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Tubeless tyres — Valves and components — Test methods

Pneumatiques sans chambre — Valves et composants — Méthodes d'essai

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Foreword

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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.

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ISO 14960 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 9, *Valves for tube and tubeless tyres*.

Tubeless tyres — Valves and components — Test methods

1 Scope

This International Standard specifies test methods and performance requirements for snap-in tubeless tyre valves and their components, intended for, but not limited to, highway applications.

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 3911, *Wheel and rims for pneumatic tyres — Vocabulary, designation and marking*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3911 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

3.2
unused valve
snap-in valve that has completed final manufacturing processing at least 24 h previously, which has not been subjected to any test or service and which has been stored for no longer than 4 months in the dark at ambient temperature, in an optimal and non-aggressive environment

NOTE Rubber compounds can change characteristics during their life expectancy.

3.3
aged valve
unused valve that has been subjected to 100 ± 3 °C for a minimum of 4 h in circulating hot air and cooled at 20 °C to 26 °C for a minimum of 4 h

4 Test set-up

4.1 Test valve description

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

4.2 Test fixtures

Break both edges on both sides of the valve hole, to form either a 45° chamfer of 0,3 mm to 0,4 mm or such that they are rounded with a radius of 0,3 mm to 0,4 mm. Emery cloth or suitable tooling should be used for this purpose. It is also recommended that the material of the test fixture be representative of the material of the actual rim.

NOTE 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 remainder of the valve body exterior to the surface of the material around the valve hole. Either or both of these seals may be affected by the compound curvatures in the wheel rims and by stock thickness.

The dimensions of the test fixtures shall be in accordance with Table 1.

Table 1 — Test Fixtures

Dimensions in millimetres

Test(s) (subclause)	Rim hole			
	Nominal diameter 11,3		Nominal diameter 15,7	
	Test hole diameter	Plate thickness	Test hole diameter	Plate thickness
Valve-to-rim seal (5.4)	$11{,}7\ ^{0}_{-0{,}05}$	$1{,}8 \pm 0{,}05$	$16{,}1\ ^{0}_{-0{,}05}$	$1{,}8 \pm 0{,}05$
Installation (5.5)	$11{,}3\ ^{+0{,}05}_{0}$	$3{,}5 \pm 0{,}05$	$15{,}7\ ^{+0{,}05}_{0}$	$3{,}5 \pm 0{,}05$
Ozone resistance (5.7)	$11{,}3\ ^{+0{,}05}_{0}$	$3{,}5 \pm 0{,}05$	$15{,}7\ ^{+0{,}05}_{0}$	$3{,}5 \pm 0{,}05$
Burst or unseating (5.6)	$11{,}7\ ^{0}_{-0{,}05}$	$1{,}8 \pm 0{,}05$	$16{,}1\ ^{0}_{-0{,}05}$	$1{,}8 \pm 0{,}05$
Flexing resistance (5.8)				

4.3 Installation

All valves, wetted with clean water as a lubricant, shall be installed in a test fixture in accordance with 4.2 by applying a valve insertion force to the end of the valve metal insert or a 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 shall be tested which has damage resulting from installation.

A valve shall be considered properly seated when the entire 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 testing.

5 Test methods and performance requirements

5.1 Adhesion

5.1.1 Test procedure

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

b) Pull each side of the button base away from the insert, towards the cap thread end at (150 ± 15) mm/min with a traction machine or manually, using pliers.

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

5.1.2 Performance requirements

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 creating a strip along the complete valve axis direction shall be considered as a failure.

5.2 Valve core seal

5.2.1 Valve core specifications

Valve cores installed in snap-in valve assemblies (see Figure 1) shall have a pin height tolerance of $^{+0,25}_{-0,90}$ mm, relative to the valve mouth, and a standard torque of

— 0,40 N·m to 0,50 N·m with metallic sealing, or

— 0,17 N·m to 0,34 N·m for a non-metallic gasket.

5.2.2 Room temperature test

5.2.2.1 Test procedure

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

b) Check for leakage using the following test air pressures:

— for a cup gasket seal, apply a pressure of 35 kPa;

— for a barrel seal, apply a pressure of 475 kPa.

5.2.2.2 Performance requirement

Leakage shall be at a rate inferior to 0,2 cm^3/min; alternatively, no bubble shall be detached during the test time of 1 min.

5.2.3 Low temperature test

5.2.3.1 Test procedure

a) Depress and release the valve core pin once after a 24 h minimum exposure at (– 40 ± 3) °C; maintain assembly pressure at (180 ± 15) kPa. See Figure 1.

