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Tubeless tyres — Valves and components —

Part 1: Test methods

Pneumatiques sans chambre — Valves et composants —

Partie 1: Méthodes d'essai

Reference number
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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.

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).

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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 31, *Tyres, rims and valves*, Subcommittee SC 9, *Valves for tube and tubeless tyres*.

This first edition of ISO 14960-1, together with ISO 14960-2, cancels and replaces ISO 14960:2004, which has been technically revised.

ISO 14960 consists of the following parts, under the general title *Tubeless tyres — Valves and components*:

— *Part 1: Test methods*

— *Part 2: Clamp-in tubeless tyre valve-test method*

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Tubeless tyres — Valves and components —

Part 1: Test methods

1 Scope

This part of ISO 14960 specifies test methods for snap-in tubeless tyre valves intended for, but are not limited to, highway applications.

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 3877-2, *Tyres, valves and tubes — List of equivalent terms — Part 2: Tyre valves*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3877-2 and the following apply.

3.1
snap-in valve
tyre valve having a rigid housing adhered to a resilient body designed to retain and seal the valve in the rim hole

4 Methods for testing tubeless tyres snap-in valves

4.1 Description of a snap-in valve

A snap-in valve is a unit free of rubber in the air passage, no rubber or cement above the second thread on the housing, and without flow cracks, blisters, voids, or other moulding defects. The mould parting line flash should not exceed 1,3 mm in height and 0,15 mm thickness at the outer edge.

4.2 Test fixtures

Break both edges on both sides of the valve hole either by a 45° chamfer or a radius from 0,3 mm to 0,4 mm. Emery cloth or suitable tooling is recommended. It is recommended that material of the test fixture be representative of the material of the actual rim.

The primary external seal of a “snap-in” valve in a valve hole is obtained from the rubber compression of the valve body onto the internal surface of the valve hole. Secondary external sealing may be present by the contact of the remainder of the valve body exterior to the surface of the material around the valve hole. Either of both of these seals can be affected by the compound curvatures in the wheel rims and by stock thickness. See Table 1.

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Table 1 — Test Fixtures

Dimensions in millimetres

Nominal hole	Diameter 11,3 mm		Diameter 15,7 mm	
Test	Test hole	Plate thickness	Test hole	Plate thickness
Valve to rim seal test low and high temperature test (see 5.4.1 and 5.4.2)	$11{,}7^{+0}_{-0{,}05}$	1,8 ± 0,05	$16{,}1^{+0}_{-0{,}05}$	1,8 ± 0,05
Installation tests (see 5.5.1 and 5.5.2)	$11{,}3^{+0{,}05}_{-0}$	3,5 ± 0,05	$15{,}7^{+0{,}05}_{-0}$	3,5 ± 0,05
Ozone resistance (see 5.7)	$11{,}3^{+0{,}05}_{-0}$	3,5 ± 0,05	$15{,}7^{+0{,}05}_{-0}$	3,5 ± 0,05
Burst or unseating (see 5.6) flexing resistance (see 5.8)	$11{,}7^{+0}_{-0{,}05}$	1,8 ± 0,05	$16{,}1^{+0}_{-0{,}05}$	1,8 ± 0,05

4.3 Installation

All valves, while wet with clean water as a lubricant, shall be installed in a proper test fixture by applying valve insertion force to the end of the valve metal insert or by applying valve traction force to the mouth of the valve perpendicular to the plane of the valve mounting hole and directly through the centre of the valve mounting hole. However, no valve assembly, which has damage resulting from installation, shall be tested.

A valve shall be considered properly seated when all of the indicator ring is observed to be through the rim or valve mounting hole fixture.

After installation, valve assemblies shall be thoroughly dried in the sealing area before continuing tests.

4.4 Limit case for valves

4.4.1 Unused valves are those that have completed final manufacturing processing at least 24 h previously, have not been subjected to any test or service**,** and have been stored for no longer than 4 months in the dark at ambient temperature, in an optimal and non**-**aggressive environment. Rubber compounds can change characteristics during their life expectancy**.**

4.4.2 For the purpose of this testing method, aged valves are those unused valves that have been subjected to 100 °C ± 3 °C for 4 h in circulating hot air and cooled at 20 °C to 26 °C for a minimum of 4 h**.**

5 Test methods and performances requirements

5.1 Adhesion

5.1.1 Test methods

— Make two axial, parallel cuts 180° apart through the full thickness of the rubber cover down the entire length of the valve.

