INTERNATIONAL STANDARD ISO 4927

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Road vehicles — Elastomeric boots for drum type hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid (Service temperature 120 °C maximum)

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 120 °C)

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4927 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in June 1976.

It has been approved by the member bodies of the following countries :

Australia	Iran	South Africa, Rep. of
Austria	Italy	Spain
Belgium	Japan	Sweden
Brazil	Korea, Rep. of	Switzerland
Bulgaria	Mexico	United Kingdom
Chile	Netherlands	U.S.A.
Czechoslovakia	New Zealand	U.S.S.R.
France	Philippines	Yugoslavia
Germany	Poland	
Hungary	Romania	

No member body expressed disapproval of the document.

Printed in Switzerland

Road vehicles — Elastomeric boots for drum type hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid (Service temperature 120 °C maximum)

1 SCOPE

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

2 FIELD OF APPLICATION

This International Standard applies 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 break of the rubber compound; it does not cover the strength of the adhesion of rubber to the reinforcement in the insert type.

The rubber material used in these boots is classified as suitable for operation in a temperature range of − 40 °C to + 120 °C.

3 REFERENCES

ISO 48, *Vulcanized rubbers — Determination of hardness (Hardness between* 30 *and* 85 IRHD*)*.

ISO 188, *Rubber, vulcanized — Accelerated ageing or heat resistance tests.*

ISO 1431, *Vulcanized rubbers — Determination of resistance to ozone cracking under static conditions.*

ISO 4925, *Road vehicles — Non-petroleum base hydraulic brake fluid.*

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

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

ISO . . ., *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)]

ISO . . ., *Road vehicles — Elastomeric boots for drum type hydraulic brake wheel cylinders using a petroleum base hydraulic brake fluid.*[1)]

4 GENERAL REQUIREMENTS

4.1 Workmanship and finish

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

4.2 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 4927".

4.3 Packaging

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

4.4 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.

5 TEST REQUIREMENTS

5.1 Resistance to fluids at elevated temperatures

After the boot has been subjected to the test for resistance to fluids at elevated temperatures as prescribed in 6.4, the change in volume and the change in hardness shall be within the following limits :

change in volume : − 10 to + 15 %;

change in hardness : − 10 to + 10 IRHD.

1) In preparation.

5.2 Heat stroking test

After stroking as specified in 6.5, a boot shall be free of flexure cracks which extend through the wall thickness, and shall fit tightly around the cylinder and push rod.

5.3 Low temperature stroking test

During stroking as specified in 6.6, a boot shall not crack or separate from its assembled position on the cylinder or become loose on the push rod.

5.4 Tension set test

After being subjected to the tension set test prescribed in 6.7, boots shall show no more than 75 % tension set.

5.5 Heat resistance test (static)

After the heat resistance test as detailed in 6.8, 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 to + 10 IRHD;

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

5.6 Ozone resistance test

At the end of the 70 h exposure period as detailed in 6.9, test specimens shall be removed from the ozone chamber and examined under 2 X magnification. The surfaces of the test specimens shall show no evidence of cracking, rupture or other deterioration.

6 TEST PROCEDURES

6.1 Test specimens

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

6.2 Test fluid

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

6.3 Hardness

The referee method of determining rubber hardness shall be as specified in ISO 48. Another procedure, as agreed upon between manufacturer and purchaser, may be used.

Test each specimen submitted; record the range of IRHD.

6.4 Resistance to fluids at elevated temperature

6.4.1 *Apparatus*

6.4.1.1 Circulating air oven as specified in ISO 188 (subclause 3.2.2).

6.4.1.2 Screw-top, straight-sided, round glass jar[1], 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).

6.4.2 *Test specimens*

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

6.4.3 *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 6.3).

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 the 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 (6.4.1.1) at 120 ± 2 °C for a period of 70 ± 2 h. At the end of the heating period, remove the jar containing the specimens from the oven and allow to cool to 23 ± 5 °C for 60 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.

1) Suitable effect-on-rubber test jars and tinned lids can be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pa. 15096 U.S.A.

After removal from the alcohol and drying, place each specimen in a separate, tared, 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.

6.4.4 *Expression of results*

6.4.4.1 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.

6.4.4.2 Change in hardness shall be determined and recorded.

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

6.5 High temperature stroking test

6.5.1 *Apparatus*

6.5.1.1 Circulating air oven as specified in ISO 188 (subclause 3.2.2).

6.5.1.2 Stroking fixtures as shown in figures 1 and 2 of ISO 4928.

6.5.2 *Test specimens*

Two boots shall be used as test specimens.

6.5.3 *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 strokes with a stroke length of 4,75 ± 0,25 mm.

Then place the cylinder assembly in the oven (6.5.1.1) and actuate for 22 ± 1 h at 120 ± 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.

6.6 Low temperature stroking test

6.6.1 *Apparatus*

6.6.1.1 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 to − 43 °C.

6.6.1.2 Stroking fixture, as shown in figure 4 of ISO 4928.

6.6.2 *Test specimens*

Two boots shall be used as test specimens.

6.6.3 *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 (6.6.1.1) and expose them to a temperature of − 40 to − 43 °C for 70 ± 2 h. After 70 ± 2 h of low temperature exposure, stroke the boots with the stroking apparatus for six strokes, at intervals of 30 s, without removal from the cold chamber.

6.7 Tension set test

6.7.1 *Apparatus*

6.7.1.1 Circular stretching mandrels, having a diameter which will expand by 15 % 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 finish (16 CLA maximum).

6.7.1.2 Circulating air oven as specified in ISO 188 (subclause 3.2.2).

6.7.2 *Procedure*

6.7.2.1 Measure accurately and record the inside diameters (d_1) of the ends of three specimen boots. Assemble on the stretching mandrels (6.7.1.1). Place the assemblies in the oven (6.7.1.2) and age for 70 ± 2 h at 120 ± 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).

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

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

where

d_1 is the unaged inside diameter, in millimetres, of the boot;

d_2 is the aged inside diameter, in millimetres, of the boot;

d_3 is the diameter, in millimetres, of the stretching mandrel.

6.7.3 Not less than three specimens shall be tested in the above manner and the average of the three results shall be reported.

6.8 Heat resistance test (static)

6.8.1 *Apparatus*

Circulating air oven as specified in ISO 188 (subclause 3.2.2).

6.8.2 *Procedure*

Select two sample boots for the heat resistance test. Determine the initial hardness of the boots as detailed in 6.3. Suspend the test specimens in the oven for 22 ± 1 h at 120 ± 2 °C. Remove them from the oven, allow to cool for 16 to 96 h at room temperature, then check for hardness, flexibility and tackiness.

6.9 Ozone resistance test

6.9.1 *Apparatus*

6.9.1.1 Ozone chamber, as described in ISO 1431, capable of maintaining an ozone concentration of 50 pphm.

6.9.1.2 Stretching mandrel (see 6.7.1).

6.9.2 *Test specimens*

Test specimens shall be two boots.

6.9.3 *Procedure*

Assemble the boots on the stretching mandrels (6.7.1.1) (which will provide $15^{\ 0}_{-3}$ % stretch in the boot bead section) and allow to rest for 22 ± 1 h at room temperature, then subject the boots installed on the mandrels to an ozone concentration of 50 ± 5 pphm by volume at 40 ± 2 °C for 70 ± 2 h.

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