INTERNATIONAL STANDARD

ISO 6117

Second edition
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Road vehicles — Elastomeric boots for drum-type, hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid (service temperature 100 °C max.)

Véhicules routiers — Capuchons en caoutchouc pour cylindres de roue pour freins hydrauliques à tambour utilisant un liquide de frein à base non pétrolière (température maximale d'utilisation 100 °C)

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6117 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 2, *Braking systems and equipment*.

This second edition cancels and replaces the first edition (ISO 6117:1980), which has been technically revised.

Road vehicles — Elastomeric boots for drum-type, hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid (service temperature 100 °C max.)

1 Scope

This International Standard specifies performance tests for moulded rubber boots used at end closures on drum-type wheel brake cylinders; these boots are designed to prevent the entrance of dirt and moisture which could cause corrosion and otherwise impair wheel brake operation.

It is applicable to boots of both plain and reinforcement insert types, for fitting in wheel cylinders using a fluid in accordance with ISO 4925. It does not include requirements relating to chemical composition, tensile strength or elongation at brake of the rubber compound; it does not cover the strength of adhesion of rubber to the reinforcement in the insert type.

The rubber material used in these boots is suitable for operation in a temperature range of –40 °C to +100 °C.

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

ISO 188:1988, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1431 (all parts), *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking*

ISO 4925, *Road vehicles — Specification of non-petroleum-base brake fluids for hydraulic systems*

ISO 4926, *Road vehicles — Hydraulic brake systems — Non-petroleum base reference fluids*

ISO 4928:1980, *Road vehicles — Elastomeric cups and seals for cylinders for hydraulic braking systems using a non-petroleum base hydraulic brake fluid (Service temperature 120 °C max.)*

3 General requirements

3.1 Workmanship and finish

The moulded boots shall be free from blisters, pin-holes, cracks, protuberances, embedded foreign material, or other physical defects, and shall conform to the dimensions specified on the drawings.

3.2 Marking

The identification mark of the manufacturer and other details as specified on the drawing shall be moulded into each boot where design permits. Each boot in conformity with this International Standard may also have the following mark: “ISO 6117”.

3.3 Packaging

Boots shall be packaged to meet requirements specified by the purchaser.

3.4 Sampling

The minimum lot on which complete specification tests shall be conducted for quality control testing, or the frequency of any specific type test used to control production, shall be agreed upon by the manufacturer and the purchaser.

4 Test requirements

4.1 Resistance to fluid at elevated temperature

After the boots has been subjected to the test for resistance to fluid at elevated temperature as prescribed in 5.3, the change in volume and the change in hardness shall be within the following limits:

— change in volume: −15 % to +15 %;

— change in hardness: −10 IRHD to +10 IRHD.

4.2 High temperature stroking performance

After the high temperature stroking as specified in 5.4, a boot shall be free of flexure cracks which extend through the wall thickness, and shall fit tightly around the cylinder and push rod.

4.3 Low temperature stroking performance

During low temperature stroking as specified in 5.5, a boot shall not crack or separate from its assembled position on the cylinder or become loose on the push rod.

4.4 Tension set performance

After being subjected to the tension set test as specified in 5.6, boots shall show no more than 75 % tension set.

4.5 Heat resistance performance (static)

After the heat resistance test as detailed in 5.7, a boot shall conform to the following requirements:

a) no cracking shall occur when the boot is flexed similarly to service conditions;

b) the change in hardness shall be within the limits −5 IRHD to +10 IRHD;

c) no tackiness shall be evident after removal from the oven.

4.6 Ozone resistance performance

At the end of the 70 h exposure period as detailed in 5.8, test specimens shall be removed from the ozone chamber and examined under 2 × magnification. The surfaces of the test specimens shall show no evidence of cracking, rupture or other deterioration.

5 Test procedures

5.1 Test specimens

Specimens prepared for all tests shall be cut from the same general area of sample. In addition, hardness test specimens shall be prepared in accordance with ISO 48.

5.2 Determination of hardness

The method of determining rubber hardness shall be as described in ISO 48.

Test each specimen submitted; record the range of IRHD.

When the shape of the boot prevents using the method described in ISO 48, an alternative method agreed between manufacturer and purchaser may be substituted. In this case, correlation of the results obtained shall be made to IRHD as in ISO 48.

5.3 Resistance to fluids at elevated temperature

5.3.1 Apparatus

5.3.1.1 Circulating air oven in accordance with ISO 188:1998, 4.1.

5.3.1.2 Screw-top, straight-sided, round glass jar, having a capacity of approximately 250 ml and inner dimensions of approximately 125 mm in height and 50 mm in diameter, and a tinned steel lid (no insert or organic coating).

5.3.2 Test specimens

A section weighting approximately 3 g to 5 g shall be cut from each of two boots.

5.3.3 Test fluid

The brake fluid used for the test shall be the compatibility fluid in accordance with ISO 4926.

5.3.4 Procedure

Rinse the specimens in isopropyl alcohol or its equivalent and wipe dry with a clean, lint-free cloth to remove dirt and packing debris. Do not allow the specimens to remain in the alcohol for more than 30 s.

