



**International  
Standard**

**ISO 14960-2**

**Tubeless tyres — Valves and  
components —**

Part 2:  
**Clamp-in tubeless tyre valve — Test  
methods**

*Pneumatiques sans chambre — Valves et composants —  
Partie 2: Méthodes d'essai pour les valves à visser*

**Second edition  
2024-01**

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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](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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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](http://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 14960-2:2014), which has been technically revised.

The main changes are as follows:

- all test methods have been revised;
- terms and definitions have been added ([Clause 3](#));
- test fixture and valve hole dimensions Clause has been added ([Clause 4](#));
- leakage test method has been added ([5.2](#));
- radial force resistance test has been added ([5.6.3](#));
- clauses and subclauses have been renumbered as necessary.

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](http://www.iso.org/members.html).

# Tubeless tyres — Valves and components —

## Part 2:

# Clamp-in tubeless tyre valve — Test methods

## 1 Scope

This document specifies test methods for clamp-in tubeless tyre valves.

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

This document applies to the tyre valve assembled on the rim hole with diameter of 11,3 mm for passenger cars or for light duty vehicles.

This document does not include tyre pressure monitoring system (TPMS) valves.

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

ISO 9413, *Tyre valves — Dimensions and designation*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions 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 clamp-in valve

type of valve for tubeless tyre, designed to be used with a valve core, a cap, an O-ring or a rubber grommet and to be fixed with a hexagonal nut and potentially a ring washer

### 3.2 valve assembly

*clamp-in valve* (3.1) (with a valve core, a cap, a nut, an O-ring or a rubber grommet and potentially a washer) fixed on the test fixture

## 4 Test fixture and valve hole dimensions

For each test, the material and the test fixture should be representative of the actual rim.

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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 rim or fixture shall be aluminium alloy or steel.

Unless otherwise stated, for all the tests, the conditions in [Table 1](#) shall be applied for the installation of the valve.

**Table 1 — Test Fixtures**

Test	Nominal hole diameter 11,3 mm	
	Test hole diameter mm	Test plate thickness mm
Valve to rim seal leakage tests (see <a href="#">5.5</a> )	Specific fixture, see <a href="#">5.5</a>	
Over torque nut test (see <a href="#">5.6.1</a> )	11,7 <sup>+0</sup> <sub>-0,05</sub>	3,5 ± 0,05
High pressure test (see <a href="#">5.6.2</a> )	11,7 <sup>+0</sup> <sub>-0,05</sub>	3,5 ± 0,05
Radial force resistance (see <a href="#">5.6.3</a> )	11,3 <sup>+0,05</sup> <sub>-0</sub>	3,5 ± 0,05
Ozone test (see <a href="#">5.7.1</a> )	Ozone test on seal alone: Specific fixture, see <a href="#">5.7.1</a> Ozone test on complete assembly valve: 11,3 <sup>+0,05</sup> <sub>-0</sub>	Ozone test on seal alone: Specific fixture, see <a href="#">5.7.1</a> Ozone test on complete assembly valve: 3,5 ± 0,05
Neutral salt spray test (see <a href="#">5.7.2</a> )	11,3 <sup>+0,05</sup> <sub>-0</sub>	3,5 ± 0,05

## 5 Test methods and performance requirements

### 5.1 General

#### 5.1.1 Appearance

If not otherwise defined between customer and supplier, the appearance shall be as follows.

- Valve external aspect: no visible valve crack, spot or scratch is allowed. No visible defect of the anodizing layer is allowed. No deep marks coming from shocks or machining are allowed. All these defects can be judged with naked eye at 1 m distance in final configuration (valve assembled on rim).
- Sealing element aspect shall be uniform: no bubble, no rubber lack, no crack visible or any other defect that can affect the performance is allowed.
- No oil, grease, corrosion or other substance that can affect the performance is allowed.

Before performing any test, check the quality of the samples.

#### 5.1.2 Operating pressure

All pressures mentioned in this document are gauge pressures.

Nominal operating pressure: 0 kPa to 830 kPa (refer to the valve manufacturer indication.)