— Pull each side of the button base away from the insert towards the cap thread end at 150 mm ± 15 mm per min with a traction machine.

The test shall be conducted at 23 °C ± 5 °C.

An alternative to the traction machine is to use pliers.

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5.1.2 Performances

Any separation between brass and rubber, brass and cement, or cement and rubber in excess of 41 mm^2, on each valve, shall be considered as a failure.

Any separation that made a strip along the complete valve axis direction shall be considered as a failure.

5.2 Valve core seal

Valve cores installed in snap-in valve assemblies (see Figure 1) have the following characteristics:

— pin height tolerance: $^{+0,25}_{-0,90}$ (reference to valve mouth);

— standard torque:

  — 0,40 N m to 0,50 N m with metallic sealing;

  — 0,23 N m to 0,34 N m for non-metallic gasket.

5.2.1 Room temperature test

5.2.1.1 Test methods

Immerse valve assembly in clean water at 23 °C ± 5 °C with mouth down vertically and not more than 100 mm below the surface of the water (see Figure 1).

Check for leakage with test pressures as follows:

a) cup gasket seal — apply 35 kPa air pressure;

b) barrel seal — apply 475 kPa air pressure.

5.2.1.2 Performances

Leakage at a rate less than 0,2 cm^3/min or no bubble detaching during the test time of 1 min is considered acceptable.

5.2.2 Low temperature test

5.2.2.1 Test methods

a) Depress and release valve core pin once after a 24 h minimum exposure at –40 °C ± 3 °C, and assembly pressure shall be maintained to 180 kPa ± 15 kPa (see following Figure 1).

b) Check for leakage with –40 °C ± 3 °C ethanol or methanol 25 mm above valve mouth, with assembly still pressurized to 180 kPa.

c) Begin leak detection after 1 min soak period.

5.2.2.2 Performances

Leakage at a rate less than 0,2 cm^3/min or no bubble detaching during the test time of 1 min is considered acceptable.

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5.2.3 High temperature test

5.2.3.1 Test methods

(See Figure 1.)

a) Depress and release valve core pin once after a 48 h minimum soak period at 100 °C ± 3 °C, and assembly pressure shall be maintained to 600 kPa ± 15 kPa.

b) Check for leakage with 66 °C ± 3 °C clean water not more than 50 mm above the mouth of the valve with assembly still pressurized to 600 kPa.

5.2.3.2 Performances

Leakage at a rate less than 0,2 cm^3/min or no bubble detaching during the test time of 1 min is considered acceptable.

5.3 Valve cap seal (optional, for sealing caps only)

5.3.1 Room temperature test with cap

5.3.1.1 Test methods

a) Screw the cap with sealing gasket at 0,15 N m to 0,20 N m torque on valve without core.

b) Immerse valve assembly in clean water at 23 °C ± 5 °C with mouth down vertically and not more than 100 mm below the surface of the water (see Figure 1).

c) Check for leakage with 475 kPa test pressure.

5.3.1.2 Performances

Leakage at a rate less than 0,2 cm^3/min or no bubble detaching during the test time of 1 min is considered acceptable.

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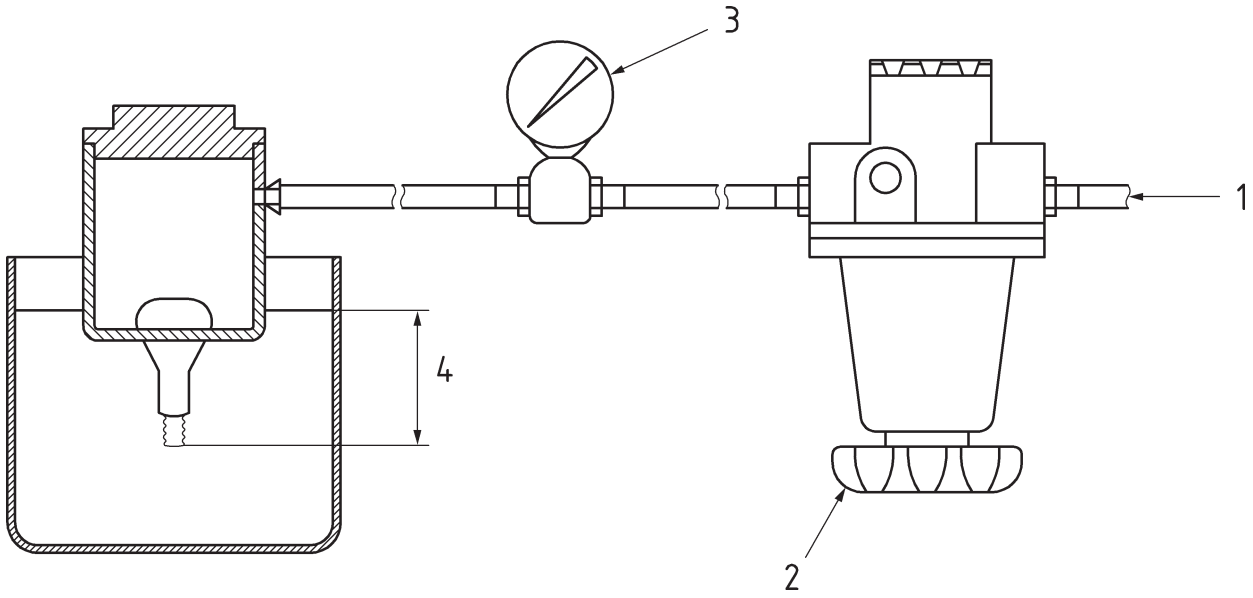

