BRITISH STANDARD AEROSPACE SERIES

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ISO 9475:1994

Test methods for aircraft inner tube and tubeless tyre valves — Cores and caps

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ACE/59, Aircraft tyres, rims and associated equipment, upon which the following bodies were represented:

British Airways
British Rubber Manufacturers' Association Ltd.
Civil Aviation Authority (Airworthiness Division)
Ministry of Defence
Retread Manufacturers' Association
Society of British Aerospace Companies Ltd.

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National foreword

This British Standard has been prepared by Technical Committee ACE/59. It is identical with ISO 9475:1994, *Aircraft inner tube and tubeless tyre valves — Cores and caps — Test methods,* published by the International Organization for Standardization (ISO).

Cross-references

International Standard	Corresponding British Standard
ISO 815:1991	BS 903 *Physical testing of rubber* Part A6:1992 *Method for determination of compression set at ambient, elevated or low temperatures* (Identical)
ISO 868:1985	BS 2782 *Methods of testing plastics* Part 3 *Mechanical properties* Method 365 B:1992 *Determination of indentation hardness by means of a durometer (Shore hardness)*

The Technical Committee has reviewed the provisions of ISO 37:1994 and ISO 48:1994, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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1 Scope

This International Standard specifies the test methods used for valve cores and caps for aircraft tyres, with or without inner tubes, and minimum airtightness standards. It constitutes a detailed method allowing products to be evaluated on the same basis, and results to be compared.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 37:1994, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties.*

ISO 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

ISO 815:1991, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures.*

ISO 868:1985, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness).*

3 General

For the test methods, the requirements laid down under the test conditions are obligatory. The procedure and certain additional performance requirements shall be fixed by agreement between the valve manufacturer and the client, with an obligation to meet the minimum airtightness requirements defined in this International Standard.

4 Valve cores

4.1 Types of tests

Aircraft tyre valve cores shall be submitted to the following tests:

a) tightening torque test (**4.4.1**);

b) washout test (**4.4.2**);

c) blowout test (**4.4.3**);

d) pressurized pulse test (**4.4.4**);

e) environmental tests at low temperature (**4.4.5**);

f) environmental tests at constant high temperature (**4.4.6**);

g) environmental tests at peak high temperature (**4.4.7**).

4.2 Minimum airtightness requirements

Valve cores shall be rejected if the leakage rate during tests is greater than 0,2 cm^3/min.

4.3 General test conditions

Unless otherwise specified, all tests shall be conducted under the following conditions:

a) ambient temperature and pressure;

b) valve cores shall be installed in a six-position manifold as shown in Figure 1;

c) tightening torques for cores with elastomeric valve seats shall be between 0,17 N·m and 0,34 N·m;

d) tightening torques for cores with metal (or elastomeric plus metal stop) valve seats shall be between 0,34 N·m and 0,54 N·m;

e) the pressure inside the manifold shall be 3 800 kPa;

f) airtightness shall be verified by immersing the core in water, acetone or alcohol.

4.4 Test methods

4.4.1 *Tightening torque test*

4.4.1.1 *Test conditions*

a) Carry out the test on six cores installed in a manifold in accordance with Figure 1.

b) Tighten the cores to the minimum torque specified in **4.3**.

c) The test pressure is 200 kPa to 3 800 kPa.

4.4.1.2 *Performance requirement*

The core leak-rate shall not be greater than the value set in **4.2** throughout the pressure range. Checks shall be made at least at the minimum and maximum pressures.

4.4.2 *Washout test*

This test simulates rapid deflation at high pressure.

4.4.2.1 *Test conditions*

a) Carry out this test on cores which have successfully passed the tightening torque test (**4.4.1**).

b) Set the manifold pressure to 3 800 kPa.

c) Carry out 10 test cycles, defined as follows, on each valve core:

1) open each core manually and keep it open for at least 3 s to allow the pressurized air to escape at high speed across the valve seal;

2) allow the core to close freely.