By default, the maximum operating pressure is the maximum pressure as described in ISO 9413 for valves CQ07 and CQ08: 1 400 kPa. This maximum operating pressure can be replaced for each test by the real maximum operating pressure according to the valve's specification pressure.

### 5.1.3 Samples

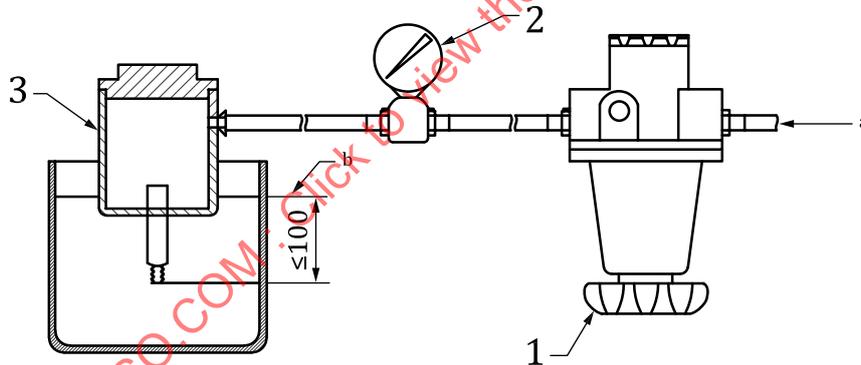
It is recommended to test the minimum quantity to be representative of the design (for example 5 samples). Each of the following tests shall be performed on unused valve assembly.

## 5.2 Leakage test method

Perform the following for each required leakage test in this document.

- a) Immerse the valve assembly vertically not more than 100 mm below the surface of the water. The valve mouth should be positioned down to test for valve core leakage (see [Figure 1](#)), and the valve mouth should be positioned up to test for valve to rim leakage (see [Figure 2](#)).
- b) Use the liquid, temperature, pressure and time described in each test procedure.
- c) Before checking for leakage, twist the test fixture several times in the water bath to remove bubbles stuck on valve and nut before starting the test (wait for surface stabilization).
- d) During the test, observe the bubbles in order to evaluate the leakage:
  - The leakage limit is 0,2 cm<sup>3</sup>/min, which is equivalent to around 14 bubbles/min with a diameter of about 3 mm or to one bubble/min with a diameter of approximately 7 mm.
  - No bubbles during 1 min is also considered as acceptable.
- e) If the leakage exceeds the limit, perform the test again to confirm the defect. Perform the test a minimum of 24 h after seal assembly onto the valve in order to take in account the seal relaxation effect.

