# International Standard 7632

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

# Road vehicles — Elastomeric seals for hydraulic disc brake cylinders using a petroleum base hydraulic brake fluid (service temperature 120 °C max.)

*Véhicules routiers — Joints en caoutchouc pour cylindres de freins hydrauliques à disque utilisant un liquide de frein à base pétrolière (température maximale d'utilisation 120 °C)*



**First edition — 1985-06-15**



**UDC 629.113-592.2 : 678.06 : 621-762** **Ref. No. ISO 7632-1985 (E)**

**Descriptors** : road vehicles, braking systems, hydraulic brakes, disk brakes, hydraulic cylinders, rubber products, seals (stoppers), O-ring seals, tests, performance tests, marking.



Price based on 6 pages

## 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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.



International Standard ISO 7632 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.





Printed in Switzerland

# Road vehicles — Elastomeric seals for hydraulic disc brake cylinders using a petroleum base hydraulic brake fluid (service temperature 120 °C max.)

## 1 Scope

This International Standard specifies the performance test methods and requirements for elastomeric seals used in road vehicle disc brake cylinders, for use with petroleum base brake fluid.



## 2 Field of application

This International Standard applies to solid section type seals (square, rectangular, O-ring) mounted stationary in the cylinder bore or on the movable piston of disc brakes.



These elastomeric seals shall be suitable for operation in a temperature range of −40 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 1817, *Vulcanized rubber — Determination of the effect of liquids.*

ISO 7309, *Road vehicles — Hydraulic braking systems — ISO Reference petroleum base fluid.*

ISO 7631, *Road vehicles — Elastomeric cups and seals for cylinders for hydraulic braking systems using a petroleum base hydraulic brake fluid (service temperature* 120 °C *max.).*

## 4 Product requirement

### 4.1 Quality and finish

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

### 4.2 Marking

**4.2.1** Each seal shall bear a green mark specifying that it refers to a category of seals for use with a petroleum base brake fluid.

**4.2.2** The identification green mark can be ink or tinted elastomer.

**4.2.3** The place and type of green mark shall be the subject of an agreement between buyer and seller.

**4.2.4** The green mark shall entail neither extra thickness nor alteration of material characteristics; it shall remain during all handling, before bringing the seal into use.

## 5 Brake test fluid

The test fluid shall be the reference fluid as defined in ISO 7309.

## 6 Apparatus

### 6.1 Resistance to fluid at elevated temperature, physical stability and precipitation characteristics

**6.1.1 Oven,** uniformly heated, dry air type conforming to the requirements of ISO 188.

**6.1.2 Test jar,** screw-top, straight-sided, round glass type, having a capacity of 250 ± 10 ml and inner dimensions of approximately 125 mm height and 50 mm diameter, with a tinned steel lid (no insert or organic coating).

### 6.2 High temperature stroking test

Apparatus as illustrated in figure 1 with oven in accordance with 6.1.1.

### 6.3 Low temperature leakage test

Apparatus as illustrated in figure 2.

## 7 Test requirements

**7.1** After the test for resistance to fluid at elevated temperature — physical stability (see clause 9), the seals shall conform to the following requirements.

**7.1.1** Any change in volume shall be within 0 to +15 %.

**7.1.2** Any change in hardness shall be within −7 to +8 IRHD.

**7.2** After the test for resistance to fluid at elevated temperature — precipitation characteristics (see clause 10), not more than 0,3 % sediment by volume shall be formed in the test fluid used.

**7.3** After the test for resistance to elevated temperature in dry air (see clause 11), the seals shall conform to the following requirements.

**7.3.1** Any change in hardness shall be within 0 to +20 IRHD.

**7.3.2** Seal condition : test specimens shall show no evidence of blistering, cracking, or change in shape from original.

**7.4** After the ambient temperature stroking test (see clause 12), seals and assembly shall conform to the following requirements.

**7.4.1** No leakage beyond normal wetting of the bore(s) shall occur during the stroking test.

**7.4.2** No leakage beyond normal wetting of the bore(s) shall occur during the static leak test in 12.2.6.

**7.5** After the high temperature stroking test (see clause 13), the seals and assembly shall conform to the following requirements.

