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**Passenger car tyres — Verifying tyre capabilities — Laboratory test methods**

*Pneumatiques pour voitures particulières — Vérification de l'aptitude des pneumatiques — Méthodes d'essai en laboratoire*

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## 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.

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 10191 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 3, *Passenger car tyres and rims*.

This third edition cancels and replaces the second edition (ISO 10191:1995 and also ISO 10191:1995/Amd.1:1998), of which it constitutes a minor revision.

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# Passenger car tyres — Verifying tyre capabilities — Laboratory test methods

## 1 Scope

This International Standard specifies test methods for verifying the capabilities of tyres for passenger cars. Of the test methods presented, it is possible that only some will be required depending on the type of tyre to be tested. The tests are carried out in a laboratory under controlled conditions.

This International Standard includes a strength test for assessing the capability of the tyre structure, with respect to braking energy, in the tread area.

A second test, the bead unseating test, assesses the resistance of the tyre to bead unseating. It applies to tubeless tyres only.

A third test, the endurance test, assesses the resistance of the tyre with respect to service at full load and moderate speed over long distances.

The fourth test, the high speed test, assesses the capability of the tyre according to its speed category.

The test methods presented in this International Standard are not intended for gradation of tyre performance or quality levels. This International Standard applies to all passenger car tyres.

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## 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 4223-1:2002, *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.

### 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**

any parting within the tread, or innerliner of the tyre extending to cord material

3.6

**innerliner separation**

parting of innerliner from cord material in the carcass

3.7

**open splice**

any parting at any junction of tread, or innerliner that extends to cord material

3.8

**ply separation**

separation 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**

any rim on which the tyre may be fitted which 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**

maximum load that the tyre is rated to carry according to its speed category

## 4 Test equipment

4.1 **Test drum**, cylindrical driven flywheel (drum) having a diameter of 1,7 m  $^{+2}_0$  % or 2 m  $^{+2}_0$  %.

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

For the test drum, the loading device shall have a capacity of at least 1 000 kg and the accuracy shall be within  $\pm 1$  % of the full scale. 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  $^{+2}_0$  km/h.

4.2 **Plunger**, in cylindrical steel and of sufficient length with a hemispherical end and a diameter of  $(19 \pm 1,6)$  mm.

For the plunger equipment, the loading device shall permit gradual application of the force. Indicators of displacement and force provided shall be accurate to within  $\pm 1\%$  of full scale. The displacement speed shall be controlled with an accuracy within  $\pm 3\%$  of the full scale.

**4.3 Bead unseating block**, of one of the two types shown in Figure 1.

The bead unseating block loading device shall permit progressive application of the force. Indicators of displacement and force provided shall be accurate to within  $\pm 1\%$  of full scale.

The displacement speed of the head unseating block shall be controlled with an accuracy within  $\pm 3\%$  of the full scale.

**4.4 Inflation pressure gauges**, with a maximum scale value of at least 500 kPa and an accuracy within  $\pm 5$  kPa.

## 5 Testing

### 5.1 Strength test

#### 5.1.1 Preparation of tyre

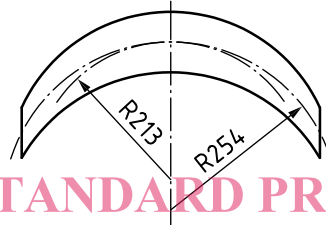
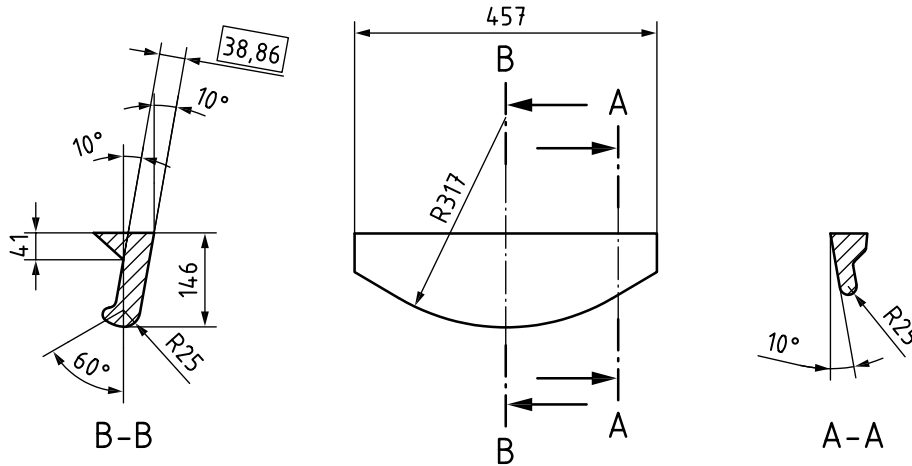
5.1.1.1 Mount the tyre on a test rim and inflate it to the pressure specified in Table 1.

