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Rubber Seals for Hydraulic Disc Brake Cylinders - SAE J62

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SAE STANDARD
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RUBBER SEALS FOR HYDRAULIC
DISC BRAKE CYLINDERS—SAE J62

SAE Standard

Report of Hydraulic Brake Systems Actuating Committee approved April 1974.

1. Scope—This specification describes the performance and part requirements for elastomeric seals used in highway vehicle disc brake calipers. Seals covered by this specification may be the solid section type (square, rectangular, O-ring, etc.) mounted stationary in the cylinder bore or on the movable piston. The specification contains the following major sections:

1. Resistance to Fluid at Elevated Temperature—Physical Stability (loose parts in $120 \pm 2^\circ\text{C}$ ($248 \pm 3.6^\circ\text{F}$) brake fluid for 70 h).
2. Resistance to Fluid at Elevated Temperature—Precipitation Characteristics (loose parts in $120 \pm 2^\circ\text{C}$ ($248 \pm 3.6^\circ\text{F}$) brake fluid for 70 h).
3. Resistance to Elevated Temperatures in Dry Air (loose parts in $175 \pm 2^\circ\text{C}$ ($347 \pm 3.6^\circ\text{F}$) air for 22 h).
4. Ambient Temperature Stroking Test (tested in brake assembly for 500,000 cycles to 7.0 ± 0.3 MPa (1000 ± 50 psi)).
5. High Temperature Stroking Test (tested in brake assembly for 70 h (70,000 strokes) at $120 \pm 2^\circ\text{C}$ ($248 \pm 3.6^\circ\text{F}$) to 7.0 ± 0.3 MPa (1000 ± 50 psi)).
6. Low Temperature Leakage Test (tested in brake assembly for 120 h at -40 – 42.8°C (-40 – 45°F)).
7. Cycling Humidity Storage Corrosion Test (tested in brake assembly for 14 days at 95% humidity cycling between 21 – 46°C (69.8 – 114.8°F)).

2. Parts Requirements

- 2.1 Parts shall conform to the pertinent drawing in all respects.
- 2.2 Manufacturer's identification, when used, shall be that on record at the Rubber Manufacturers Association.
- 2.3 All parts to be tested shall be cleaned prior to testing by rinsing in isopropyl alcohol and blown dry or wiped dry with a lint-free cloth. Seals shall not remain in alcohol for more than 30 s.

3. Brake Test Fluid—Fluid for all test phases except 7 (paragraph 6.7) shall be SAE compatibility fluid, or a mutually agreed upon commercial fluid which subscribes to SAE J1703. Fluid used in test 7 shall be SAE compatibility fluid or a mutually agreed upon commercial preservative type fluid.

NOTE: See Appendix for description of SAE compatibility fluid.

4. Test Equipment—Equipment used for testing shall be as shown in Figs. 1 and 2.

5. Test Requirements

5.1 After test 1, Resistance to Fluid at Elevated Temperature—Physical Stability, the parts must subscribe to the following:

- 5.1.1 Volume change must be within 0 and +15%.
- 5.1.2 IRHD hardness change must be within 0 and –15 points.

5.2 After test 2, Resistance to Fluid at Elevated Temperature—Precipitation Characteristics, the parts must subscribe to the following:

- 5.2.1 Not more than 0.05% vol sediment shall be formed.

5.3 After test 3, Resistance to Elevated Temperature in Dry Air, the parts must subscribe to the following:

- 5.3.1 Change in IRHD hardness must be within 0 and +15 points.

5.3.2 SEAL CONDITION—Test parts shall show no evidence of tackiness, blistering, cracking, or change in shape from original appearance.

5.4 After test 4, Ambient Temperature Stroking Test, parts and assembly must subscribe to the following:

5.4.1 No leakage beyond normal wetting of the bore(s) is allowed during the stroking test.

5.4.2 No leakage beyond normal wetting of the bore(s) is allowed during static leak test (paragraph 6.4.8).

5.5 After test 5, High Temperature Stroking Test, the parts must subscribe to the following:

5.5.1 No leakage beyond normal wetting of the bore(s) is allowed during the stroking test.

5.5.2 No leakage beyond normal wetting of the bore(s) is allowed during static leak test (paragraph 6.5.11).

5.6 After test 6, Low Temperature Leakage Test, the parts and assembly must subscribe to:

5.6.1 No leakage beyond normal wetting of the bore(s) is allowed during the test period or pressure applications.

5.6.2 The seal shall not crack and shall show evidence of rubber-like qualities during the flexibility bend test (paragraph 6.6.10).

