
TPMS snap-in valves —

**Part 3:
Performances**

*Valves à boutonner («snap-in») pour TPMS —
Partie 3: Performances*

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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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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 9, *Valves for tube and tubeless tyres*.

A list of all parts in the ISO 18885 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.

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TPMS snap-in valves —

Part 3: Performances

1 Scope

This document specifies test methods for TPMS snap-in tubeless valves.

These methods are defined to determine the minimum level of performances requested.

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 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 18885-2, *TPMS snap-in valves — Part 2: Valve environment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 <http://www.electropedia.org/>

3.1

unused valve

valve that has completed final curing processing at least 24 h previously, has not been subjected to any test or service and has been stored for no longer than 4 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.

3.2

stem insert

metallic part of the valve (usually in brass material) designed to be matched with inner core, cap, *sensor housing* (3.4) and partially covered by rubber

3.3

sealing cap

protection part that is matched with valve *stem* (3.2) and includes an elastomer seal

3.4

sensor housing

rigid case that is matched with valve *stem* (3.2) and contains TPMS sensor components

4 Conditions for testing TPMS snap-in valves

4.1 General

All the pressures mentioned in the testing procedures below are relative pressures.

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. The material of the test fixture should 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 can be present by the contact of the remaining part of the valve body exterior to the surface of the material around the valve hole. Either or both of these seals can be affected by the compound curvatures in the wheel rims and by stock thickness.

The test fixture used for each of the following tests shall be the worst couple. The hole diameter/thickness for the considered test is specified in [Table 1](#).

Table 1 — Test fixtures

Nominal hole	Diameter 11,3 mm	
	Test hole mm	Plate thickness mm
Valve to rim seal test low and high temperature test - 5.5	11,7 _{-0,05} ⁰	1,8 ± 0,05
Installation tests:	11,3 ₀ ^{+0,05}	3,5 ± 0,05
— Force to seat: 5.6.2		
— Force to pull out: 5.6.3		
Ozone resistance - 5.8	11,3 ₀ ^{+0,05}	3,5 ± 0,05
Burst - 5.7	11,7 _{-0,05} ⁰	1,8 ± 0,05
Flexing resistance - 5.9		
Pull-back test - 5.6.4		

4.3 Installation

All valves, lubricated following the valve supplier recommendation or a solution of water and soap, shall be installed in a proper test fixture by applying valve insertion force to the housing 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 (as defined in ISO 18885-2) 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 proceeding to tests.

4.4 Ageing

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

5 Test methods

5.1 General

Each of the following tests shall be considered on unused valves.

5.2 Adhesion

5.2.1 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 minute with a traction machine.

The test shall be conducted at 23 °C ± 5 °C and without the TPMS housing.

Alternatively, pliers may be used instead of a traction machine.

5.2.2 Performance

Any separation between the stem and rubber stem and cement or cement and rubber in excess of 41 mm², 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.

5.3 Valves core seal

5.3.1 General

To verify valve cores installed in TPMS snap-in valve assemblies ([Figure 1](#)), the sensor may not be attached. The installation of the valve core in the valve shall meet the following conditions:

- 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 for a valve core with metallic sealing;
- 0,23 Nm to 0,56 Nm for a valve core with non-metallic gasket.

5.3.2 Room temperature test

5.3.2.1 Test method

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](#)).

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.

5.3.2.2 Performance

Leakage at a rate less than 0,2 cm³/min or no bubble detaching during the test time of 1 min is considered acceptable.

5.3.3 Low temperature test

5.3.3.1 Test method

- a) Depress and release valve core pin once after a 24 h minimum exposure at $-40\text{ °C} \pm 3\text{ °C}$; assembly pressure shall be maintained at $180\text{ kPa} \pm 15\text{ kPa}$.
- b) Check for leakage with ethanol or methanol at a minimum depth of 25 mm above valve mouth, with assembly still pressurized to the corresponding pressure.
- c) Begin leak detection after 1 min soak period.

5.3.3.2 Performance

Leakage at a rate less than 0,2 cm³/min or no bubble detaching during the test time of 1 min is considered acceptable.

5.3.4 High temperature test

5.3.4.1 Test method

- a) Depress and release valve core pin once after a 48 h minimum exposure at $100\text{ °C} \pm 3\text{ °C}$; pressure shall be maintained at $600\text{ kPa} \pm 15\text{ kPa}$ for applications equal to or below 450 kPa (see [Figure 1](#)).
- b) Check for leakage with $66\text{ °C} \pm 3\text{ °C}$ clean water not more than 50 mm above valve mouth, with assembly still pressurized to the pressure defined in [5.3.4.1 a\)](#);
- c) Begin leak detection after 1 min soak period.