5.1.1.2 Maintain the assembly at test room for at least 3 h.

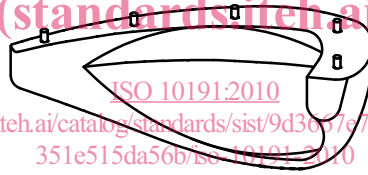
**Table 1 — Inflation pressures for resistance test**

Tyre type	Pressure kPa
Standard	180
Reinforced/extra load	220
T type (temporary use)	360
NOTE In case of other tyre types, the tyre manufacturer shall send a request to ISO for insertion in this table of a different test pressure, with reasons.	

Dimensions in millimetres  
 Material: Al-Si2 Mg Ti or Al-Si7 Mg0,3 (see reference [2])  
 Condition: TF (see reference [1])  
 Surface roughness: Ra 1,25 µm

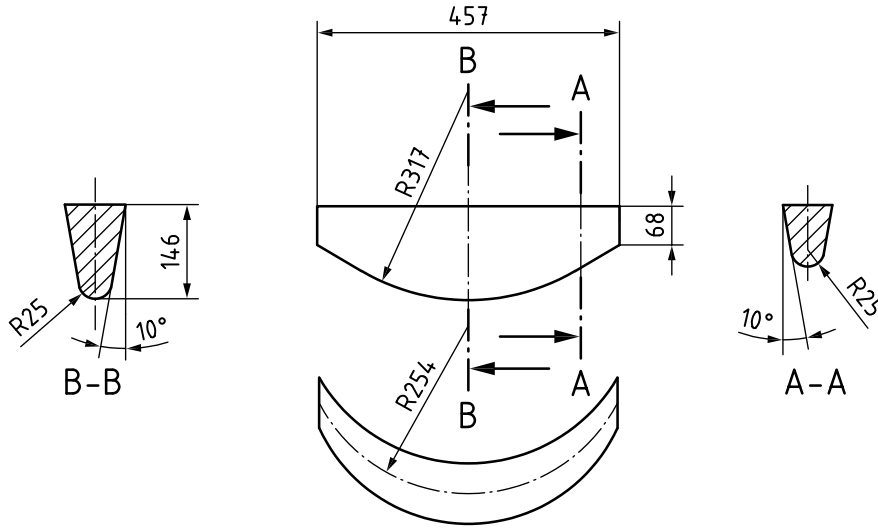


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a) Type A



b) Type B

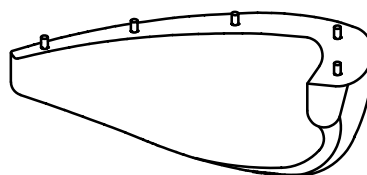


Figure 1 — Diagrams of bead unseating blocks



## 5.1.2 Test procedure

5.1.2.1 Readjust the tyre pressure to that specified in 5.1.1.1 and mount the assembly on a fixture.

5.1.2.2 Position the plunger as near to the line as possible, avoiding penetration into the tread grooves, and force the plunger perpendicularly into the tread at a rate of  $(50 \pm 2,5)$  mm/min.

5.1.2.3 Record the force and penetration at the moment of breaking (see also 5.1.2.7) at each of five test points approximately equally spaced around the tyre circumference. Check the pressure before moving to the next test point.

5.1.2.4 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.

5.1.2.5 Compute the breaking energy,  $W$ , in joules for each test point, except those considered by means of the following formula:

$$W = \frac{F \times P}{2\,000}$$

where

$F$  is the force, in newtons;

$P$  is the penetration, in millimetres.

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

5.1.2.7 When an appropriate device is available, which automatically evaluates the value of the energy  $W$ , the penetration can be stopped shortly after having achieved the prescribed value.

5.1.2.8 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 Bead unseating test

### 5.2.1 General

This test applies to tubeless tyres only.