Determine and record the initial hardness of the test specimens (see 5.2).

Determine the volume of each specimen in the following manner:

Weigh each specimen in air (m_1) to the nearest 0,001 g and then weigh the specimen immersed in distilled water at room temperature (m_2). Quickly dip each specimen in alcohol and then wipe dry with a clean, lint-free cloth.

Immerse two specimens completely in 75 ml of the test fluid in the glass jar and tightly cap the jar.

Place the jar containing the specimens in the oven (5.3.1.1) at 100 °C ± 2 °C for a period of 70 h ± 2 h. At the end of the heating period, remove the jar containing the specimen from the oven and allow to cool to 23 °C ± 5 °C for 60 min to 90 min. At the end of the cooling period, remove the specimens from the jar and rinse in isopropyl alcohol or its equivalent and wipe dry with a clean, lint-free cloth. Do not allow the specimens to remain in the alcohol for more than 30 s.

After removal from the alcohol and drying, place each specimen in a separate, tarred, stoppered weighing bottle and weigh (m_3). Remove each specimen and weigh it immersed in distilled water (m_4) to determine water displacement after hot fluid immersion.

Determine the final volume and hardness of each specimen within 60 min after rinsing in alcohol.

5.3.5 Expression of results

5.3.5.1 Volume change shall be reported as a percentage of the original volume. The percentage change in volume is given by the formula:

$$\frac{(m_3 - m_4) - (m_1 - m_2)}{(m_1 - m_2)} \times 100$$

where

m_1 is the initial mass, in grams, in air;

m_2 is the initial apparent mass, in grams, in water;

m_3 is the mass, in grams, in air after immersion in test fluid;

m_4 is the apparent mass, in grams, in water after immersion in test fluid.

5.3.5.2 Change in hardness shall be determined and recorded.

5.3.5.3 The specimens shall be examined for disintegration as evidenced by blisters or sloughing (carbon black).

5.4 High temperature stroking test

5.4.1 Apparatus

5.4.1.1 Circulating air oven as specified in ISO 188:1998, 4.1.

5.4.1.2 Stroking fixtures as shown in ISO 4928:1980, Figure 1.

5.4.2 Test specimen

Two boots shall be used as test specimens.

5.4.3 Procedure

Install two sample wheel cylinder boots on the cylinder for which they are designed, or equivalent. Then mount the cylinder in the actuator assembly, set to operate at (1 000 ± 100) strokes per hour with a stroke length of 4,8 mm ± 0,5 mm.

Then place the cylinder assembly in the oven (5.4.1.1) and actuate for 70 h ± 2 h at 100 °C ± 2 °C. After the actuation of the assembly, remove it from the oven, allow to cool to room temperature, and examine the boots for flexure cracks and general appearance.

5.5 Low temperature stroking test

5.5.1 Apparatus

5.5.1.1 **Cold chamber**, in which the test specimens are exposed to the low temperature, of sufficient size to contain the apparatus assembled with test specimens, and so arranged as to permit the operator to check and operate it without removal from the chamber.

It shall be capable of maintaining a uniform atmosphere of cold dry air within the specified temperature range of −40 °C to −43 °C.

5.5.1.2 **Stroking fixtures** as shown in ISO 4928:1980, Figure 1.

5.5.2 Test specimen

Two boots shall be used as test specimens.

5.5.3 Procedure

Install the sample wheel cylinder boots on the cylinder for which they are designed, or equivalent. Place the test boots and test apparatus in the cold chamber (see 5.5.1.1) and expose them to temperature of −40 °C to −43 °C for 22 h ± 1 h. After 22 h ± 1 h of low temperature exposure, stroke the boots with the stroking apparatus for six strokes with length 4,8 mm ± 0,5 mm, at intervals of 30 s, without removal from the cold chamber.

5.6 Tension set test

5.6.1 Apparatus

5.6.1.1 **Circular stretching mandrels**, having a diameter which will expand by $15\,^{0}_{-3}$ % one or the other of the sealing ends attached to the wheel cylinder or to the actuating rod.

The mandrel diameter (d_3) is calculated as 115 % of the moulded diameter of the chosen boot end. The moulded diameter shall be calculated from the average of two measurements made at right angles to one another on a contour projector. The mandrel shall be provided with a smooth lead-in chamfer to prevent cutting of the rubber and shall itself have a polished machine finished (16 Ra maximum).

5.6.1.2 Circulating air oven as specified in ISO 188:1998, 4.1.

5.6.2 Test specimens

Three boots shall be used as test specimens.

5.6.3 Procedure

5.6.3.1 Measure accurately and record the inside diameter (d_1) of the ends of three specimen boots. Assemble on the stretching mandrels (5.6.1.1). Place the assemblies in the oven (5.6.1.2) and age for 70 h ± 2 h at 100 °C ± 2 °C. Remove the assemblies and cool at room temperature for 1 h. Remove the boots. Allow to recover for between 30 min and 1 h. Again measure and record the diameter (d_2).

5.6.3.2 The tension set as a percentage of the original stretch deflection is given by the formula:

$$\frac{d_2 - d_1}{d_3 - d_1} \times 100$$