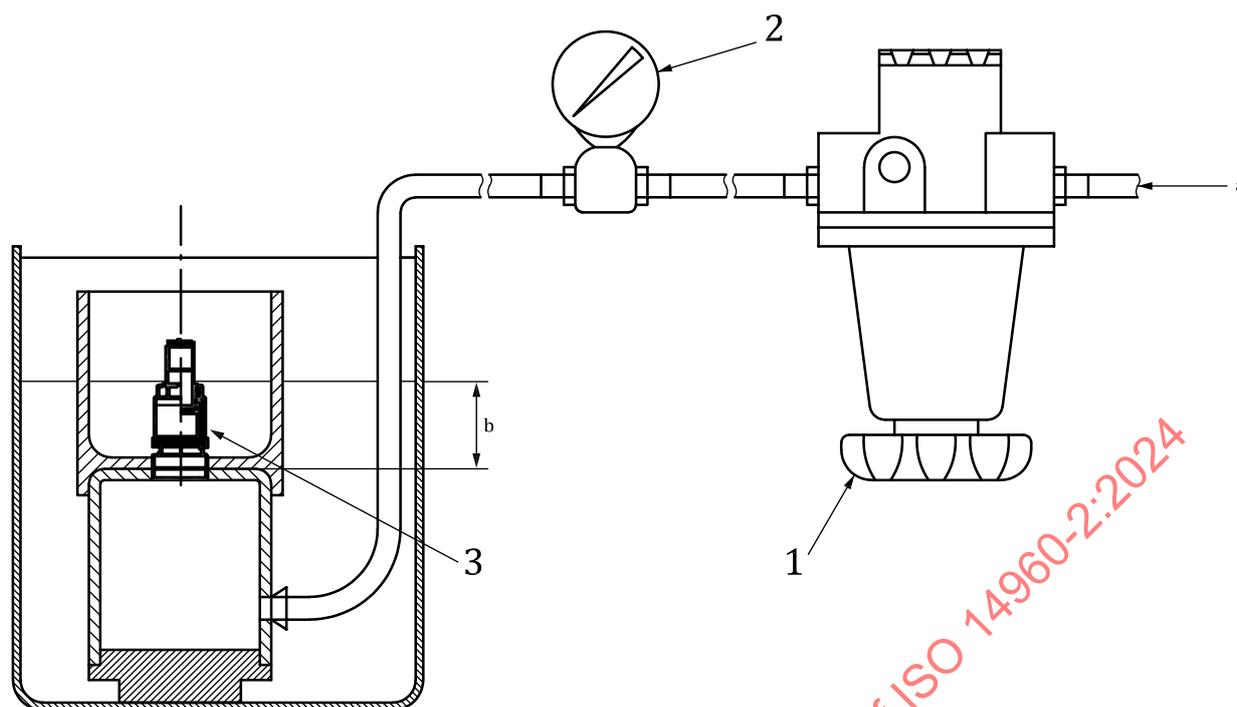
Dimensions in millimetres



#### Key

- 1 regulator
- 2 gauge
- 3 clamp-in valve
- a Air supply
- b Liquid level.

Figure 1 — Valve core leakage test set-up

**Key**

- 1 regulator
- 2 gauge
- 3 clamp-in valve
- a Air supply.
- b Liquid level (100 mm maximum).

**Figure 2 — Valve to rim leakage test set-up**

### 5.3 Valve core tests

#### 5.3.1 Valve core specifications

Valve cores installed in clamp-in valve assemblies shall have:

- a pin height tolerance between  $-0,90$  mm and  $+0,25$  mm, relative to the valve mouth;
- a standard torque of:
  - $0,34$  Nm to  $0,56$  Nm with metallic sealing;
  - $0,23$  Nm to  $0,56$  Nm for non-metallic gasket.

The valve core leakage tests shall be conducted with a valve without cap.

#### 5.3.2 Valve core room temperature leakage test

##### 5.3.2.1 Test procedure

- a) Immerse the valve assembly vertically in clean water at  $23\text{ °C} \pm 5\text{ °C}$  not more than 100 mm below the surface of the water (see [Figure 1](#)).
- b) Check for leakage of the cup gasket seal using a pressure of  $35\text{ kPa} \pm 5\text{ kPa}$  for 1 min.

- c) Then check for leakage of the barrel seal using the maximum operating pressure  $\pm 15$  kPa for 1 min as defined in [5.1.2](#).

### 5.3.2.2 Performance requirement

The leak rate shall not be greater than  $0,2 \text{ cm}^3/\text{min}$ .

### 5.3.3 Valve core low temperature leakage test

#### 5.3.3.1 Test procedure

- a) Depress and release the valve core pin once after a minimum exposure period of 24 h at  $-40 \text{ °C} \pm 3 \text{ °C}$ ; maintain pressure at  $180 \text{ kPa} \pm 15 \text{ kPa}$ .
- b) Immerse the valve assembly vertically in ethanol or methanol at  $-40 \text{ °C} \pm 3 \text{ °C}$  not more than 100 mm below the surface (see [Figure 1](#)).
- c) Check for leakage using a pressure of  $180 \text{ kPa} \pm 15 \text{ kPa}$  for 1 min.
- d) Then, check for leakage using the maximum operating pressure  $\pm 15$  kPa for 1 min as defined in [5.1.2](#).

#### 5.3.3.2 Performance requirement

The leak rate shall not be greater than  $0,2 \text{ cm}^3/\text{min}$ .