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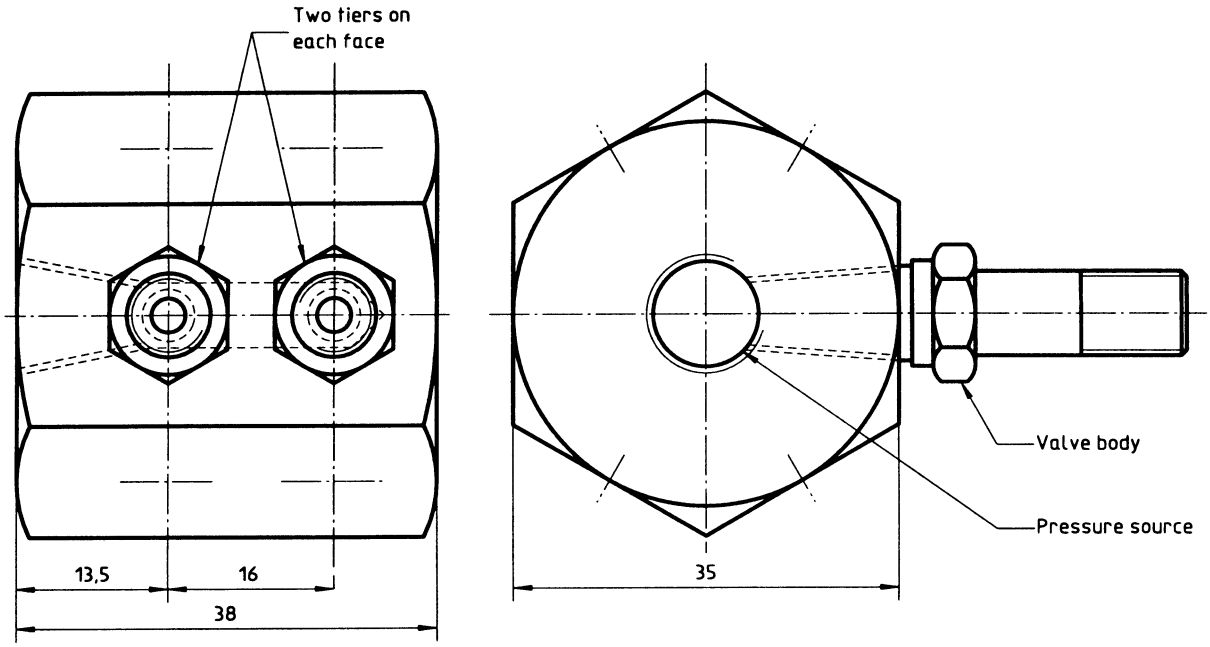

Figure 1 — Manifold

4.4.2.2 *Performance requirement*

The leak-rate, measured after 10 cycles, shall not be greater than the value specified in **4.2**.

4.4.3 ***Blowout test***

This test simulates rapid inflation at high pressure.

4.4.3.1 *Test conditions*

a) Carry out this test on the cores that have passed the tightening torque test (**4.4.1**) and the washout test (**4.4.2**).

b) Carry out 10 test cycles, defined as follows, on each valve core:

1) reduce the manifold pressure to 0 kPa;

2) attach a standard connector to a 3 800 kPa compressed air system;

3) keep each core open for at least 3 s to allow the pressurized external air to enter the manifold at high speed across the valve seal;

4) after 3 s, remove the inflation connector and let the core close freely.

4.4.3.2 *Performance requirement*

The leak-rate, measured after 10 cycles, shall not be greater than the value specified in **4.2**.

4.4.4 ***Pressurized pulse test***

4.4.4.1 *Test conditions*

a) Carry out this test on six new cores installed in a manifold in accordance with Figure 1.

b) Carry out the pulse tests on the valve cores in accordance with Table 1.

4.4.4.2 *Performance requirement*

Throughout the test, the leak-rate shall not be greater than the value set in **4.2**. It shall be noted after every 1 000 cycles.

4.4.5 ***Environmental test at low temperature***

4.4.5.1 *Test conditions*

a) Carry out this test on six new cores installed in a test manifold in accordance with Figure 1.

b) Hold the cores at a temperature of – 54 °C for 24 h.

c) Check the airtightness in acetone or alcohol cooled to – 54 °C, with air cooled to – 54 °C at a pressure of 3 800 kPa.

d) After cooling, check the airtightness at each of the following stages, in the order indicated:

1) at 3 800 kPa; if the core leaks, retighten to the maximum torque defined in **4.3**;

2) washout test (**4.4.2**);

3) blowout test (**4.4.3**);

4) at 200 kPa;

5) at 620 kPa;

6) at 1 380 kPa;

7) at 3 800 kPa.

Perform seven test cycles at each pressure.

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Table 1

Operation	Pressure kPa		Cycles per minute	Total cycle in this condition
	min.[a]	max.		
High-pressure cycle	1 380	3 800	35	1 000
Normal cycle	620	1 380	35	1 000
Low-pressure cycle	200	620	5	1 000

[a] Never let the pressure fall below the indicated minimum pressures.

4.4.5.2 *Performance requirement*

Under each test condition, the leak-rate shall not be greater than the value set in **4.2**.

