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Second edition
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Tubeless tyres — Valves and components —

Part 1: Snap-in tyre valves test methods

Pneumatiques sans chambre — Valves et composants —

Partie 1: Méthodes d'essai des valves à boutonner («snap-in») pour pneumatiques

Reference number
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Foreword

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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 document 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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This document was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 9, *Valves for tube and tubeless tyres*.

This second edition cancels and replaces the first edition (ISO 14960-1:2014), which has been technically revised.

The main changes are as follows:

— all test methods have been revised;

— test methods have been added for valve hole with diameter 8,8 mm;

— resistance tests have been added.

A list of all parts in the ISO 14960 series can be found on the ISO website.

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.

Tubeless tyres — Valves and components —

Part 1:
Snap-in tyre valves test methods

1 Scope

This document specifies test methods for snap-in tubeless tyre valves intended for, but are not limited to, on-road applications. TPMS valves and high-pressure valves are not included in this document.

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

ISO 9413, *Tyre valves — Dimensions and designation*

3 Terms and definitions

For the purposes of this document, the terms, definitions and designations given in ISO 3877-2, ISO 9413 and the following apply.

ISO and IEC maintain terminology 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
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

3.2
unused valve
valve that has completed final curing processing at least 24 h previously, that has not been subjected to any test or service and that has been stored for no longer than four months in the dark at an ambient temperature between 18 °C and 28 °C, in an optimal and non-aggressive environment

Note 1 to entry: Rubber compounds can change characteristics during their life expectancy.

3.3
sealing cap
protective part that is matched with a valve stem and includes an elastomer seal

Note 1 to entry: An example of sealing cap is given in ISO 9413.

4 Methods for testing tubeless tyres snap-in valves

4.1 General

All the pressures mentioned in the testing procedures are gauge pressures.

A tested snap-in valve shall be 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 if present should not influence the test execution.

4.2 Ageing

If nothing specified, each of the following tests shall be considered on unused valves.

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 then cooled at 23 °C ± 5 °C a minimum of 4 h.

Other ageing profile should be considered regarding the real-life case. The definition of other ageing profile shall be agreed between the customer and the valve manufacturer.

4.3 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 these seals can be affected by the compound curvatures in the wheel rims and by stock thickness.

The hole diameter and thickness for the considered test is specified in Table 1.

Table 1 — Test fixtures

Test	Nominal hole diameter 8,8 mm		Nominal hole diameter 11,3 mm		Nominal hole diameter 15,7 mm	
	Test hole diameter mm	Test plate thickness mm	Test hole diameter mm	Test plate thickness mm	Test hole diameter mm	Test plate thickness mm
Valve to rim seal tests (see 5.4.1 and 5.4.2)	$9{,}10^{+0}_{-0{,}05}$	1,8 ± 0,05	$11{,}7^{+0}_{-0{,}05}$	1,8 ± 0,05	$16{,}1^{+0}_{-0{,}05}$	1,8 ± 0,05
Installation tests (see 5.5.1 and 5.5.2)	$8{,}8^{+0{,}05}_{-0}$	1,8 ± 0,05	$11{,}3^{+0{,}05}_{-0}$	3,5 ± 0,05	$15{,}7^{+0{,}05}_{-0}$	3,5 ± 0,05
Ozone resistance test (see 5.7)	$8{,}8^{+0{,}05}_{-0}$	1,8 ± 0,05	$11{,}3^{+0{,}05}_{-0}$	3,5 ± 0,05	$15{,}7^{+0{,}05}_{-0}$	3,5 ± 0,05
Burst test (see 5.6) and flexing resistance test (see 5.8)	$9{,}10^{+0}_{-0{,}05}$	1,8 ± 0,05	$11{,}7^{+0}_{-0{,}05}$	1,8 ± 0,05	$16{,}1^{+0}_{-0{,}05}$	1,8 ± 0,05

4.4 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.

5 Test methods and performances requirements

5.1 Adhesion

5.1.1 Test method

— 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.

5.1.2 Performances

Any separation between stem and rubber, stem 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 position of the valve core: from +0,25 mm to –0,90 mm (relative to the valve mouth);

— standard torque:

  — 0,34 Nm to 0,56 Nm with metallic sealing;

  — 0,23 Nm to 0,56 Nm for non-metallic gasket.

