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INTERNATIONAL
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SURFACE VEHICLE STANDARD

SAE J1570 | REV. SEP91

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Submitted for recognition as an American National Standard

(R) RUBBER DUST BOOTS FOR THE HYDRAULIC DISK BRAKE PISTON

1. ***Scope—***This SAE Standard covers molded rubber boots used on disc brake pistons to prevent the entrance of dirt and moisture which could cause corrosion and otherwise impair caliper operation.

The specification includes performance tests of brake piston boots of both plain and insert types under specified conditions and does not include requirements relating to chemical composition or physical properties of the rubber compound. Further, it does not cover the strength of the adhesion of rubber to the insert material where an insert is used.

The rubber material used in these boots is classified as suitable for operating in a temperature range of –40 to + 120 °C ± 2 °C (–40 to + 248 °F ± 3.6 °F).

2. ***References***

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1601—Rubber Cups for Hydraulic Actuating Cylinders

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM D 471—Test Method for Rubber Property-Effect of Liquids
ASTM D 573—Test Method for Rubber-Deterioration in an Air Oven
ASTM D 1149—Test Method for Rubber Deterioration-Surface Ozone Cracking in a Chamber
ASTM D 1415—Test Method for Property-International Hardness
ASTM D 2240—Test Method for Rubber Property-Durometer Hardness

3. ***General Requirements***

3.1 Workmanship and Finish—Boots shall be free from blisters, pinholes, cracks, protuberance, embedded foreign material, or other physical defects which can be detected by thorough inspection, and shall conform to the dimensions specified on the drawings.

3.2 Marking—The identification mark of the manufacturer as recorded by the Rubber Manufacturers Association and other details as specified on drawings shall be molded into each boot.

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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 being subjected to the test for resistance to fluid at elevated temperatures as prescribed in 5.4, boots shall conform to the following requirements:

a. Change in volume: –5 to +20%
b. Change in hardness: –15 to +5 points
c. IRHD (Shore A)

4.2 Heat Stroking Test—After stroking as detailed in 5.5, boots will have passed the requirements if the following criteria are met:

a. Both beads must remain in installed position during stroking.
b. IRHD hardness change must not exceed –10 to +15 points.
c. Boots must not be cracked through (surface cracking allowed) after completion of the stroking and removal from the caliper or fixture.
d. Clearance must not occur at the interference points measured per 5.5.2.

4.3 Low Temperature Stroking Test—During stroking as detailed in 5.6, boots shall be considered to have passed the test if the following criteria are met:

a. Boot beads shall remain in the installed position during stroking.
b. No cracks caused by flexing at low temperature shall be in evidence.

4.4 Heat Resistance Test (Static)—After the heat resistance test, as described in 5.7, boots shall conform to the following requirements:

a. The boots must not be cracked through (surface cracking allowed) after installation, flexing, and removal.
b. Change in IRHD (Shore A) hardness: –5 to +20 points

4.5 Ozone Resistance Test—At the end of the 168 h exposure period, as detailed in 5.8, test specimens shall be removed from the ozone chamber and examined under 2X magnification while in the installed position. Surface of the test specimens shall show no evidence of cracking, rupture, or other deterioration.

5. Test Procedures

5.1 Test Specimens—Specimens prepared for a particular test shall be cut from the same approximate location on different sample boots. Hardness test specimens shall be prepared to present a flat molded surface to the indentor.

5.2 Test Fluid—The brake fluid used for testing shall be that specified in Appendix A.

5.3 Hardness—The method of determining rubber hardness shall be as described in ASTM D 1415. If agreed upon by vendor and purchaser, an alternate procedure, ASTM D 2240 may be used.

5.4 Resistance to Fluids at Elevated Temperatures

5.4.1 APPARATUS

a. Oven—Circulating air oven as specified in Section 5 of ASTM D 573.
b. Container—Use a screw top, straight-sided, round glass jar, having a capacity of approximately 250 cm^3 and inner dimensions of approximately 125 mm in height and 50 mm in diameter, and tinned steel lid (no insert or organic coating).

5.4.2 TEST SPECIMENS—Two new test segments weighing 0.5 to 5 g shall be cut from complete boots.

5.4.3 TEST PROCEDURE

a. The segments shall be rinsed in isopropyl alcohol, and blown dry or wiped dry with a lint-free cloth to remove dirt and packaging debris. The segments shall not remain in the alcohol for more than 30 s.
b. Determine and record the volume of the segments in accordance with Section 10 of ASTM D 471, except use isopropyl alcohol where acetone is specified.
c. Determine and record the initial IRHD hardness of test segments.
d. The segments shall be placed in a suitable glass container and completely immersed in 75 mL of the approved brake fluid, and the container shall be sealed to prevent vapor loss and placed in an oven at 120 °C ± 2 °C (248 °F ± 3.6 °F) for 70 h followed by removal per ASTM D 471.
e. Determine and record the final volume and IRHD (Shore A) hardness of the segments.

5.4.4 CALCULATIONS

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

$$\% \text{ Increase in Volume} = \frac{(M_3 - M_4) - (M_1 - M_2)}{(M_1 - M_2)} \times 100 \qquad \text{(Eq. 1)}$$

where:

M_1 = initial mass in air
M_2 = initial mass in water
M_3 = mass in air after test
M_4 = mass in water after test

b. Hardness Change—Calculate and record the change in IRHD (Shore A) hardness.

