INTERNATIONAL STANDARD 4929

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

Road vehicles — Diaphragm gaskets for hydraulic brake master cylinder reservoirs using a non-petroleum base hydraulic brake fluid

Véhicules routiers — Joints à diaphragme pour réservoirs de maîtres-cylindres de freins hydrauliques utilisant un liquide de frein à base non pétrolière

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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 4929 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.
Germany	Philippines	Yugoslavia
Hungary	Poland	
India	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

France

Printed in Switzerland

Road vehicles — Diaphragm gaskets for hydraulic brake master cylinder reservoirs using a non-petroleum base hydraulic brake fluid

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies performance requirements and test methods for diaphragm gaskets of hydraulic brake master cylinder reservoirs to be used on road vehicles; these gaskets provide a seal and protection from water and contamination from external sources.

2 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 rubber — Determination of resistance to ozone cracking under static conditions.*

ISO 1817, *Vulcanized rubbers — Resistance to liquids — Methods of test.*

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.).*

ASTM D 91, *Test for precipitation number of lubricating oils.*

ASTM E 145, *Specification for gravity-convection and forced-ventilation ovens.*

NOTE — The ASTM references will be replaced by ISO references when the latter become available.

3 GENERAL REQUIREMENTS

3.1 Composition

The materials used in the diaphragm gaskets shall be a rubber elastomer or combination of elastomers and moisture barrier materials suitable for use with road vehicle brake fluid complying with ISO 4925.

3.2 Workmanship and finish

Diaphragms shall be free from blisters, pin-holes, cracks, protuberances, embedded foreign material or other physical defects which can be detected by thorough inspection; they shall conform to the dimensions specified on the drawings.

3.3 Marking

The identification mark of the manufacturer and other details as specified on the drawing shall be moulded into each diaphragm gasket. Each gasket complying with this International Standard may also have the following mark : "ISO 4929".

3.4 Packaging

Diaphragm gaskets shall be packaged to meet requirements specified by the purchaser.

3.5 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 CLASSIFICATION OF TESTS

4.1 Qualification tests

The qualification tests shall include all tests specified herein.

4.2 Lot acceptance tests

Quality control tests for production lot acceptance shall include tests specified in 5.1.2, 5.3 and 5.4.

4.3 Sampling and test frequency

The quantity of parts and the frequency of qualification tests and lot acceptance tests used to control production shall be agreed upon by the manufacturer and the purchaser.

5 PHYSICAL REQUIREMENTS

5.1 Rubber hardness

5.1.1 *Qualification*

When tested as specified in 6.1, the rubber hardness shall be within the limits of 45 to 67 IRHD. Hardness determinations from any one lot shall not vary more than ± 5 IRHD.

5.1.2 *Lot acceptance*

When tested as specified in 6.1, the rubber hardness shall be equal to the qualifying value within ± 5 IRHD, providing it is within the limits of 45 to 67 IRHD.

5.2 Heat resistance test (static) at elevated temperature (100 °C)

After being subjected to the test for accelerated ageing at 100 °C in accordance with 6.2, the diaphragm material shall conform to the following requirement :

Lot acceptance : Change in hardness 0 to + 10 IRHD.

5.3 Low temperature flexibility at – 40 °C

After the low temperature test as specified in 6.3, the diaphragm shall not crack and shall return to its approximate original shape within 1 min.

NOTE – Residual kinking of some convolutions shall not be cause for rejection.

5.4 Resistance to fluids at elevated temperature (120 °C)

After being subjected to the test for resistance to fluids at elevated temperature in accordance with 6.4, the diaphragm materials shall conform to the following requirements :

Lot acceptance

Change in hardness : – 10 to + 5 IRHD

Change in volume : – 10 to + 20 %

Precipitation : not more than 0,3 % sediment by volume shall be formed in the centrifuge tube after the diaphragm materials have been tested as specified in 6.4.4.

5.5 Ozone resistance

After being tested in accordance with 6.5, the surface of the diaphragm shall show no cracking, rupture, or other deterioration when examined under 2X magnification.