**7.5.1** No leakage beyond normal wetting of the bore(s) shall occur during the stroking test.

**7.5.2** No leakage beyond normal wetting of the bore(s) shall occur during the static leak test in 13.2.9.

**7.6** After the low temperature leakage test (see clause 14), the seals and assembly shall conform to the following requirements.

**7.6.1** No leakage beyond normal wetting of the bore(s) shall occur during the test period or pressure application.

**7.7** After the cycling humidity storage corrosion test (see clause 15), the seals and assembly shall conform to the following requirements.

**7.7.1** No evidence of rubber adhesion of the test seal(s) shall appear during disassembly of the test brake.

**7.7.2** No surface of the sealing systems shall show evidence of corrosion or deterioration which would interfere with proper sealing action. Normal staining or discoloration of metal parts is acceptable if surface finish is unaffected.

**7.8** After all tests, disassemble the cylinder and inspect the seal. Record the visual condition of the seal, bore and piston. Seals shall not show excessive deterioration such as scoring, scuffing, blistering, or change in shape from original.

## 8 Preparation of test specimens

All seals to be tested shall be cleaned prior to testing by rinsing in hexane and blown dry or wiped dry with a lint-free cloth. Seals shall not remain in the hexane for more than 10 s.

## 9 Resistance to fluid at elevated temperature — Physical stability

### 9.1 Test specimens

From three or more seals to be tested, obtain a sample of mass 3 to 5 g.



### 9.2 Procedure



**9.2.1** Determine and record the initial volume of the sample in accordance with ISO 1817.

**9.2.2** Determine and record the initial IRHD hardness of the sample. Measure hardness as described in ISO 48 using a microtester (or according to a procedure previously agreed upon between vendor and purchaser).

**9.2.3** Place the sample in the test jar (6.1.2) and completely immerse in 75 ml of brake test fluid (see clause 5). Seal the test jar to prevent vapour loss and place in the oven (6.1.1) at 120 ± 2 °C for 70 h.

**9.2.4** After 70 h, remove the test jar from the oven and allow the sample to cool in the test jar at 23 ± 5 °C for 60 to 90 min. At the end of the cooling period, remove the sample from the test jar, rinse in hexane and wipe dry with a clean, lint-free cloth.

Do not allow the sample to remain in the hexane for more than 10 s.

**9.2.5** Determine and record within 60 min the final volume and IRHD hardness of each seal in accordance with 9.2.1 and 9.2.2.

**9.2.6** The change in volume is given, as a percentage of the original volume, 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.

## 10 Resistance to fluid at elevated temperature — Precipitation characteristics

### 10.1 Test specimens

From two or more seals to be tested, obtain a sample of 4 ± 0,5 g. Since whole seals are quite large, small pieces may be cut from the seal to reach the required mass. Use a minimum number of pieces to obtain a mass of 4 ± 0,5 g.

### 10.2 Procedure

**10.2.1** Place the sample in a test jar (6.1.2) and cover with 75 ml of the test fluid (see clause 5). Seal the test jar to prevent vapour loss and place in the oven (6.1.1) at 120 ± 2 °C. (Optional : a blank test may be conducted on the brake fluid prior to the test, and any sediment resulting from this blank test may be deducted from the volume of sediment obtained after the test.)



**10.2.2** After 70 h, remove the test jar from the oven. Allow the sample to remain in the fluid at room temperature for 24 h, then shake the test fluid and pour into a cone-shaped centrifuge tube.

**10.2.3** Rotate the centrifuge tube for 30 min at 1 500 $min^{-1}$. Note the volume of sediment observed in the tube. Repeat the above rotation for an additional 30 min and record any difference in volume of sediment.

**10.2.4** Record the percentage amount of sediment obtained after the second centrifuging.

## 11 Resistance to elevated temperature in dry air

### 11.1 Test specimens

Two or more seals shall be used.