### 5.3.4 Valve core high temperature leakage test

#### 5.3.4.1 Test procedure

- a) Depress and release the valve core pin once after a minimum soak period of 48 h at  $100 \text{ °C} \pm 3 \text{ °C}$ ; maintain pressure at the maximum operating pressure  $\pm 15$  kPa as defined in [5.1.2](#).
- b) Immerse the valve assembly vertically in clean water at  $66 \text{ °C} \pm 3 \text{ °C}$  not more than 100 mm below the surface (see [Figure 1](#)).
- c) Check for leakage using the maximum operating pressure  $\pm 15$  kPa for 1 min as defined in [5.1.2](#).

#### 5.3.4.2 Performance requirement

The leak rate shall not be greater than  $0,2 \text{ cm}^3/\text{min}$ .

### 5.3.5 Valve core over torque resistance test

#### 5.3.5.1 Test procedure

With a calibrated torque wrench, torque the core on the valve twice the maximum specified torque. Remove the core and examine for separation of the swivel from the barrel, and the barrel gasket from the barrel.

#### 5.3.5.2 Performance requirement

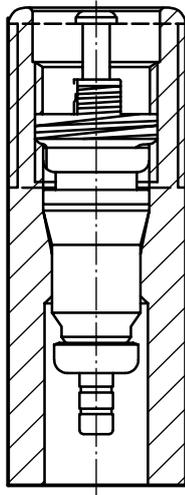
The core shall come out of the valve without separation.

### 5.3.6 Valve core endurance test

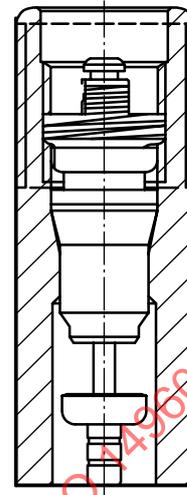
#### 5.3.6.1 Test procedure

- a) With the valve pressurized at the maximum operating pressure  $\pm 15$  kPa as defined in [5.1.2](#), depress the valve core pin to its maximum travel 120 times in  $10 \text{ min} \pm 3 \text{ min}$  (see [Figure 3](#)).

- b) After the endurance test, immerse the valve assembly vertically in clean water at  $23\text{ °C} \pm 5\text{ °C}$  not more than 100 mm below the surface of the water (see [Figure 1](#)).
- c) Check for leakage using the maximum operating pressure  $\pm 15\text{ kPa}$  for 1 min as defined in [5.1.2](#).



a) Valve core in closed position



b) Valve core pin depressed to its maximum travel

Figure 3 — Valve core endurance test method

#### 5.3.6.2 Performance requirement

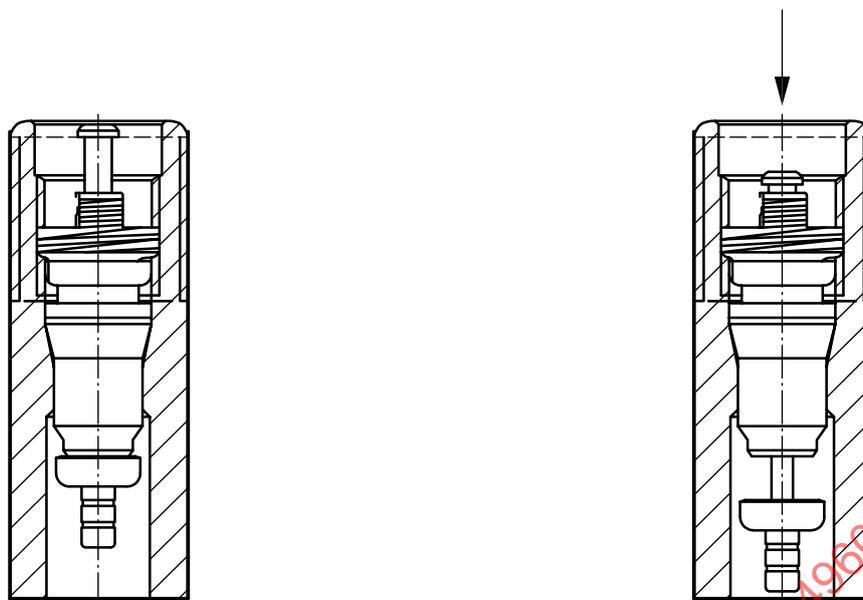
The leak rate shall not be greater than  $0,2\text{ cm}^3/\text{min}$ .