5.6 Heat pressure stroking

After being subjected to the heat pressure stroking test as specified in 6.6, there shall be no fluid dampness on the top surface of the diaphragm except where there is contact with metal.

5.7 Functional design test

After being subjected to the functional design test as specified in 6.7, the convolutions of the diaphragm shall be fully extended, or the brake fluid level in the master cylinder reservoir shall not be more than 3,2 mm above the master cylinder porting.

6 TEST PROCEDURES

6.1 Rubber hardness

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

Test each specimen submitted for test; record the range of hardness in IRHD.

Sample diaphragms, segments thereof, or specimens mutually acceptable to manufacturer and purchaser shall be plied together as necessary to provide the test thickness. The same operator shall make all hardness determinations for any one test.

6.2 Accelerated ageing at 100 °C

6.2.1 *Rubber hardness change*

6.2.1.1 APPARATUS

Circulating air oven as specified in ISO 188 (sub-clause 3.2.2).

6.2.1.2 PROCEDURE

Rinse the sample diaphragms, specimen sections thereof, or accepted specimens in isopropyl alcohol or its equivalent and wipe dry with a 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 rubber hardness of unaged test specimens as specified in 6.1. Place new test specimens in the oven (6.2.1.1), and maintain for 70 h at 100 ± 2 °C. Remove the specimens from the oven, place on a clean, dry table top and allow to cool to 23 ± 5 °C for 16 to 96 h. Retest the specimens for hardness as specified in 6.1.

6.3 Low temperature flexibility

6.3.1 *Apparatus*

Cold chamber, capable of being maintained at – 40 to – 43 °C, of sufficient size to allow the test to be carried out without removal of the specimen.

6.3.2 *Procedure*

Rinse the sample diaphragms or accepted specimens in isopropyl alcohol or its equivalent and wipe dry with a lint-free cloth. Do not allow the specimens to remain in the alcohol for more than 30 s.

Place a specimen in the cold chamber and maintain for 22 h at −40 to −43 °C. Bend the specimen through 180° around a 6,3 mm diameter mandrel, conditioned at the test temperature, and release immediately. Note the time required for the part to return to its approximate original shape. (Bend the cold specimen while in the cold chamber, with cold gloves, to prevent heating by the fingers.)

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*

Sample diaphragms or acceptable specimens providing a suitable sample size shall be used for the rubber hardness, volume change and precipitation tests.

The specimens shall be stabilized at room temperature and then rinsed in isopropyl alcohol or its equivalent and wiped dry with a lint-free cloth to remove dirt and packing debris. Do not allow the specimens to remain in the alcohol for more than 30 s.

6.4.3 *Rubber hardness and volume change*

Select two test specimens for test. Determine and record the initial rubber hardness in accordance with 6.1.

Determine and record the volume of the same two specimens in accordance with ISO 1817, using the water displacement method. Then dip the specimens in alcohol to remove the water and dry with a lint-free cloth. Immediately after drying, place each specimen in a glass jar and completely immerse in 75 ml of the compatibility fluid specified in ISO 4926.

Seal the jars to prevent vapour loss, place in the oven (6.4.1.1) and maintain at 120 ± 2 °C for 70 h. At the end of the heating period, remove the jars containing the specimens from the oven and allow to cool at 23 ± 5 °C for 60 to 90 min. Then remove the specimens from their jars, rinse the specimens in isopropyl alcohol and wipe dry with a lint-free cloth.

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

Carry out the weighings as the last operation before and the first operation after the immersion in brake fluid and follow these by making a rubber hardness determination.

Calculate the volume change in accordance with ISO 1817 as follows to determine conformity with 5.4 :

$$\% \text{ change in volume} = \frac{(m_3 - m_4) - (m_1 - m_2)}{(m_1 - m_2)} \times 100$$

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 *Precipitation*

6.4.4.1 APPARATUS

6.4.4.1.1 Glass containers of capacity approximately 250 ml and diameter 50 mm, which can be tightly sealed.

6.4.4.1.2 Cone-shaped centrifuge tube of capacity 100 ml.

6.4.4.1.3 Oven, uniformly heated dry air type, conforming to the requirements for type II A of ASTM E 145.

6.4.4.2 TEST SPECIMENS

From two or more diaphragms to be tested, obtain a sample of mass 4,0 ± 0,5 g. Since sizes of diaphragms may vary, small pieces may be cut from them to arrive at the total mass. Use the minimum number of pieces to obtain a mass of 4,0 ± 0,5 g.