5.5 Heat Stroking Test

5.5.1 APPARATUS

a. Oven—Circulating air oven as specified in Section 5 of ASTM D 573.
b. Actuated Stroking Fixture—This fixture shall be composed of a production caliper assembly or simulating fixture capable of being stroked 0.020 in at the one-half worn lining piston position.
c. Actuating Stroking Fixture—This fixture shall be composed of a mechanically, pneumatically or hydraulically actuated device whose rate of operation shall be controlled at 1000 strokes per hour ±100 strokes per hour.
d. Drawing—A drawing of a typical actuated and actuating system is shown in SAE J1601, Figure 1.

5.5.2 TEST SPECIMEN PREPARATION

a. Two new boots shall be rinsed in isopropyl alcohol and blown dry or wiped dry with a lint-free cloth to remove dirt and packaging debris.
b. The boots shall not remain in the alcohol for more than 30 s. Measure and record IRHD (Shore A) hardness of boots.
c. Measure, record, and calculate boot-to-piston and boot-to-caliper groove interferences (diametral and/or side interference at sealing bead, as designed).
d. Install the dry boots on the caliper assembly or fixture.

5.5.3 TEST PROCEDURE

a. Place the caliper assemblies or fixtures (adjusted to simulate the one-half worn lining piston position) in the oven and connect as required.
b. Stroke for 70 h at 1000 strokes per hour ± 100 strokes per hour at 120 °C ± 2 °C (248 °F ± 3.6 °F). If simulating fixtures are used, a stroke of 0.020 in shall be maintained.
c. After 70 h, discontinue stroking, shut off heat and allow oven to cool for 1 h with door open. Remove boots for inspection within 30 h.
d. Note and record general condition of boots relative to cracks, retention of shape, and tackiness.
e. Remeasure and record interference per 5.5.2.
f. Remeasure and record IRHD (Shore A) hardness of boots.

5.6 Low Temperature Stroking Test

5.6.1 APPARATUS

a. Cold Chamber—A cold chamber large enough to permit installation of the test caliper (or fixture) and capable of continuous –40 °C (–40 °F) operation.
b. Caliper—A test caliper (or fixture) per SAE J1601 Figure 1, except modified to allow for stroking from upworn lining piston position to full worn lining piston position.
c. Actuator—An actuator capable of actuating the boot test caliper or fixture.

5.6.2 TEST SPECIMEN PREPARATION

a. Two new boots shall be rinsed in isopropyl alcohol and blown dry or wiped dry with a lint-free cloth. The test boot shall not remain in alcohol for more than 30 s.
b. Install boots on calipers or fixtures and place in cold chamber.

5.6.3 TEST PROCEDURE

a. The test caliper or fixture shall be subjected to a temperature of –40 °C ± 2 °C (–40 °F ± 3.6 °F). After a total of 70 h, stroke the calipers (or fixtures) from full lining piston position to full worn lining piston position for six strokes, 10 s apart, without removal from the cold chamber.
b. After return to ambient temperature, inspect for boot retention and remove boots from fixtures and note and record general condition of boots relative to cracks.

5.7 Heat Resistance Test (Static)

5.7.1 APPARATUS—Circulating air oven as specified in Section 5 of ASTM D 573.

5.7.2 TEST SPECIMEN PREPARATION

a. Two new boots shall be rinsed in isopropyl alcohol and blown dry or wiped dry with a lint-free cloth to remove dirt and packing debris. The boots shall not remain in the alcohol for more than 30 s.
b. Measure and record IRHD (Shore A) hardness of the boots per 5.3.

5.7.3 TEST PROCEDURE

a. The test boots shall be placed in the circulating air oven and held for 22 h at 175 °C ± 2 °C (347 °F ± 3.6 °F).
b. At the termination of the heating period, the boots shall be removed from the oven and allowed to cool for 30 min at room temperature.
c. The boots shall be visually inspected and the IRHD hardness, after aging, determined and recorded. Also, record any visual change in the boot.
d. Install boots in normal manner, flex 10 times from new to full worn lining position and remove.

5.8 Ozone Resistance Test

5.8.1 APPARATUS—The apparatus shall consist of an ozone chamber as described in ASTM D 1149, and shall be capable of maintaining an ozone partial pressure of 100 MPa ± 10 MPa (100 ± 10 parts of ozone/100 million parts of air by volume).

5.8.2 TEST SPECIMEN PREPARATION—Two new test boots shall be installed on a caliper assembly or fixture which shall simulate the normal actual installation stretch at the piston and caliper assembly groove beads and the full worn lining piston position.

5.8.3 TEST PROCEDURE

a. Assemble two new test boots on the calipers or fixtures.
b. Immediately after assembly, the calipers or fixtures shall be placed in the chamber and exposed to an ozone partial pressure of 100 MPa ± 10 MPa (100 ± 10 parts of ozone/100 million parts of air by volume) at a temperature of 40 °C ± 1 °C (104 °F ± 1.8 °F) for 7 days.
c. After the 7-day period, remove the caliper or fixture and examine the boots for cracks under a 2X magnification while in the installed position.

6. Notes

6.1 Marginal Indicia—The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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