### 11.2 Procedure

**11.2.1** Measure and record the IRHD hardness of each in accordance with 9.2.2.

**11.2.2** Place the test seals in a circulating air oven, as described in ISO 188, and maintain at 120 ± 2 °C for 70 h.

**11.2.3** At the termination of the heating period, remove the seals from the oven and allow to cool for 16 to 96 h at room temperature.

**11.2.4** After cooling, measure and record the IRHD hardness in accordance with 9.2.2 and note any visual change such as cracking, blistering, distortion, etc.

## 12 Ambient temperature stroking

### 12.1 Test specimen

Adequate test seals for at least one complete cylinder shall be prepared.

### 12.2 Procedure

**12.2.1** Moisten the seals and cylinder bores with brake test fluid (see clause 5). Install the test seals in the cylinder.

**12.2.2** Complete test cylinder assembly, placing the piston to simulate a half-worn lining position.

**12.2.3** Mount the test cylinder assembly on a production hub and disc assembly or equivalent simulating fixture.

**12.2.4** Connect the test fixture to the pressure source. It may be necessary or desirable to include a fluid accumulator (see ISO 7631).

**12.2.5 Test parameters**

**12.2.5.1** Temperature : 18 to 32 °C.

**12.2.5.2** Pressure : Apply pressure by external means at a maximum rate of pressure rise of 21,0 ± 1,4 MPa/s from 0 to 7,0 ± 0,3 MPa.

**12.2.5.3** Cycles required : 500 000 total.

**12.2.5.4** Cycle rate : 3 600/h ± 10 %.

**12.2.6 Leakage test**

Observe leakage during and after the stroking test. After completion of the stroking test, run high and low pressure leak tests.

**12.2.6.1** High pressure leak test

Apply 0,7 MPa hydraulic pressure for 5 min and observe and record leakage, if any.

**12.2.6.2** Low pressure leak test

Remove the cylinder from the test stand and connect the test cylinder to a pressure source at 10 ± 1,75 kPa for 24 h. Observe leakage, if any.

NOTE — The pressure source may be a static column of fluid. A 1 200 mm column will provide 10 kPa.

**12.2.7** Disassemble the cylinder and inspect the seal. Record the visual condition of the seal, bore and piston. Seals shall not show excessive deterioration such as scoring, scuffing, blistering, cracking, or change in shape from original.

## 13 High temperature stroking test

### 13.1 Test specimens

Adequate test seals for at least one complete cylinder shall be prepared.

### 13.2 Procedure

**13.2.1** Moisten the seals and cylinder bores with brake test fluid (see clause 5). Install the test seals in the cylinder.

**13.2.2** Complete test cylinder assembly, placing the piston to simulate a half-worn lining position.

**13.2.3** Mount the test cylinder assembly on a production hub and disc assembly or equivalent simulating fixture.

**13.2.4** Place the complete test fixture in an oven conforming to clause 4 of ISO 188 (see also figure 1).

**13.2.5** Connect to the pressure device.

The device may be composed of a pneumatically or hydraulically actuated automotive type master cylinder the rate of operation of which shall be set at 1 000 ± 100 strokes/h.

The test fixture shall be connected to the actuating pressure device and arranged so as to yield a maximum rate-of-pressure rise of 7,0 MPa/s, and a minimum dwell period below 0,18 MPa of 0,25 s. (It may be found necessary to install a fluid accumulator, such as a standard wheel cylinder as in ISO 7631, to meet the required pressure/displacement curve.)

#### 13.2.6 Test parameters

**13.2.6.1** Temperature : 120 ± 2 °C.

**13.2.6.2** Pressure : 7,0 ± 0,3 MPa at a rate-of-pressure rise of 7,0 MPa/s max.

**13.2.6.3** Elapsed time : 70 h.

**13.2.6.4** Cycles required : 70 000 ± 5 000.

**13.2.7** After 70 h, discontinue stroking, shut off the heat, open the oven door, release hydraulic pressure in the system and allow the oven to cool for 60 min. The circulating fan may be left on to aid in cooling.