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

c) Begin leak detection after a 1 min soak period.

5.2.3.2 Performance requirement

Leakage shall be at a rate inferior to 0,2 cm^3/min; alternatively, no bubble shall be detached during the test time of 1 min.

5.2.4 High temperature test

5.2.4.1 Test procedure

a) Depress and release the valve core pin once after a 48 h minimum soak period at (100 ± 3) °C; maintain assembly pressure at (600 ± 15) kPa. See Figure 1.

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

5.2.4.2 Performance requirement

Leakage shall be at a rate inferior to 0,2 cm^3/min; alternatively, no bubble shall be detached during the test time of 1 min.

5.3 Valve cap seal — Room temperature test (optional, for sealing caps only)

5.3.1 Test procedure

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

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

c) Check for leakage using a 475 kPa test pressure.

5.3.2 Performance requirement

Leakage shall be at a rate inferior to 0,2 cm^3/min; alternatively, no bubble shall be detached during the test time of 1 min.

5.4 Valve-to-rim seal

5.4.1 Principal

Temperature tests are performed to subject the test valve to extremes in temperature. The flexing of the valve simulates possible operational conditions.

The same valve and assembly, as shown in Figure 2, may be used for both tests, provided the low temperature test is conducted first.

5.4.2 Low temperature test

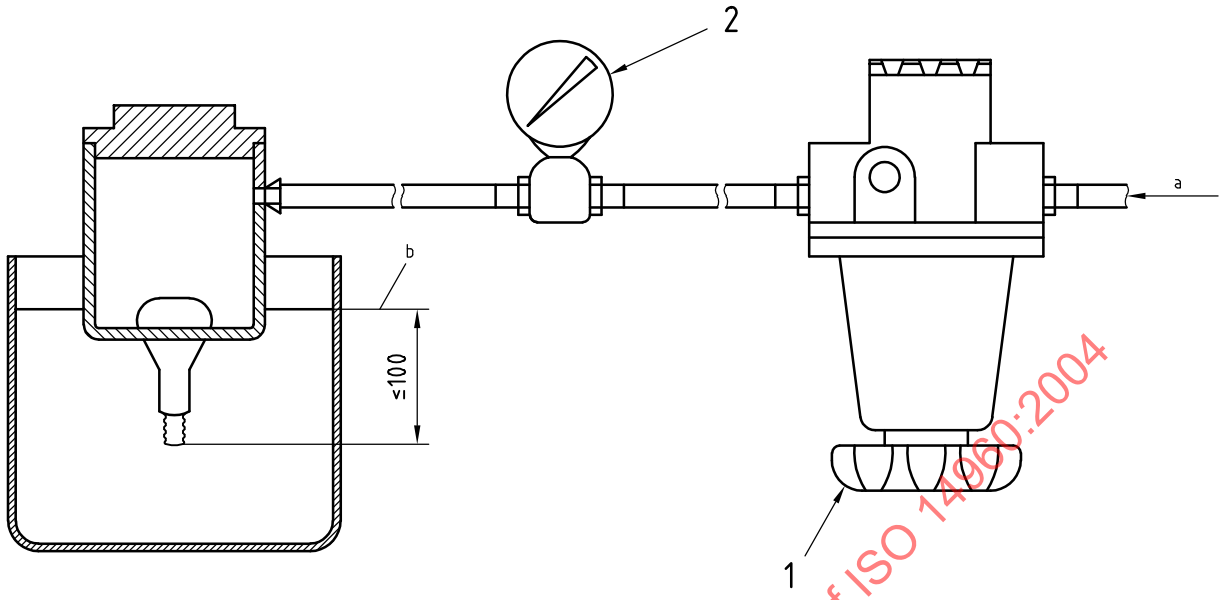
5.4.2.1 Test hole dimensions

The test holes shall have the following dimensions, in millimetres:

— $11{,}7\ ^{0}_{-0{,}05}$ in diameter and 1,8 ± 0,05 thick;

— $16{,}1\ ^{0}_{-0{,}05}$ in diameter and 1,8 ± 0,05 thick.

Dimensions in millimetres



Key

1 regulator
2 gauge

a Air supply.

b Liquid level.