### 5.2.2 Preparation of tyre

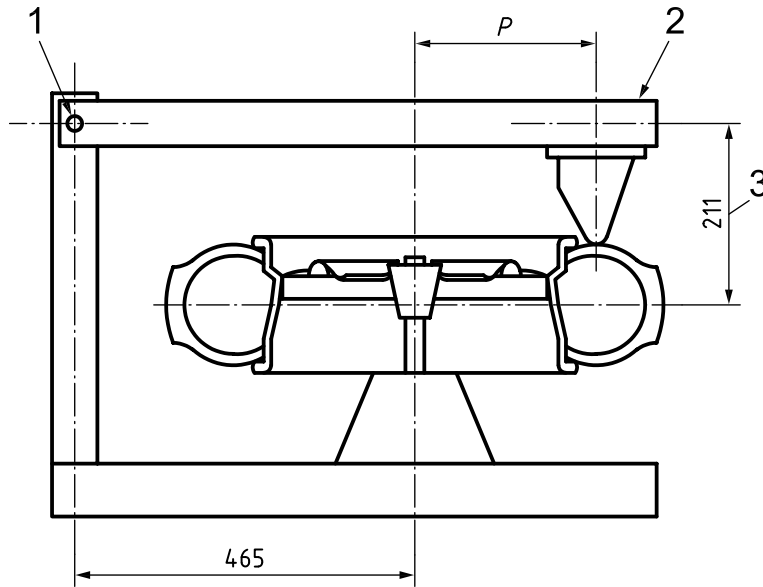
5.2.2.1 Wash the tyre, dry it at the beads, and mount it without lubrication or adhesive on a clean, painted test rim. The rim contour shall be one of those specified for the fitment of the test tyre.

5.2.2.2 Mount the tyre on a test rim and inflate it to the pressure specified in Table 1.

### 5.2.3 Test procedure

5.2.3.1 Mount the tyre and rim assembly on a fixture as shown in Figure 2.

Dimensions in millimetres



**Key**

- 1 pivot on centreline of beam
- 2 horizontal beam
- 3 to bottom of anvil

**Figure 2 — Bead unseating fixture**  
(standards.iteh.ai)

**5.2.3.2** Position the bead unseating block (4.3) against the tyre at a horizontal distance, *P*, as shown in Table 2.

**5.2.3.3** Apply a force through the block to the tyre outer at a rate of  $(50 \pm 2,5)$  mm/min.

**5.2.3.4** Increase the force until the bead block seats or until the prescribed value is reached.

**5.2.3.5** Repeat the test at least four times at places approximately equally spaced around the tyre circumference.

**Table 2 — Distance *P* from bead unseating block (see Figure 2)**

Dimensions in millimetres

Nominal rim diameter code	Dimension <i>P</i>	
	T type temporary use spare tyres	All other tyres
10		216
12		241
13		254
14		267
15		279
16		292
17		305
18		318
19		330
290		229
315		241
340		254
365		267
390		279
415		292

### 5.3 Endurance test

#### 5.3.1 Preparation of tyre

5.3.1.1 Mount the tyre on a test rim and inflate it to the pressure specified in Table 1.

5.3.1.2 Maintain the tyre and rim assembly at an ambient temperature of not less than 35 °C for at least 3 h.

#### 5.3.2 Test procedure

5.3.2.1 Readjust the tyre pressure to the value specified in Table 1 immediately before testing.

5.3.2.2 Mount the tyre and rim assembly on a test axle so that the tyre may be pressed radially against the outer face of test drum.

5.3.2.3 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.

5.3.2.4 Conduct the test, without interruptions, at not less than 80 km/h test speed with loads and test periods not less than those shown in Table 3.

5.3.2.5 Throughout the test, the inflation pressure shall not be corrected and the test loads shall be kept constant at the value corresponding to each test period.

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**Table 3 — Test parameters for endurance**  
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Test period	Duration ISO 10191:2010 min.	Load as a percentage of tyre maximum load rating min.
1	4 h	85 %
2	6 h	90 %
3	24 h	100 %

### 5.4 High speed test

#### 5.4.1 General

For those tyres not marked with a service description, note should be taken of the additional test conditions given in Annex A.

#### 5.4.2 Preparation of tyre

5.4.2.1 Mount the tyre on a test rim, inflate it to a pressure related to its speed symbol, tyre version and load type, as shown in Table 4.

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.

5.4.2.2 Maintain the tyre and rim assembly at test room temperature for at least 3 h.