**13.2.8** After a 60 min cooling period, remove the test assembly and allow it to complete cooling in the open air for 25 ± 5 h.

#### 13.2.9 Leakage test

Observe leakage during and after the 70 h stroking test. After completion of the 25 h cooling period, carry out a high and low pressure leak test.

**13.2.9.1** High pressure leak test

Apply 0,7 MPa hydraulic pressure for 5 min and observe and record leakage, if any.

**13.2.9.2** Low pressure leak test

Remove the cylinder from the test stand and connect the test cylinder to a pressure source at 10 ± 3,3 kPa for 24 h. Observe leakage, if any.

NOTE — The low pressure source may be a static column of fluid. A 1 200 mm column will provide 10 kPa.

**13.2.10** Disassemble the cylinder and inspect the seal. Record the visual condition of the seal, bore and piston. Seals shall not show excessive deterioration such as scoring, scuffing, blistering, cracking or change in shape from original.



## 14 Low temperature leakage test

### 14.1 Test specimens

Adequate test seals for at least one complete cylinder shall be prepared.

### 14.2 Procedure

**14.2.1** Moisten the seals and cylinder bores with brake test fluid (see clause 5). Install the test seals in the cylinder.

**14.2.2** Complete the test cylinder assembly, placing the piston to simulate a new lining position. Arrangements shall be made to change the piston position during the cold test to simulate new, half, two-thirds, and fully worn lining positions.

**14.2.3** Mount the test cylinder assembly on a production hub and disc assembly or equivalent simulating fixture.

**14.2.4** Place the test fixture in a cold chamber at −40 to −43 °C and connect to the pressure source as shown in figure 2. The pressure source shall be located to provide a static reservoir head of 300 to 600 mm.

**14.2.5** Allow the cylinder to soak for 72 h with the piston in the new lining position.

**14.2.6** After 72 h, operate the stroking mechanism six times at 1 ± 0,07 MPa followed by six times at 4,2 ± 0,35 MPa. The strokes shall be held for approximately 5 s and applied ap-

proximately 60 s apart. Immediately after stroking, remove the first shims and by means of the stroking mechanism, move the pistons into half-worn lining position using minimum line pressure to establish the new location for all pistons. Observe and record leakage, if any, 30 min after the new position is established. Allow the test cylinder to continue to soak for 24 h.

**14.2.7** After 96 h total soaking time, repeat 14.2.6, but at the two-thirds worn lining position.

**14.2.8** After 120 h total soaking time, repeat 14.2.6, but at the fully worn lining position; discontinue the test 30 min after establishing final piston position.

**14.2.9** Disassemble the cylinder and inspect the seal. Record the visual condition of the seal, bore and piston. Seals shall not show excessive deterioration such as scoring, scuffing, blistering, cracking, or change in shape from original.

## 15 Cycling humidity storage corrosion test

### 15.1 Test specimens

Adequate test seals for at least one complete cylinder shall be prepared.

### 15.2 Procedure

**15.2.1** Moisten the seals and cylinder with ISO reference petroleum base hydraulic fluid (see ISO 7309). Install the test seals in the cylinder.

**15.2.2** Complete the test cylinder assembly, placing the piston to simulate a half-worn lining position. The cylinder assembly need not be assembled to a hub or test fixture as long as provisions are made to hold the pistons in their correct positions and boots are properly installed.

**15.2.3** Place the test cylinder in a humidity chamber capable of maintaining 95 ± 2 % relative humidity and a temperature range of 21 to 46 °C. The cylinder should be placed with the inlet port open and facing down.

**15.2.4** Maintain the cylinder at 43 to 46 °C and 95 ± 2 % humidity for 16 h.

**15.2.5** Change the temperature to 18 to 21 °C while maintaining 95 ± 2 % relative humidity, and maintain for 8 h.

**15.2.6** Continue the above 24 h cycle for 12 days. When interrupted by one or more non-working days, maintain in accordance with 15.2.5 until the temperature cycling can be resumed.

