INTERNATIONAL STANDARD

ISO 18885-3

Second edition
2021-11

TPMS snap-in valves —

Part 3: Performances

Valves à boutonner («snap-in») pour TPMS —

Partie 3: Performances

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 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 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*.

This second edition cancels and replaces the first edition (ISO 18885-3:2019), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the flexing angle degree for the cycling flexing test has been revised;

— the flexing angle degree for the for the leakage test has been revised.

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.

TPMS snap-in valves —

Part 3: Performances

1 Scope

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

3.2
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.

3.3
sensor housing
rigid case that is matched with a valve stem and contains TPMS sensor components

4 Conditions for testing TPMS snap-in valves

4.1 General

All the pressures mentioned in the testing procedures in 5.5.2, 5.5.3, 5.7.1, 5.9.1, 5.12.1, 5.13.1 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 case. The hole diameter and thickness for the considered test is specified in Table 1.

Table 1 — Test fixtures

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

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/min ± 15 mm/min 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 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.

5.3 Valves core seal

5.3.1 General

To verify valve cores installed in TPMS snap-in valve assemblies (see 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.

The same valve core shall be tested in cascade as follows: room temperature test, low temperature test and finally high temperature test.

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 cm^3/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 the valve core pin once after a 24 h minimum exposure at –40 °C ± 3 °C; assembly pressure shall be maintained at 180 kPa ± 15 kPa.

b) Check for leakage with ethanol or methanol at a minimum depth of 25 mm above valve mouth, with the 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 cm^3/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 the valve core pin once after a 48 h minimum exposure at 100 °C ± 3 °C; pressure shall be maintained at 600 kPa ± 15 kPa for applications equal to or below 450 kPa (see Figure 1).

b) Check for leakage with 66 °C ± 3 °C clean water not more than 50 mm above valve mouth, with the 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 cm^3/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.

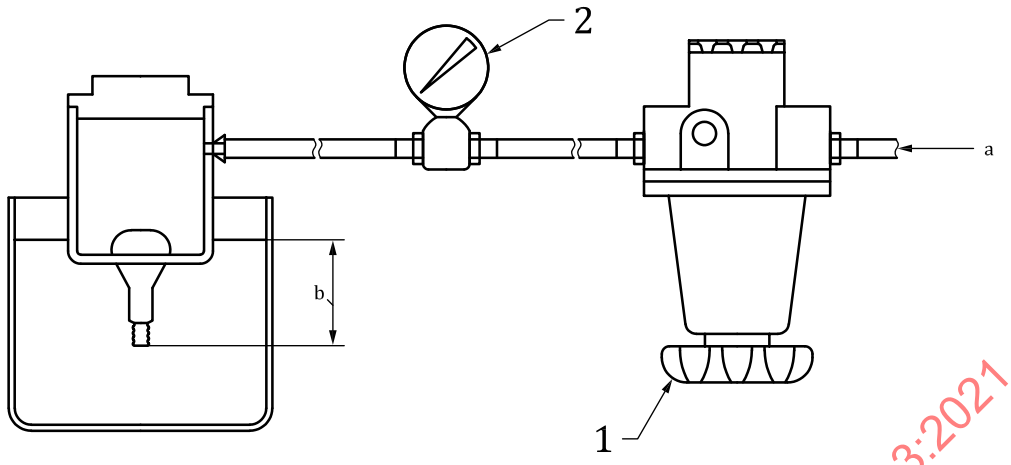
a) Screw the cap with sealing gasket at 0,15 Nm to 0,20 Nm torque on valve without core.

b) Soak the valve assembly in clean water at 23 °C ± 5 °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 of less than 0,2 cm^3/min or with 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 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 properly oriented that can limit the flexion of the valve.

The same valves and assemblies shall be tested in cascade, provided the low temperature test is conducted first.

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 °C ± 3 °C for 24 h minimum to ensure the valve seal area is at the test temperature, and pressure shall be maintained at 180 kPa ± 15 kPa.

c) The valve assembly, still pressurized to 180 kPa ± 15kPa, shall then be soaked 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 4).

d) With respect to the axis of the valve mounting hole, the soaked valve shall be flexed to a minimum angle of 10° ± 3°, 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 if it is possible. 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 °C ± 3 °C after each test and pressure shall be maintained at 180 kPa ± 15 kPa.