Key

1 air supply
2 regulator
3 gauge
4 liquid level (100 mm max)

Figure 1 — Valve seal test description

5.4 Valve to rim seal

Temperature tests are performed to subject the valves to extremes in temperature. Flexing of valves simulates possible operational conditions.

The same valves and assemblies as shown may be used for both tests provided that the low temperature test is conducted first (see Figure 2).

5.4.1 Low temperature

5.4.1.1 Test holes

— Ø11,7 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick;

— Ø16,1 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick.

5.4.1.2 Test methods

a) Test valves shall be mounted in a test plate as per 4.2 and 4.3.

b) Assembly shall then be exposed to a temperature of -40 °C ± 3 °C for a minimum of 24 h to ensure that the valve seal area is at the test temperature, and pressure shall be maintained to 180 kPa ± 15 kPa.

c) The valve assembly, still pressurized to 180 kPa ± 15 kPa, shall then be immersed, valve mouth up, in ethanol or methanol at -40 °C ± 3 °C, valve button not more than 100 mm below the surface of the liquid.

d) With respect to the axis of the valve mounting hole, the immersed valve shall be flexed to an angle of 25° ± 3°. The cap end of the valve shall then be revolved one complete turn around the axis of the mounting hole. This single revolution shall be executed at a uniform rate without the application of torque to the valve body and accomplished within 15 s to 45 s.

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e) The assembly shall be returned in the refrigerator at -40 °C ± 3 °C after each test, and pressure shall be maintained to 180 kPa ± 15 kPa.

f) Repeat points c) to e) at 0,5 h minimum interval period for a total of five times.

5.4.1.3 Performances

Leakage at a rate less than 0,2 cm^3/min or no bubble detaching during the test time of 1 min is considered acceptable at the rim seal before, during, or after revolving and flexing the valve.

Air inclusions during installation are not considered.

5.4.2 High Temperature

5.4.2.1 Test holes

— Ø11,7 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick;

— Ø16,1 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick.

5.4.2.2 Test methods

a) Test valve shall be mounted in a test plate as per 4.2 and 4.3.

b) The test assembly shall then be exposed to a temperature of 100 °C ± 3 °C for 48 h in a hot air circulating oven to simulate ageing, and pressure shall be maintained to 600 kPa ± 15 kPa.

c) The assembly still pressurized is immersed, valve mouth up, in clean water at 66 °C ± 3 °C, valve button not more than 100 mm below the surface of the liquid.

d) With respect to the axis of the valve mounting hole, the immersed valve shall be flexed to an angle of 25° ± 3°. The cap end of the valve shall then be revolved one complete turn around the axis of the mounting hole. This single revolution shall be executed at a uniform rate without the application of torque to the valve body and accomplished within 15 s to 45 s. Water temperature shall be maintained at 66 °C ± 3 °C during the whole test.

e) The assembly shall be returned to the hot air oven and pressure shall be maintained to 600 kPa ± 15 kPa.

f) Repeat items c) to e) at 0,5 h minimum interval period for a total of five times. The last test shall be performed at the end of the 72 h.

5.4.2.3 Performances

Leakage at a rate less than 0,2 cm^3/min or no bubble detaching during the test time of 1 min is considered acceptable at the rim seal before, during, or after revolving and flexing the valve.

Air inclusions during installation are not considered.