4.4.6 ***Environmental test at constant high temperature***

4.4.6.1 *Test conditions*

a) Carry out this test on the same cores as passed the low-temperature test (**4.4.5**).

b) Place them in an oven and increase the temperature to + 93 °C. Hold this for 24 h.

c) Cool the samples to + 52 °C and check the airtightness in water at + 52 °C with air at + 52 °C at a pressure of 3 800 kPa.

d) Then follow the test procedure in **4.4.5.1** d).

4.4.6.2 *Performance requirement*

Under each test condition, the leak-rate shall not be greater than the value set in **4.2**.

4.4.7 ***Environmental test at peak temperature***

4.4.7.1 *Test conditions*

a) Carry out this test on the same cores as passed the low-temperature test (**4.4.5**) and constant high-temperature test (**4.4.6**).

b) Place them in an oven and increase the temperature to + 120 °C. Hold this for 20 min.

c) Cool the samples to + 52 °C and check the airtightness in water at + 52 °C with air at + 52 °C at a pressure of 3 800 kPa.

d) Then follow the test procedure in **4.4.5.1** d), 10 times.

4.4.7.2 *Performance requirement*

Under each test condition, the leak-rate shall not be greater than the value set in **4.2**.

5 Tyre valve caps

5.1 Test types

Aircraft tyre valve caps shall be submitted to the following tests:

a) determination of mechanical properties of seal material (**5.3.1**);

b) temperature resistance test (**5.3.2**);

c) ageing test (**5.3.3**);

d) screwing/unscrewing test (**5.3.4**).

5.2 Minimum airtightness requirement

No leakage is acceptable during the various airtightness checks. Leaking caps shall be rejected.

5.3 Test methods

5.3.1 *Mechanical properties of gasket materials*

5.3.1.1 *Test conditions*

a) Determine the following initial properties of the gasket material as indicated:

— breaking strength, in accordance with ISO 37;

— elongation in accordance with ISO 37;

— hardness in accordance with ISO 48 or ISO 868;

— compression set in accordance with ISO 815.

b) Determine the properties of the seal again after oven-ageing at + 93 °C for 7 days.

5.3.1.2 *Performance requirements*

Variations in tensile strength, elongation and hardness characteristics determined after oven-heating shall not differ from initial characteristics by more than the maximum variation values given in Table 2.

Table 2

Characteristic	Increase max.	Decrease max.
Tensile strength	—	20 %
Elongation	—	30 % or 40 % (to be specified)
Shore A hardness	10 %	—

5.3.2 *Temperature resistance test*

5.3.2.1 *Test conditions*

a) Carry out this test on six valve caps.

b) The service temperature range is – 54 °C to + 93 °C with a 24-h holding period at each of these two temperatures.

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c) The cap tightening torque is between 0,56 N·m and 0,79 N·m.

d) The test pressure is up to 3 800 kPa.

5.3.2.2 *Performance requirements*

The requirement in **5.2** shall be met within the temperature and torque tightening range for pressures of up to 3 800 kPa.

5.3.3 ***Ageing test***

5.3.3.1 *Test conditions*

a) Carry out this test on six valve caps.

b) Place the caps in an oven and increase the temperature to + 93 °C. Hold this for 7 days.

5.3.3.2 *Performance requirements*

After oven heating, the requirement in **5.2** shall be met.

5.3.4 ***Screwing/unscrewing test***

5.3.4.1 *Test conditions*

a) Carry out this test on three new caps and three caps aged in accordance with **5.3.3**.

b) Screw the caps down with a torque of 0,56 N·m 10 times, unscrewing them each time, ensuring that the seals break contact with the valve mouth.

Carry out at least five of the screwing/unscrewing cycles at – 54 °C on caps which have been held at this temperature for a minimum of 72 h. The caps shall not be screwed onto the valve body during this 72-h hold period at – 54 °C.

c) Screw the caps which have undergone 10 screwing/unscrewing cycles back onto the valve body and torque them to between 0,56 N·m and 0,79 N·m.

d) Apply a pressure of 70 kPa and hold it for 1 h.

e) Apply a pressure of 3 800 kPa and hold it for 1 h.

f) With the caps still tightened onto the valve body with the same torque, cool them to – 54 °C and hold this temperature for 24 h, applying an internal pressure to the cap of at least 3 800 kPa.

5.3.4.2 *Performance requirements*

The requirement in **5.2** shall be met during stages **5.3.4.1** d), **5.3.4.1** e) and **5.3.4.1** f). In addition, after this test, the seal shall rotate freely within the cap without becoming unseated.

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List of references

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