5.3.4.2 Performance

Leakage at a rate less than 0,2 cm³/min or no bubble detaching during the test time of 1 min is considered acceptable.

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

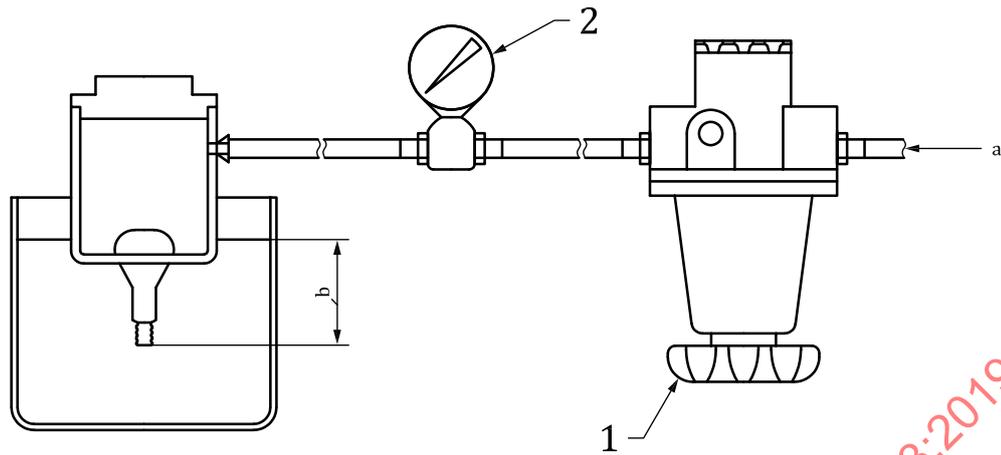
5.4.1 Test method

The test is performed at a room temperature between 18 °C and 28 °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 $23\text{ °C} \pm 5\text{ °C}$ with mouth down vertically and not more than 100 mm under water surface (see [Figure 1](#)).
- c) Check for leakage with 475 kPa test pressure.

5.4.2 Performance

Leakage at a rate less than 0,2 cm³/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 max).

Figure 1 — Valve seal test description**5.5 Valve to rim seal****5.5.1 General**

Temperature tests are performed to subject the valves to extremes in temperature. Flexing of valves simulates possible operational conditions. If possible, the test should be performed with the presence of a sensor that can limit the flexion of the valve.

The same valves and assemblies shall be used for both tests provided the low temperature test is conducted first (see [Figure 2](#)).

5.5.2 Low temperature**5.5.2.1 Test method**

- a) Test valves shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#).
- b) Assembly shall then be exposed to $-40\text{ °C} \pm 3\text{ °C}$ for 24 h minimum to ensure the valve seal area is at the test temperature, and pressure shall be maintained at $180\text{ kPa} \pm 15\text{ kPa}$.
- c) The valve assembly, still pressurized to $180\text{ kPa} \pm 15\text{ kPa}$, shall then be soaked valve mouth up in ethanol or methanol at $-40\text{ °C} \pm 3\text{ °C}$, 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 a minimum angle of 10° , if the flexibility of the system allows it. 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 refrigerator at $-40\text{ °C} \pm 3\text{ °C}$ after each test and pressure shall be maintained at $180\text{ kPa} \pm 15\text{ kPa}$.
- f) Repeat points c) to e) at 0,5 h interval minimum for a total of 5 times.

5.5.2.2 Performance

Leakage at a rate less than 0,2 cm³/min or no bubble detaching during the test time of 1 min is considered acceptable.

5.5.3 High temperature

5.5.3.1 Test method

- a) Test valves shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#).
- b) Assembly shall then be exposed to 100 °C ± 3 °C for 48 h in a hot air circulating oven to simulate ageing, and pressure shall be maintained at 600 kPa ± 15 kPa. The valve assembly, still pressurized to the above mentioned pressure, 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 water (see [Figure 2](#)).
- c) With respect to the axis of the valve mounting hole, the soaked valve shall be flexed to a maximum angle of 25°, if the flexibility of the system allows it. 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 45s. Water temperature shall be maintained at 66 °C ± 3 °C during the whole test.
- d) The assembly shall be returned to the hot air oven and pressure shall be maintained at the value mentioned in point b).
- e) Repeat points c) and d) at 0,5 hour interval minimum for a total of 5 times. The last test shall be performed at the end of 72 h.