5.2.1 Room temperature test

5.2.1.1 Test method

Soak the valve assembly in clean water at 23 °C ± 5 °C with the 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 ± 5 kPa air pressure;

b) barrel seal — apply 475 kPa ± 15 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 method

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 Figure 1).

b) Check for leakage with –40 °C ± 3 °C ethanol or methanol at a minimum depth of 25 mm above valve mouth, with assembly still pressurized to 180 kPa ± 15 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.

5.2.3 High temperature test

5.2.3.1 Test method

a) Depress and release valve core pin once after a 48 h minimum exposure 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 valve mouth with assembly still pressurized to 600 kPa ± 15 kPa (See Figure 1).

c) Begin leak detection after 1 min soak period.

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 Test method

The test is performed at 23 °C ± 5 °C.

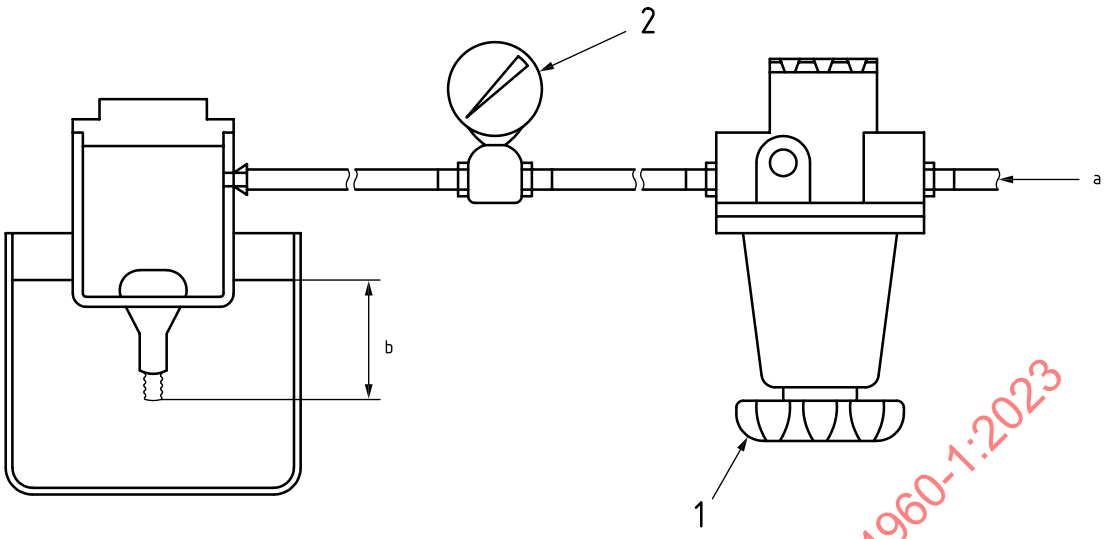
a) Screw the cap with sealing gasket at 0,15 Nm to 0,20 Nm torque on valve without core.

b) Soak the 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 ± 15 kPa test pressure.

5.3.2 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.



Key

1 regulator

2 gauge

[a] Air supply.

[b] Liquid level (100 mm maximum).

Figure 1 — Valve core 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.

5.4.1 Low temperature

5.4.1.1 Test method

a) Test valves shall be mounted in a test plate as per 4.3 and 4.4.

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 (See Figure 2).

d) With respect to the axis of the valve mounting hole, the soaked 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.

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.

5.4.1.2 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 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 method

a) Test valve shall be mounted in a test plate as per 4.3 and 4.4.

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 for 11,3 mm rim hole and 15,7 mm rim hole and 475 kpa ± 15 kpa for 8,8 mm rim hole.

c) The assembly still pressurized is soaked, valve mouth up, in clean water at 66 °C ± 3 °C, valve button not more than 100 mm below the surface of the liquid (see Figure 2).

d) With respect to the axis of the valve mounting hole, the soaked 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.