#### 5.3.7 Valve core air flow rate test

##### 5.3.7.1 Test procedure

Depress the valve core pin by  $2\text{ mm} \pm 0,5\text{ mm}$  from the closed position (see [Figure 4](#)).

Measure the air flow through the tyre valve with 690 kPa pressure applied.



a) Valve core in closed position

b) Valve core pin depressed to  $2 \text{ mm} \pm 0,5 \text{ mm}$  from the closed position

Figure 4 — Valve core air flow rate position

### 5.3.7.2 Performance requirement

The valve shall flow a minimum of 100 l/min.

## 5.4 Valve cap seal: room temperature test (optional, for sealing caps only)

### 5.4.1 Test procedure

- Screw the cap with a sealing gasket at 0,15 Nm to 0,20 Nm torque on a valve without a core.
- Immerse the valve assembly vertically in clean water at  $23 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$  not more than 100 mm below the surface of the water (see [Figure 1](#)).
- Check for leakage using the maximum pressure indicated by valve or cap manufacturer.

### 5.4.2 Performance requirement

The leak rate shall not be greater than  $0,2 \text{ cm}^3/\text{min}$ .

## 5.5 Valve to rim seal

### 5.5.1 Valve to rim seal leakage test — General

Installation parameters for temperature leakage tests are indicated in [Table 2](#).

Minimum and maximum values are according to ISO 9413 for the particular valve being tested.

Table 2 — Installation parameters for temperature leakage test

Trial	Factor		
	Rim hole diameter	Rim thickness mm	Installation torque (valve nut) mm
A	Maximum $\begin{matrix} 0 \\ -0,05 \end{matrix}$ 11,7 $\begin{matrix} 0 \\ -0,05 \end{matrix}$	Minimum $\pm 0,05$	Minimum $\pm 5 \%$
B	Minimum $\begin{matrix} +0,05 \\ 0 \end{matrix}$ 11,3 $\begin{matrix} +0,05 \\ 0 \end{matrix}$	Maximum $\pm 0,05$	Maximum $\pm 5 \%$

## 5.5.2 Valve to rim seal low temperature leakage test

### 5.5.2.1 Test procedure

- Subject the valves to  $-40 \text{ °C} \pm 3 \text{ °C}$  for 24 h at  $180 \text{ kPa} \pm 15 \text{ kPa}$ .
- Immerse the valve assembly vertically in ethanol or methanol at  $-40 \text{ °C} \pm 3 \text{ °C}$  not more than 100 mm below the surface (see [Figure 2](#)).
- Check for leakage using a pressure of  $180 \text{ kPa} \pm 15 \text{ kPa}$  for 1 min.
- Then, check for leakage using the maximum operating pressure  $\pm 15 \text{ kPa}$  for 1 min as defined in [5.1.2](#).

### 5.5.2.2 Performance requirement

The leak rate shall not be greater than  $0,2 \text{ cm}^3/\text{min}$ .

## 5.5.3 Valve to rim seal high temperature leakage test

### 5.5.3.1 Test procedure

- Subject the valves to  $100 \text{ °C} \pm 3 \text{ °C}$  for 72 h at the maximum operating pressure  $\pm 15 \text{ kPa}$  as defined in [5.1.2](#).
- Check for leakage with  $66 \text{ °C} \pm 3 \text{ °C}$  clean water at not more than 100 mm above the valve mouth (see [Figure 2](#)).
- Check for leakage using the maximum operating pressure  $\pm 15 \text{ kPa}$  for 1 min as defined in [5.1.2](#).

### 5.5.3.2 Performance requirement

The leak rate shall not be greater than  $0,2 \text{ cm}^3/\text{min}$ .

## 5.5.4 Valve to rim seal peak temperature leakage test

### 5.5.4.1 Test procedure

- Subject the valves to  $135 \text{ °C} \pm 3 \text{ °C}$  for 1 h at the maximum operating pressure  $\pm 15 \text{ kPa}$  as defined in [5.1.2](#).
- Submerge the fixture in water at  $66 \text{ °C} \pm 3 \text{ °C}$  and check for leakage at the valve core and seal/rim interface.
- Check for leakage using the maximum operating pressure  $\pm 15 \text{ kPa}$  for 1 min as defined in [5.1.2](#).