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

5.5.2.2 Performance

Leakage at a rate of less than 0,2 cm^3/min or with 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 4).

c) With respect to the axis of the valve mounting hole, the soaked valve shall be flexed to an angle of 15° ± 3°. If the flexibility of the system allows it. If the real-life angle case is higher or lower than 15°, this should be considered as a test condition up to a maximum of 25° ± 3°. The cap end of the valve shall then be revolved one complete turnaround the axis of the mounting hole if it is possible. 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.

d) The assembly shall be returned to the hot air oven and pressure shall be maintained at the value mentioned in step b).

e) Repeat steps c) and d) at 0,5 h interval minimum for a total of five 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 cm^3/min or with 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 4.3, shall be mounted in a test plate in accordance with 4.2 and 4.3 at a rate of 150 mm/min ± 15 mm/min with a calibrated system to measure the force.

If the sensor is influencing the installation it shall be included in the test conditions.

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 only for valve with sensor housing designed to be connected only after valve seating

5.6.3.1 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.

5.6.3.2 Performance

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

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 ± 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. If the sensor is influencing the test condition it shall be included in the test.

— 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 the fixture.

5.8 Ozone resistance

5.8.1 Test method

The ozone test may be performed with the TPMS sensor housing attached. If the sensor is influencing the test condition, it shall be included in the test.

— The valve shall be aged for 72 h at 100 °C ± 3 °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 °C ± 3 °C.

5.8.2 Performance

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

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 properly oriented 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.

If the sensor is influencing the sealing, it shall be included in the test conditions.

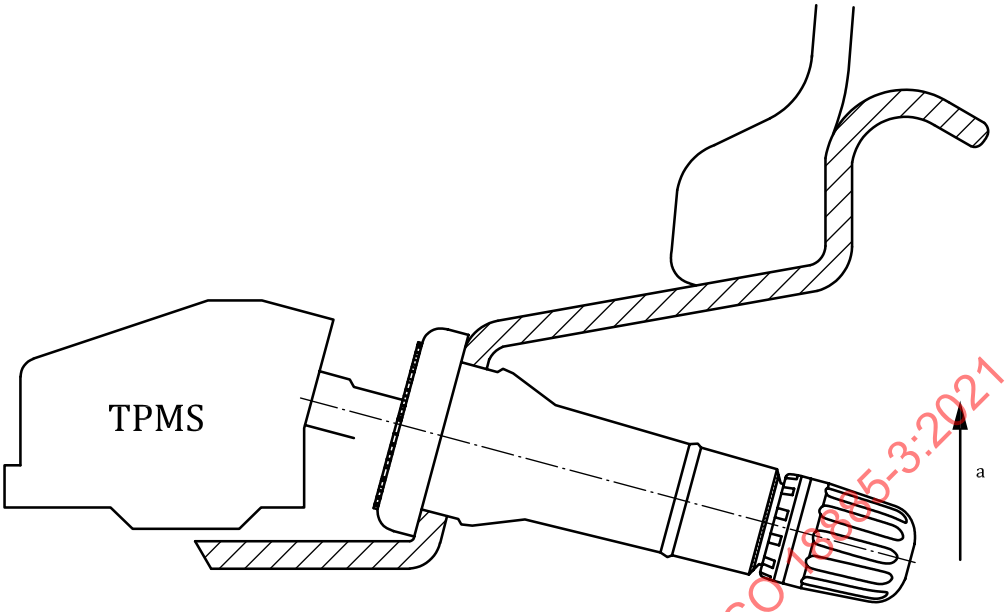
The test angle is parallel to the *G* force direction (see Figure 2).

The valve assembly pressure shall be maintained at 200 kPa and the flexing angle shall be 15° ± 3° from the valve axis, if the flexibility of the system allows it. If the real-life angle case is higher or lower than 15°, this should be considered as test condition up to a maximum of 25° ± 3° (see Figure 3).

The frequency shall be 2 Hz.