5.5.3.2 Performance

Leakage at a rate less than 0,2 cm³/min or no bubble detaching during the test time of 1 min is considered acceptable.

5.6 Installation test

5.6.1 General

Installation test shall be executed in the configuration recommended by the valve manufacturer: with or without sensor housing attached.

5.6.2 Force to seat

5.6.2.1 Test method

The test valve lubricated as per [4.2](#), shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#) at a rate of 150 mm ± 15 mm per minute with a calibrated system to measure the force.

The presence of the sensor housing depends on the methodology of the real insertion case.

5.6.2.2 Performance

The force to seat shall be below 1 000 N.

No tearing, crack or rupturing of the valve is permitted.

No breakage or crack of sensor housing is permitted when the sensor and valve is one integral unit.

5.6.3 Force to pull-out

5.6.3.1 Valve with sensor housing designed to be connected only after valve seating

5.6.3.1.1 Test method

This test is performed without sensor housing.

The valve is installed as in [5.6.2](#) and an additional force shall be applied with a calibrated system until unseating.

5.6.3.1.2 Performance

The force to unseat shall be at a minimum 150 N above the maximum value of force to seat.

5.6.3.2 Valve with sensor housing designed to be connected before valve seating

5.6.3.2.1 Test method

This test is performed with sensor housing.

The valve is installed as in [5.6.2](#) and an additional force of max. 1 700 N shall be applied with a calibrated system for 15 s.

5.6.3.2.2 Performance

The valve should not unseat.

No breakage or crack of sensor housing is permitted.

5.6.4 Force to pull back (unseating)

5.6.4.1 Test method

- a) The test valve shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#).
- b) The valve shall be pushed to opposite direction at a rate of 150 mm/min \pm 15 mm/min with a calibrated system to measure the force.

5.6.4.2 Performance

The pull-back force shall be higher than 1 500 N.

5.7 Burst

5.7.1 Test method

The burst test should be performed with the TPMS sensor housing attached.

- The test valve shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#); this test shall be conducted between 18 °C and 28 °C.
- Hydrostatic pressure shall be applied to the valve base to obtain a pressure of 1,4 MPa for applications equal to or below 450 kPa (or three times the maximum cold operating pressure) within 1 min interval.
- The maximum pressure shall be maintained for two additional minutes.

5.7.2 Performance

The valve shall not burst or unseat from fixture.

5.8 Ozone resistance

5.8.1 Test method

The ozone test may be performed with the TPMS sensor housing attached.

- The valve shall be aged for 72 h at $100\text{ °C} \pm 3\text{ °C}$.

NOTE The valve can be aged on the test fixture.

- The aged valve shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#).
- After cleaning the lubricant from the valve, with respect to the axis of the mounting hole, the valve is deflected 10° from its axis, if the flexibility of the system allows it, and retained in that position for the duration of the test.
- The retained valve is placed into a darkened enclosure at 18 °C to 28 °C for a minimum of 24 h.
- The valve shall then be tested in an ozone circulating chamber, maintaining (100 ± 5) parts of ozone per 100 million parts of air with reference to the volume fraction for 72 h at $38\text{ °C} \pm 3\text{ °C}$.

5.8.2 Performance

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

5.9 Flexing resistance

5.9.1 Test method

The test is done at room temperature between 18 °C and 28 °C .

Flexing valves simulates possible operational conditions.

If possible, the test should be performed with the presence of a sensor that can limit the flexion of the valve. The test valve shall be mounted in a test plate in accordance with [4.2](#) and [4.3](#).

The valve assembly pressure shall be maintained at 200 kPa and the flexing angle shall be $25^\circ \pm 1^\circ$ from the valve axis, if the flexibility of the system allows it.

The frequency shall be 2 Hz.

After 40 000 cycles, the valve assembly, still pressurized to 200 kPa, is soaked valve mouth up in clean water at $23\text{ °C} \pm 5\text{ °C}$, valve button not more than 100 mm below the surface of the water (see [Figure 2](#)). With respect to the axis of the valve mounting hole, the soaked valve shall be flexed to angle of $25^\circ \pm 3^\circ$. If the real-life angle case is lower than 25° , the real-life maximum angle shall be considered for this test.

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

5.9.2 Performance

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