6.4.4.3 PROCEDURE

To determine the precipitation characteristics of the test diaphragms, place the sample (6.4.4.2) in a suitable glass container (6.4.4.1.1) containing 75 ml of the compatibility fluid specified in ISO 4926. Seal the container to prevent vapour loss and place in an oven (6.4.4.1.3) at 120 ± 2 °C for 70 h.

Optional test : A blank test may be carried out on the brake fluid prior to the test and any sediment from the blank test may be subtracted from the amount of sediment obtained from the test.

At the end of the heating period, remove the container from the oven. Allow to cool at room temperature for 24 h, after which remove the diaphragm specimens.

Agitate the contents of the jar thoroughly and transfer to a cone-shaped centrifuge tube (6.4.4.1.2) and determine the sediment as described in paragraphs 5 and 6 of ASTM D 91.

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.

6.5 Ozone resistance

6.5.1 *Apparatus*

Ozone test chamber, as described in ISO 1431 and capable of maintaining an ozone concentration of 50 pphm by volume.

6.5.2 *Test specimens*

The diaphragm test specimens shall be segments cut from the gasket area of the diaphragm or any substantially flat area.

6.5.3 *Procedure*

Mount the specimens flat and clamp at each end to provide a 15 % stretch. Allow them to rest in this position for 22 h at room temperature and then expose them in the test chamber (6.5.1) to an ozone concentration of 50 ± 5 pphm by volume at 40 ± 2 °C for a period of 70 h.

6.6 Heat pressure stroking

6.6.1 *Apparatus*

6.6.1.1 Circulating air oven as specified in ISO 188 (subclause 3.2.2). The oven shall suitably contain the master cylinder as mounted on the stroking fixture.

6.6.1.2 Stroking fixture : a pressure stroking device for actuating a master cylinder containing the specimen, at a rate of 1 000 ± 50 strokes/h and providing a master cylinder piston movement of 90 % of the total available master cylinder stroke or 60 mm maximum. It shall conform in general to the stroking test apparatus described in ISO 4928 except that provision shall be made to return fluid from the bypass valve to the master cylinder reservoir below the diaphragm.

6.6.2 *Procedure*

Assemble a master cylinder designed for use with the test diaphragm on the stroking fixture and connect it to a displacement apparatus which allows the master cylinder primary cup(s) to pass over the compensating port(s) at a pressure not exceeding 1 MPa. Make provision to return the fluid from the bypass valve to the master cylinder reservoir with the compatibility fluid specified in ISO 4926 and install the test diaphragm and cap correctly.

Actuate the system for 70 h with the fluid temperature in the master cylinder maintained at 120 ± 2 °C. At the termination of the 70 h stroking period, shut off the heat with the master cylinder in the off position. After a 1 h cooling period, disconnect the fluid line from the master cylinder and remove the cylinder from the oven. After an additional cooling period of 21 h, disassemble the master cylinder reservoir cover and inspect the top of the diaphragm for dampness.

6.7 Functional design test

6.7.1 *Apparatus*

A brake master cylinder of the proper configuration to accept the test diaphragm.

6.7.2 *Procedure*

Fill the master cylinder reservoir and cylinder bore with the compatibility fluid specified in ISO 4926 and install the test diaphragm. Connect the master cylinder outlet port(s) to an open reservoir 30 cm below the master cylinder. Actuate the master cylinder at room temperature at a rate not exceeding 200 strokes/h until hydraulic brake fluid is no longer expelled from the master cylinder outlet(s). Then remove the cover from the master cylinder and note the deflection of the diaphragm and fluid level in the reservoir.

NOTE — An inspection hole may be made through the master cylinder cover to facilitate inspection of the diaphragm pleating and deflection.

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