percentage of tyre maximum load rating %
1	4	100
2	6	108
3	24	117

5.2.2.5 Throughout the test, the inflation pressure shall not be corrected and the test loads shall be kept constant.

5.3 High-speed test

5.3.1 General

This test does not apply to tyres with a speed capability below 130 km/h.

5.3.2 Preparation of tyre

5.3.2.1 Mount the tyre on a test rim, and inflate it to a pressure related to its speed symbol and version in accordance with [Table 2](#).

The tyre manufacturer may request, giving reasons, the use of a different test inflation pressure. In such a case, the tyre shall be inflated to that pressure.

Table 2 — Inflation pressures for high speed

Tyre version	Speed symbol	Inflation pressure kPa
Standard load	M to P inclusive	250
	Q, R, S	300
	T, U, H, V	350
	W	320
Reinforced/extra load	M to P inclusive	330
	Q to H inclusive	390

5.3.2.2 Maintain the tyre and rim assembly at test room temperature for not less than 3 h.

5.3.3 Test method

5.3.3.1 Before or after mounting the tyre and rim assembly on a test axle, readjust the tyre pressure to that specified in [5.3.2](#).

5.3.3.2 Press the tyre and rim assembly against the outer face of the test drum.

5.3.3.3 Apply a load equal to 65 % of the maximum load rating of the tyre to the test axle.

NOTE For speed symbol V tyres, the maximum load rating is 85 % of the rated load (load index). For speed symbol W tyres, the maximum load rating is 75 % of the rated load (load index) (see ISO 5751-1). See [Annex B](#) for related high-speed tests.

In the case of tyres designed for heavyweight touring motorcycles, i.e. tyres with a rim diameter code 15 and above and a load capacity Index 65 and above in reinforced/extra-load version, the applied load shall be 75 % of the maximum tyre load rating.

5.3.3.4 Throughout the test, the tyre pressure shall not be corrected and the test load shall be kept constant.

5.3.3.5 During the test, the temperature in the test room shall be maintained at between 20 °C and 30 °C, or at a higher temperature if the tyre manufacturer agrees.

5.3.3.6 Carry the test through without interruptions, as follows, in relation to the tyre speed symbol and the test drum diameter.

- a) The initial test speed is equal to the tyre's speed category:
 - less 40 km/h on a 1,7 m drum;
 - less 30 km/h on a 2,0 m drum.
- b) Accelerate the equipment at a constant rate such that the initial test speed is reached at the end of 20 min from start-up.
- c) Operate the equipment with the test drum speed at the initial test speed for 10 min;
 - then, at the initial test speed plus 10 km/h for 10 min;
 - then, at the initial test speed plus 20 km/h for 10 min;
 - finally, at the initial speed plus 30 km/h for a further 10 min.

5.4 Centrifugal growth test

5.4.1 General

This test is applicable only to road tyres with speed symbols P and above.

5.4.2 Preparation of tyre

5.4.2.1 Mount the tyre on a test rim and inflate it to the pressure related to its speed symbol, in accordance with [Table 3](#).

Table 3 — Inflation pressures for centrifugal growth

Speed symbol	Inflation pressure kPa
P	225
Q to S inclusive	250
T to H inclusive	280
over 210 km/h	290

5.4.2.2 Maintain the tyre and rim assembly at test room temperature for not less than 3 h.

5.4.3 Test procedure

5.4.3.1 Readjust the tyre pressure to the value specified in [5.4.2.1](#).

5.4.3.2 Mount the tyre and rim assembly on the test axle and ensure that the assembly rotates freely.

5.4.3.3 Position the contour outline device and ascertain that it is perpendicular to the rotation of the test tyre tread.

5.4.3.4 Accelerate the assembly without interruption to reach the maximum speed capability of the tyre within 5 min.

The tyre may be rotated either by means of a drive motor acting on the tyre axis or by pressing it against a test drum (4.1).

5.4.3.5 Check that the tyre speed is within ± 2 % of the maximum speed capability of the tyre.

Maintain the equipment at constant speed for at least 5 min and then check the tyre contour.

5.4.3.6 During the test, the temperature in the test room shall be maintained at between 20 °C and 30 °C, or at a higher temperature if the tyre manufacturer agrees.

6 Requirements

6.1 Test sample

Tyres with identical characteristics, e.g. size designation and service description or maximum load rating and speed capability, shall comprise a test sample.

- a) the strength test;
- b) the endurance test;
- c) either the high-speed performance test or the centrifugal growth test, or both.

Each test a), b) and c) shall use new test tyres. However, the two types of tests for c) may use the same tyre.

The pressures, loads and speeds shall be as specified for each test method.

Each test sample shall conform to the requirements specified in 6.2 to 6.5, as appropriate.

6.2 Strength test

6.2.1 General

This test does not apply to radial-tyres.

6.2.2 Each test sample shall meet at least the requirements for minimum breaking energy specified in Table 4, when tested in accordance with 5.1.

Table 4 — Minimum breaking energy

Tyre version	Minimum breaking energy
	J
Light	17
Standard	34
Reinforced/extra load	45

6.2.3 For tyres with a design section width of less than 62 mm, the required energy value shall be reduced by 15 %.

6.3 Endurance test

6.3.1 After completion of the laboratory endurance test specified in [5.2](#) using a test rim and a valve which undergo no permanent deformation and allow no loss of air, there shall be no visual evidence of tread, ply, cord, inner liner, belt or bead separation, chunking, open splices, cracking or broken cords.

6.3.2 If the final pressure measured immediately after the test is less than the initial pressure, repeat the test with another sample.

6.4 High-speed test

6.4.1 After completion of the laboratory high-speed test specified in [5.3](#) using a test rim and a valve which undergo no permanent deformation and allow no loss of air, there shall be no visual evidence of tread, ply, cord, inner liner, belt or bead separation, chunking, open splices, cracking or broken cords.

6.4.2 If the final pressure measured immediately after the test is less than the initial pressure, repeat the test with another sample.

6.5 Centrifugal growth test

6.5.1 The tyre to be tested shall have passed the high-speed test (see [6.4](#)) or, alternatively, it shall be a new tyre adequately broken-in.

6.5.2 The contour of the tyre found at the maximum speed shall not exceed the enveloping curve defined in [Figure A.1](#) with reference to the tyre axis (i.e. the lines XX and YY of the curve shall coincide with those of the plotted tyre contour).