#### 5.5.4.2 Performance requirement

The leak rate shall not be greater than 0,2 cm<sup>3</sup>/min.

### 5.6 Valve mechanical resistance

#### 5.6.1 Over torque nut test

##### 5.6.1.1 Test procedure

Using a calibrated torque wrench, tighten the hex nut on the valve to two times the maximum installation torque given in ISO 9413, then unscrew immediately.

##### 5.6.1.2 Performance requirement

No mechanical breakage of either the nut or the valve is permitted.

#### 5.6.2 High pressure test

##### 5.6.2.1 Test procedure

- a) At 23 °C ± 5 °C, apply 3 times the maximum operating pressure ±15 kPa as defined in [5.1.2](#) to the valve assembly with a representative time of real inflation process. In case the representative time of real inflation pressure is unknown, 1 min ± 5 s can be used.
- b) Maintain this pressure for 3 min.

##### 5.6.2.2 Performance requirement

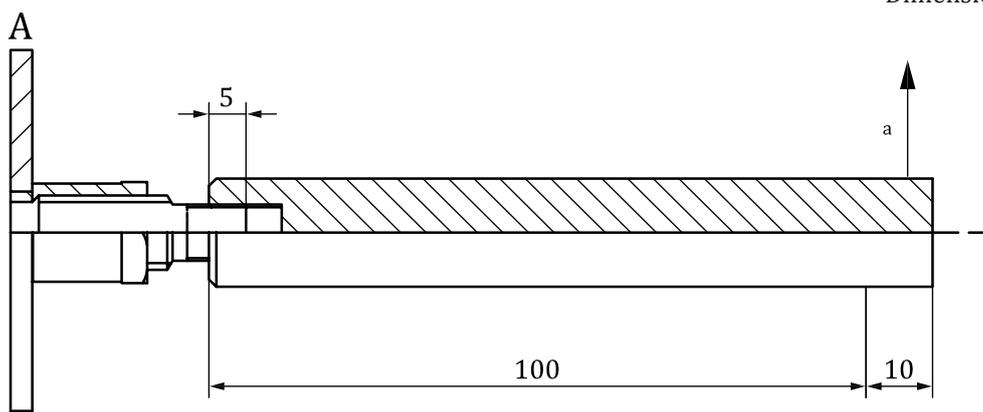
The valve shall not burst.

#### 5.6.3 Radial force resistance (nose resistance)

##### 5.6.3.1 Test procedure with a dynamometer

For this test, a valve core shall be assembled in the valve.

- a) At room temperature, mount the complete valve on a fix plate.
- b) Screw a rigid extension arm of 100 mm minimum length on the valve mouth. The arm shall be screwed by 5 mm ± 1 mm on the threading of the nose of valve and shall remain hanging on.
- c) Push at the extremity of the extension arm with a minimum speed of 10 mm/min. The force shall be applied at a maximum of 10 mm from the end of the extension arm. The applied load shall be perpendicular to the extension arm and shall be recorded using a dynamometer (see [Figure 5](#)).

**Key**

- A fix plate  
a Force.

**Figure 5 — Radial force resistance set-up with a dynamometer**

### 5.6.3.2 Performance requirement

There shall be no breakage visible at naked eye till a minimal force of 80 N.

### 5.6.3.3 Alternative test procedure with a weight

For this test, a valve core shall be assembled in the valve.

- At room temperature, mount the complete valve on a fix plate.
- Screw a rigid extension arm of 100 mm minimum length on the valve mouth. The arm shall be screwed by  $5 \text{ mm} \pm 1 \text{ mm}$  on the threading of the nose of valve and shall remain hanging on.
- Apply a static force of 80 N (a metal weight with fixed weight is suggested) at a maximum of 10 mm from the end of the extension arm (see [Figure 6](#)). The applied force shall be perpendicular to the extension arm.
- Apply the force during 60 s, then remove the force.
- Observe the valve assembly after the test.