5.7 After test 7, Cycling Humidity Storage Corrosion Test, the parts and assembly must subscribe to the following:

5.7.1 No evidence of rubber adhesion of the test seal(s) is allowed during disassembly of the test brake.

5.7.2 No surfaces 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.

6. Test Procedures**6.1 Resistance to Fluid at Elevated Temperatures—Physical Stability**

6.1.1 TEST SPECIMENS—From three or more seals to be tested, obtain a sample of 3–5 g.

6.1.2 Determine and record the initial volume of each seal in accordance with section 9.1 of ASTM D 471.

6.1.3 Determine and record the initial IRHD hardness of the test seals. Measure hardness as prescribed in ASTM D 1415 using a microtester (or per a procedure previously agreed upon between vendor and purchaser).

6.1.4 Test specimens shall be placed in a suitable glass container and completely immersed in 75 ml of test brake fluid; the container shall be sealed to prevent vapor loss and placed in an oven at $120 \pm 2^\circ\text{C}$ ($248 \pm 3.6^\circ\text{F}$) for 70 h.

6.1.5 After 70 h, remove the test specimens from the oven and allow to cool in the container at $23 \pm 5^\circ\text{C}$ ($73.4 \pm 9^\circ\text{F}$) for 60–90 min. At the end of the cooling period, remove the seals from the container and rinse in isopropyl or ethyl alcohol and wipe dry with a clean, lint-free cloth. Seals shall not remain in the alcohol for more than 30 s.

6.1.6 Determine and record within 60 min the final volume and IRHD hardness of each seal per paragraphs 6.1.2 and 6.1.3.

NOTE: The change in volume shall be reported as a percentage of the original volume. The calculations shall be made as follows:

$$\text{Increase in volume, \%} = \frac{(W_3 - W_4) - (W_1 - W_2)}{(W_1 - W_2)} \times 100$$

where: W_1 = initial weight in air

W_2 = initial weight in water

W_3 = weight in air after test

W_4 = weight in water after test

6.2 Resistance to Fluid at Elevated Temperature—Precipitation Characteristics

6.2.1 TEST SPECIMENS—From three or more seals to be tested, obtain a sample of 3–5 g.

6.2.2 Place the test seals in a suitable glass container, together with 75 ml of the test fluid. The container shall be sealed to prevent vapor loss and placed in an oven at $120 \pm 2^\circ\text{C}$ ($248 \pm 3.6^\circ\text{F}$).

6.2.3 After 70 h remove the container from the oven. The seals shall remain in the fluid at room temperature for 24 h, after which the test fluid is agitated and poured into a cone-shaped centrifuge tube.

6.2.4 Rotate the tube for 30 min at 1500 rpm. Note the volume of sediment as observed in tube. Repeat the above rotation for an additional 30 min and record any difference in volume of sediment.

6.2.5 Record amount of sediment per paragraph 5.2.1.

6.3 Resistance to Elevated Temperatures in Dry Air

6.3.1 TEST SPECIMENS—Two or more seals shall be used.

6.3.2 Measure and record the IRHD hardness of each seal per paragraph 6.1.3.

6.3.3 The test seals shall be placed in a circulating air oven, as prescribed in ASTM D 573 and held for 22 h at $175 \pm 2^\circ\text{C}$ ($347 \pm 3.6^\circ\text{F}$).

6.3.4 At the termination of the heating period, the seals shall be removed from the oven and allowed to cool for 30 min to room temperature.

6.3.5 After cooling, measure and record the IRHD hardness per paragraph 6.1.3 and note any visual change such as cracking, blistering, distortion, etc.

6.4 Ambient Temperature Stroking Test

6.4.1 TEST SPECIMENS—Adequate test seals for at least one complete caliper shall be prepared.

6.4.2 Measure and record the IRHD hardness of the seal per paragraph 6.1.3.

6.4.3 Wet seals and caliper bores with the test brake fluid. Install test seals in caliper.

6.4.4 Complete the test caliper assembly, placing the disc in simulate half-worn lining position.