Figure 1 — Valve seal test set-up

5.4.2.2 Test procedure

a) Mount the test valve on a test plate in accordance with 4.2 and 4.3.

b) Expose the assembly to a temperature of (– 40 ± 3) °C for 24 h minimum to ensure the valve seal area is at the test temperature, while applying a test pressure of (180 ± 15) kPa.

c) Immerse the valve assembly, still pressurised to (180 ± 15) kPa, with the valve mouth upwards, in ethanol or methanol at (– 40 ± 3) °C, and with the valve button not more than 100 mm below the surface of the liquid (see Figure 2).

d) Flex the immersed valve to an angle of 25° ± 3° with respect to the axis of the valve mounting hole. Revolve the cap end of the valve one complete turn around the axis of the mounting hole, executing this single revolution at a uniform rate, without the application of torque to the valve body and within 15 s to 45 s.

e) Place the assembly in a refrigerator at (– 40 ± 3) °C; maintain the pressure at (180 ± 15) kPa.

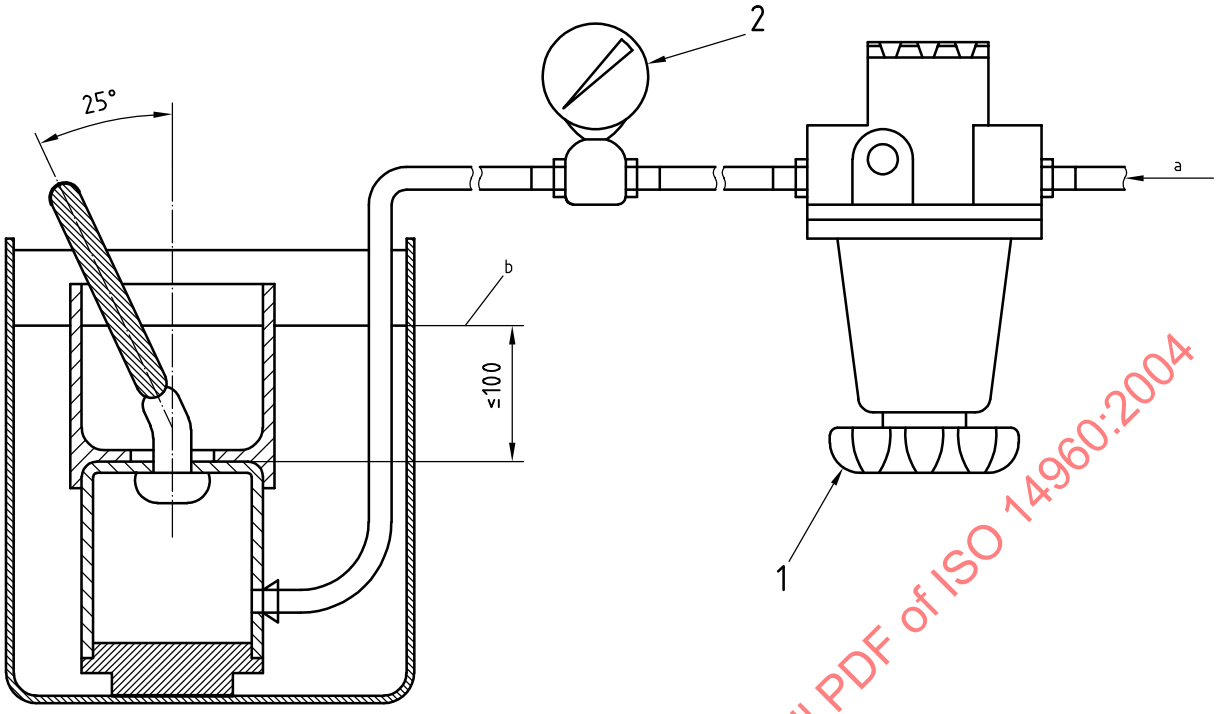
f) Repeat steps c) to e) of the procedure at minimum intervals of 0,5 h a total of five times.

5.4.2.3 Performance requirements

Leakage shall be at a rate inferior to 0,2 cm^3/min; alternatively, no bubble shall be detached during the test time of 1 min at the rim seal before, during or after revolving and flexing the valve.

NOTE Air inclusions during installation are not considered.

Dimensions in millimetres



Key

1 regulator
2 gauge
a Air supply.
b Liquid level.

Figure 2 — Valve-to-rim seal test set-up

5.4.3 High temperature test

5.4.3.1 Test hole diameter and plate thickness

The test holes and plates shall have the following dimensions, in millimetres:

— $11{,}7\ ^{0}_{-0{,}05}$ in diameter and 1,8 ± 0,05 thick;

— $16{,}1\ ^{0}_{-0{,}05}$ in diameter and 1,8 ± 0,05 thick.