**15.2.7** At the conclusion of the 12 days test, remove the test cylinder for disassembly and inspection. Do not rotate the cylinder, and where possible, disassemble while holding in the test position.

**15.2.8** Inspect and note all components for corrosion, pitting, adhesion and other deleterious factors resulting from corrosion and/or interaction between the materials involved.



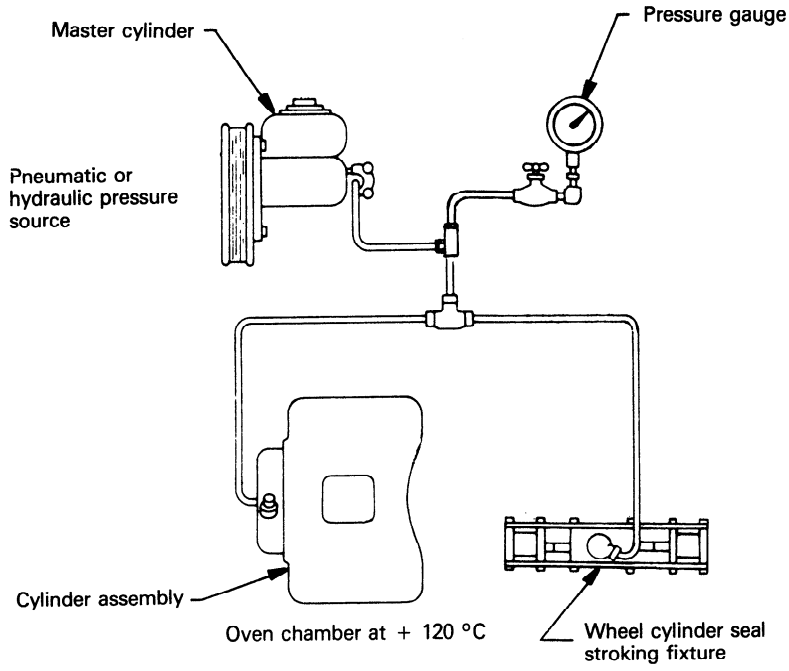


**Figure 1 — High temperature stroking test**

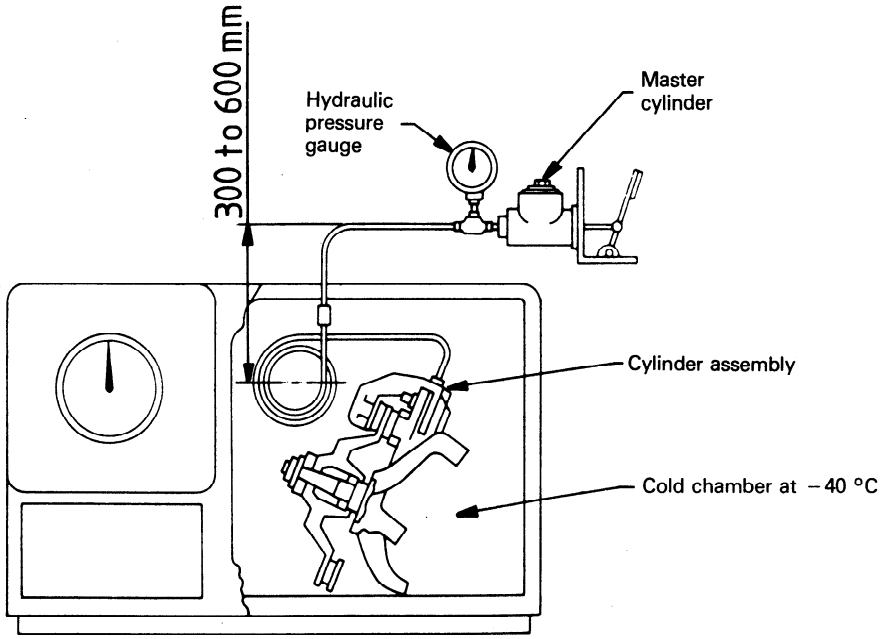


**Figure 2 — Low temperature leakage test**