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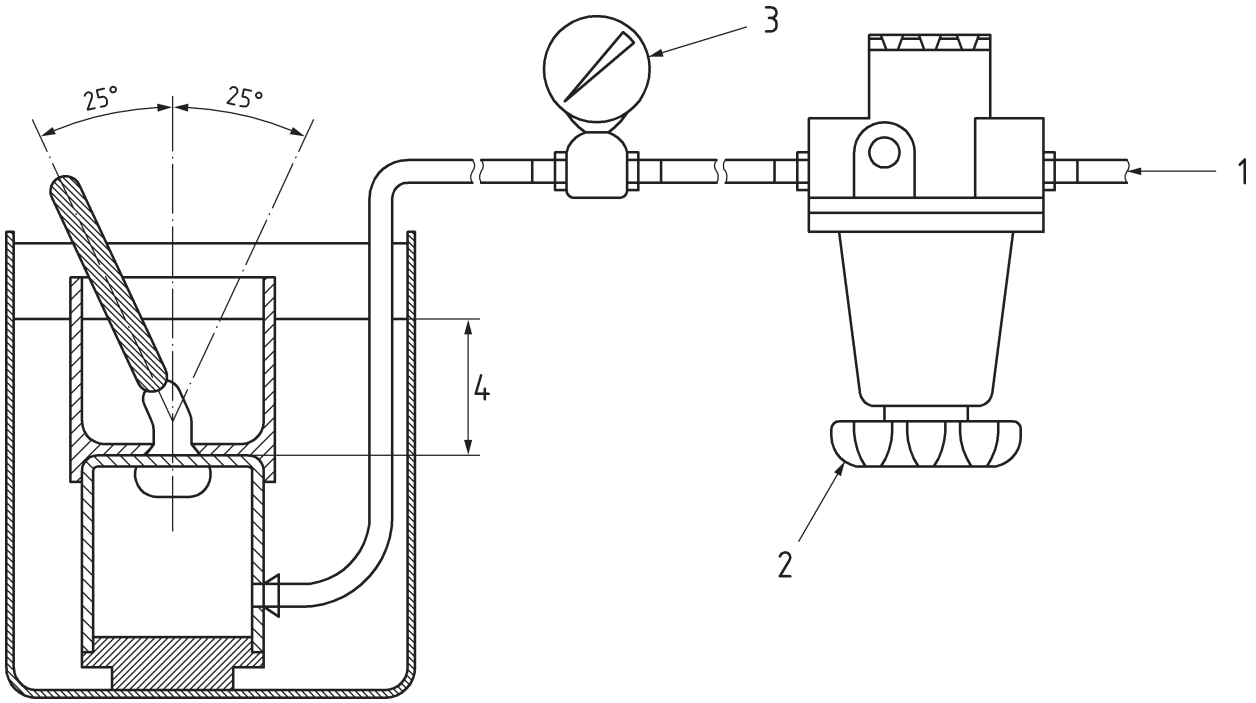

Key

1 air supply
2 regulator
3 gauge
4 liquid level (100 mm max)

Figure 2 — Valve to rim seal test description

5.5 Installation tests

5.5.1 Force to seat

5.5.1.1 Test holes

— Ø11,3 $^{\pm 0,05}$, 3,5 $^{\pm 0,05}$ thick;

— Ø15,7 $^{\pm 0,05}$, 3,5 $^{\pm 0,05}$ thick.

5.5.1.2 Test methods

The test valve shall be mounted in a test plate as per 4.2 and 4.3 at a rate of 150 mm ± 15 mm per min with a method of measuring the force required.

5.5.1.3 Performances

The force to seat the valve shall be included between 180 N and 450 N.

No tearing or rupturing of the valve is permitted.

5.5.2 Force to pull out

5.5.2.1 Test holes

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— Ø1,3 $^{\pm 0,05}$, 3,5 $^{\pm 0,05}$ thick;

— Ø15,7 $^{\pm 0,05}$, 3,5 $^{\pm 0,05}$ thick.

5.5.2.2 Test methods

a) The valve is installed as in 5.5.1.2.

b) Additional force shall be applied as in 5.5.1 and the force to break the valve or pull out shall be measured.

5.5.2.3 Performances

Minimum force to apply shall be 560 N.

This force is acceptable to break the valve base or to pull the valve out of the hole.

5.6 Burst

5.6.1 Test holes

— Ø11,7 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick;

— Ø16,1 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick.