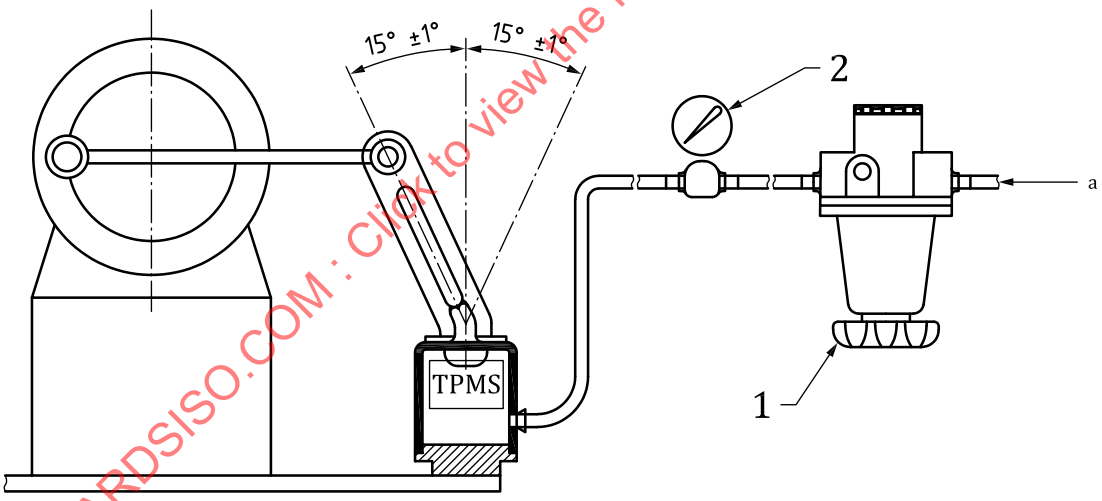
After 40 000 cycles, the valve assembly, still pressurized to 200 kPa, is soaked valve mouth up in clean water at 23 °C ± 5 °C, valve button not more than 100 mm below the surface of the water (see Figure 4). With respect to the axis of the valve mounting hole, the soaked valve shall be flexed to an angle similar to the one defined in the flexing test method.

With respect to the axis of the valve mounting hole, the soaked valve shall be revolved one complete turnaround the axis of the mounting hole if it is possible. 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. In case the complete turn (360°) cannot be performed, the leakage test direction shall be equivalent to the flexing test direction.



a *G* force direction.

Figure 2 — Test angle direction



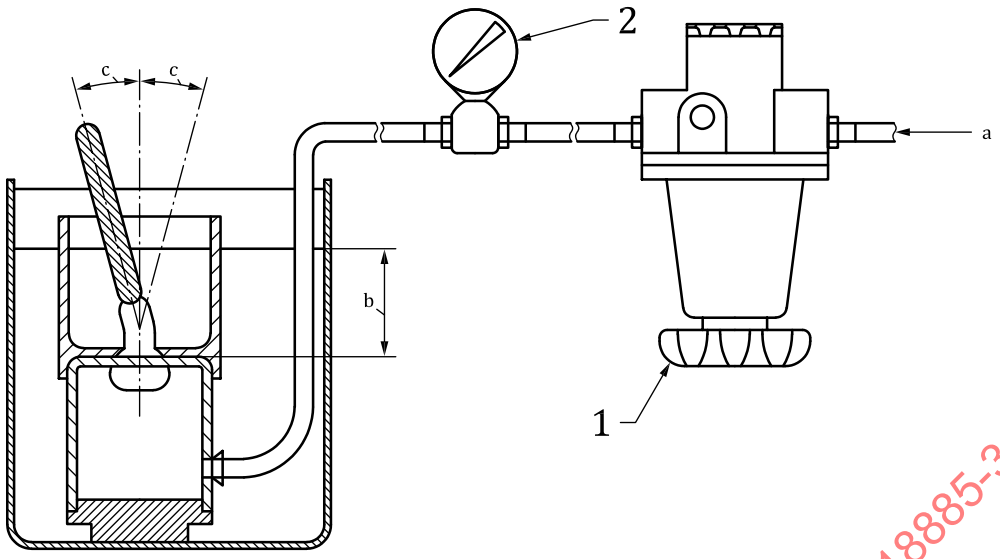
Key

1 regulator

2 gauge

a Air supply.

Figure 3 — Flexing resistance test method



Key

1 regulator

2 gauge

a Air supply.

b Liquid level (100 mm maximum).

c Flexion angle (specified value in each test method).

NOTE The sensor is not shown in Figure 4.

Figure 4 — Leaking test method

5.9.2 Performance

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.

5.10 Corrosion test

5.10.1 Test method

The valve shall be exposed, at least during 240 h, to neutral salt spray (NSS) in accordance with ISO 9227. Valve configuration should simulate real orientation of the valve mounted onto the wheel. In all cases, the test should be performed both with the cap on and off.

5.10.2 Performance

After the 240 h neutral salt spray test and the cleaning of the valve to remove salt spray deposit, the TPMS valve should present the following level of performance.

The cap should be dismountable by hand.

The core should be airtight following 5.3.2, allow pressure checking and pressure adjustment and be dismountable with common tools.