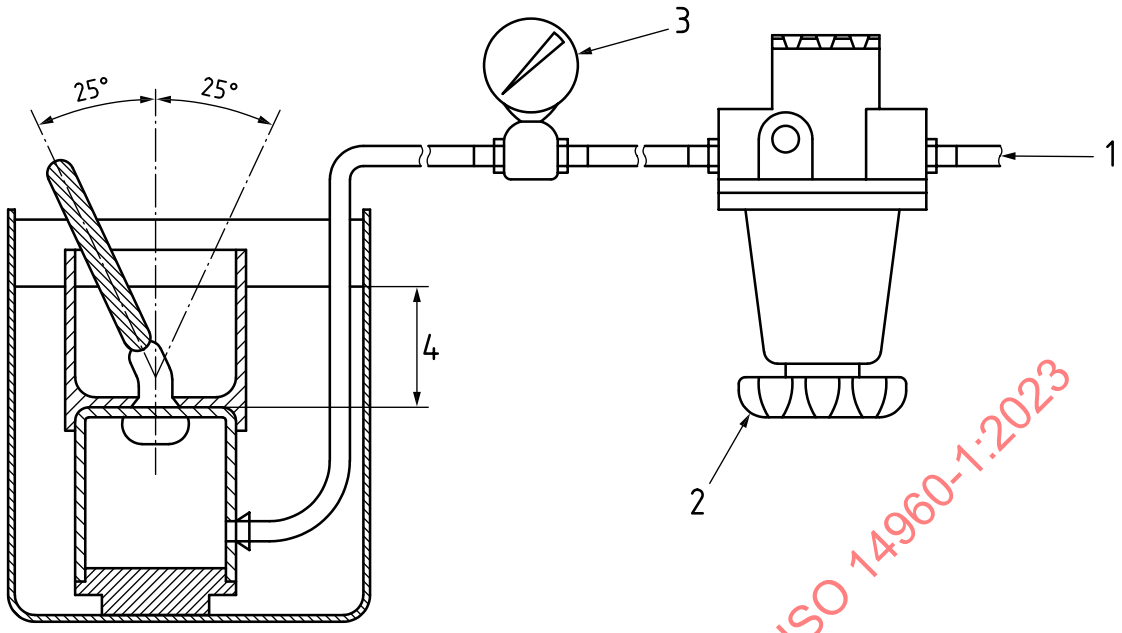
e) The assembly shall be returned to the hot air oven and pressure shall be maintained to 600 kPa ± 15 kPa for 11,3 mm rim hole and 15,7 mm rim hole and 475 kpa ± 15 kpa for 8,8 mm rim hole.

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.

5.4.2.2 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 at the rim seal before, during, or after revolving and flexing the valve.

Air inclusions during installation are not considered.



Key

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

Figure 2 — Valve to rim leaking test method

5.5 Installation tests

5.5.1 Force to seat

5.5.1.1 Test method

The test valve shall be mounted in a test plate as per 4.3 and 4.4 at a rate of 150 mm/min ± 15 mm/min with a calibrated system to measure the force.

5.5.1.2 Performances

For valve hole diameter of 11,3 mm and 15,7 mm: The force to seat the valve shall be included between 180 N and 450 N.

For valve hole diameter of 8,8 mm: The force to seat the valve shall be included between 180 N and 400 N.

No tearing or rupturing of the valve is permitted.

5.5.2 Force to pull out

5.5.2.1 Test method

a) The valve is installed as in 5.5.1.1.

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

5.5.2.2 Performances

For valve hole diameter of 11,3 mm and 15,7 mm: The force to apply shall be at a minimum 560 N.

For valve hole diameter of 8,8 mm: The force to apply shall be at a minimum 480 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 method

a) The test valve shall be mounted in a test plate as per 4.3 and 4.4. This test shall be conducted at 23 °C ± 5 °C.

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

c) This maximum pressure shall be maintained for two additional minutes.

5.6.2 Performances

The valve shall not burst.

5.7 Ozone resistance

5.7.1 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 4.3 and 4.4.

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 with reference to the volume fraction for 72 h at 38 °C ± 3 °C.

5.7.2 Performances

At the end of the exposure, the valve rubber shall not exhibit any cracks when viewed with 5× amplification.

5.8 Flexing resistance

5.8.1 Test methods

Flexing valves simulates possible operational conditions.

a) The test valve shall be mounted in a test plate as per 4.3 and 4.4.

b) The valve assembly pressure shall be maintained to 200 kPa ± 15 kPa and the flexing angle shall be 25° ± 1° from the valve axis (see Figure 3). The frequency shall be 2 Hz. This test shall be conducted at 23 °C ± 5 °C.

c) The test should be conducted during 40 000 cycles.