5.6.2 Test methods

a) The test valve shall be mounted in a test plate as per 4.2 and 4.3.

b) Hydrostatic pressure shall be applied to the valve base to attain a pressure of 1,4 Mpa within 1 min interval.

c) This test shall be conducted at 20 °C to 26 °C. This maximum pressure shall be maintained for an additional 2 min.

5.6.3 Performances

The valve shall not burst.

5.7 Ozone resistance

5.7.1 Test holes

— Ø11,3 $^{\pm 0,05/-0}$, 3,5 $^{\pm 0,05}$ thick;

— Ø15, 7 $^{\pm 0,05/-0}$, 3,5 $^{\pm 0,05}$ thick.

5.7.2 Test methods

a) The unmounted valve shall be aged for 72 h at 100 °C ± 3 °C.

b) The aged valve shall be mounted in a test plate as per 4.2 and 4.3.

c) With respect to the axis of the mounting hole, the valve is deflected 10° from its axis and retained in that position for the duration of the test.

d) The retained valve is placed into a darkened enclosure at 20 °C to 26 °C for a minimum of 24 h.

e) The valve shall then be tested in an ozone-circulating chamber, maintaining 100 ± 5 parts of ozone to 100 million parts of air for 72 h at 38 °C ± 3 °C.

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5.7.3 Performances

The valve rubber shall not exhibit any cracks when viewed with 5x amplification.

5.8 Flexing resistance

5.8.1 Test holes

— 11,7 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick;

— 16,1 $^{\pm 0/-0,05}$, 1,8 $^{\pm 0,05}$ thick.

5.8.2 Test methods

Flexing valves simulates possible operational conditions.

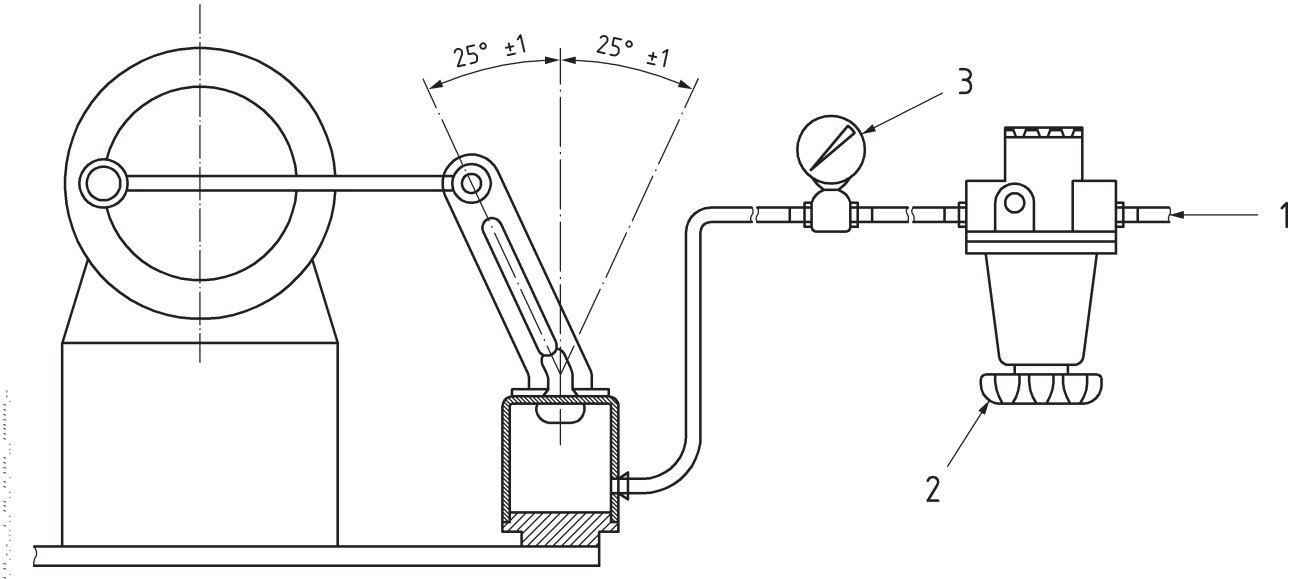
a) The test valve shall be mounted in a test plate as per 4.2 and 4.3 (see Figure 3).

b) The valve assembly pressure shall be maintained to 200 kPa and the flexing angle shall be 25° ± 1° from the valve axis. The frequency shall be 2 Hz.

5.8.3 Performances

There shall be no failure after 40,000 cycles.

Failure is defined as a crack visible to the naked eye.



Key

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2 regulator
3 gauge

Figure 3 — Flexing resistance test description

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