5.4.3.2 Test methods

a) Mount the test valve on a test plate in accordance with 4.2 and 4.3.

b) Expose the test assembly to a temperature of (100 ± 3) °C for 48 h in a hot air circulating oven to simulate ageing, while applying a test pressure of (600 ± 15) kPa.

c) Immerse the valve assembly, still pressurised to (600 ± 15) kPa, with the valve mouth upwards, in clean water at (66 ± 3) °C, and with the valve button not more than 100 mm below the surface of the liquid (see Figure 2).

d) Flex the immersed valve to an angle of 25° ± 3° with respect to the axis of the valve mounting hole. Revolve the cap end of the valve one complete turn around the axis of the mounting hole, executing this single revolution at a uniform rate without the application of torque to the valve body and within 15 s to 45 s. Maintain the water temperature at (66 ± 3) °C during the whole test.

e) Return the assembly to the hot air oven, maintaining the pressure at (600 ± 15) kPa.

f) Repeat steps c) to e) at minimum intervals of 0,5 h a total of five times; the last time shall be at the end of 72 h.

5.4.3.3 Performance requirement

Leakage shall be at a rate inferior to 0,2 cm^3/min; alternatively, no bubble shall be detached during the test time of 1 min at the rim seal before, during or after revolving and flexing the valve.

NOTE Air inclusions during installation are not considered.

5.5 Installation tests

5.5.1 Force to seat

5.5.1.1 Test hole diameter and plate thickness

The test holes and plates shall have the following dimensions, in millimetres:

— $11{,}3\ ^{+0{,}05}_{0}$ in diameter and 3,5 ± 0,05 thick;

— $15{,}7\ ^{+0{,}05}_{0}$ in diameter and 3,5 ± 0,05 thick.

5.5.1.2 Test procedure

Mount the valve on a test plate in accordance with 4.2 and 4.3 at a rate of (150 ± 15) mm/min, while measuring the force needed to seat the valve using an appropriate force measuring method.

5.5.1.3 Performance requirements

The force to seat the valve shall be between 180 N and 450 N. There shall be no tearing or rupturing of the valve.

5.5.2 Force to pull out

5.5.2.1 Test hole diameter and plate thickness

The test holes and plates shall have the following dimensions, in millimetres:

— $11{,}3\ ^{+0{,}05}_{0}$ in diameter and 3,5 ± 0,05 thick;

— $15{,}7\ ^{+0{,}05}_{0}$ in diameter and 3,5 ± 0,05 thick.

5.5.2.2 Test procedure

a) Install the valve according to 5.5.1.2.

b) Apply and measure the additional force needed to break or pull out the valve.

5.5.2.3 Performance requirement

The minimum force to break the valve base or pull the valve out of the hole shall be 560 N.

5.6 Burst

5.6.1 Test hole diameter and plate thickness

The test holes and plates shall have the following dimensions, in millimetres:

— $11{,}7\ ^{0}_{-0{,}05}$ in diameter and $1{,}8 \pm 0{,}05$ thick;

— $16{,}1\ ^{0}_{-0{,}05}$ in diameter and $1{,}8 \pm 0{,}05$ thick.

5.6.2 Test procedure

a) Mount the valve on a test plate in accordance with 4.2 and 4.3.

b) Apply hydrostatic pressure to the valve base to attain a pressure of 1,4 MPa within a 1 min interval.

c) Maintain this maximum pressure for an additional 2 min.

The test shall be conducted at 20 °C to 26 °C.

5.6.3 Performance requirement

The valve shall not burst.

5.7 Ozone resistance

5.7.1 Test hole diameter and plate thickness

The test holes and plates shall have the following dimensions, in millimetres:

— $11{,}3\ ^{0}_{-0{,}05}$ in diameter and $3{,}5 \pm 0{,}05$ thick;

— $15{,}7\ ^{0}_{-0{,}05}$ in diameter and $3{,}5 \pm 0{,}05$ thick.

5.7.2 Test procedure

a) Age an unmounted valve for 72 h at (100 ± 3) °C.

b) Mount the aged valve on a test plate in accordance with 4.2 and 4.3.

c) Deflect the valve 10° from its axis with respect to the axis of the mounting hole and retain it in that position for the duration of the test.

d) Place the valve in a darkened enclosure at 20 °C to 26 °C for a minimum of 24 h.

e) Place the valve in an ozone circulating chamber, with (100 ± 5) parts of ozone to 100 million parts of air, for 72 h at (38 ± 3) °C.