SAE International™

SURFACE VEHICLE STANDARD

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Superseding J2053 JUN1994	

(R) Brake Master Cylinder Plastic Reservoir Assembly for Road Vehicles

RATIONALE

This standard has been reviewed and updated to accommodate changes in the Federal requirement and other requirement from OEM users.

1. SCOPE

This SAE Standard specifies the performance test procedures and requirements of a plastic reservoir assembly suitable for use on a Hydraulic Brake Master Cylinder (reference SAE J1153). Intended usage is for on-road vehicles using brake fluid conforming to FMVSS 116 (DOT 3), SAE J1703, and SAE J1704 specifications. This document includes the cap/cover and diaphragm as integral parts of the reservoir assembly. The fluid level sensor (FLS) is also included as an integral part of the assembly. However, additional FLS standards and/or requirements are applicable and necessary which are not covered in this document.

1.1 Purpose

This document is intended to provide minimum performance requirements of current established designs on those reservoir assemblies generally used by individual manufacturers which have demonstrated satisfactory field performance. This document is applicable to new reservoir assemblies for commercial or aftermarket production.

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, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1153 Hydraulic Master Cylinders for Motor Vehicle Brakes—Test Procedure

SAE J1703 Motor Vehicle Brake Fluid

SAE J1704 Borate Ester Based Brake Fluids

2.1.2 ASTM Publication

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 570 Test Method for Water Absorption of Plastics

2.1.3 Federal Safety Standards

Available from the Superintendent of Documents, U.S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320.

FMVSS 105 Hydraulic Brake Systems

FMVSS 135 Passenger Car Brake Systems

FMVSS 116 Motor Vehicle Hydraulic Brake Fluids

3. GENERAL REQUIREMENT

3.1 The reservoir assembly is used on a brake master cylinder assembly located in the underhood compartment environment which must meet SAE J1153 requirements.

3.2 Must be functional between -40 °C and 120 °C (-40 °F and 250 °F) and during typical motion of an installed master cylinder.

3.3 Must be functional during typical brake apply and release pressures.

3.4 Must be capable of withstanding exterior contact from other underhood fluids, greases, and vapors, humidity, road salts, water, and assembly materials.

3.5 Reservoir assembly must be compatible with the intended usage type brake fluids.

3.6 Reservoir assembly must be compatible with the intended vehicle master cylinder assembly and service usage bleed or fill operations.

3.7 Reservoir assembly must meet or exceed applicable government requirements such as FMVSS 105 or FMVSS 135.

3.8 Reservoir assembly must be capable of the intended shipping, handling, assembly to the master cylinder, test and other appropriate processing methods without damage.

4. MATERIAL, QUALITY, AND IDENTIFICATION

4.1 Composition

Shall be manufactured in accordance with applicable Material Specifications to meet this part specification.

4.2 Dimension

Parts shall conform to all requirements of the drawing, including dimensional stability requirements.

4.3 Quality

Part shall be uniform in quality and be free from splay, blisters, voids, burn marks, foreign material, and other imperfections.

5. TEST PROCEDURE AND REQUIREMENT

5.1 Leakage Test

5.1.1 Procedure

5.1.1.1 Using a minimum of three master cylinder assemblies with the attached plastic reservoir and FLS, if applicable, conduct the following leakage tests. If reservoir assembly is intended for original equipment usage, use factory fill pressures, otherwise use the pressures as specified in this procedure. Install appropriate filling or bleed type apparatus head to reservoir as required. Equipment should be capable of providing hydraulic pressure to 450 kPa (65 psi). Plug master cylinder outlets.

5.1.1.2 Apply hydraulic pressure at a rate of 80 kPa ± 7 kPa (12 psi ± 1 psi) per second to 400 kPa to 450 kPa (60 psi to 65 psi) and hold for 1 min. Measure leakage in cubic centimeters (cc).

5.1.2 Requirement

5.1.2.1 Leakage not to exceed 1 cc maximum.

5.1.2.2 Reservoir shall not crack or tear.

5.2 Fluid Expansion Test

5.2.1 Procedure

5.2.1.1 Using a master cylinder assembly with cap/cover, plug the master cylinder outlets. Mount at designed vehicle installation angle (e.g., 15 degrees from horizontal). Fill and bleed with appropriate brake fluid to maximum specified fill mark at room temperature. Expose to 120 °C ± 5 °C (250 °F ± 10 °F) for 30 to 35 min. Measure the new level of fluid while at 120 °C ± 5 °C (250 °F ± 10 °F).

5.2.2 Requirement

5.2.2.1 The fluid level while at 120 °C ± 5 °C (250 °F ± 10 °F) shall not touch the diaphragm, cover, or cap.

NOTE: This is a design intent test to provide air space above the fluid for expansion due to temperature. Typically this is 10 to 15 % air volume space above the maximum fill mark (8 % per 100 °C). Air space allowance minimizes cosmetic leakage and excess pressure buildup which could result in brake drag.

5.3 Fluid Capacity Test

5.3.1 Procedure

5.3.1.1 Using a master cylinder or equivalent fixture to attach the reservoir, mount at designed vehicle installation angle, plug outlets, and fill and bleed reservoir with appropriate brake fluid to the specified full mark.

5.3.1.2 Allow fluid to drain out of front reservoir chamber to the bottom of the plastic reservoir (do not include any fluid contained in the master cylinder or fixture). Record amount of fluid drained.

5.3.1.3 Measure remaining fluid which can be drained from rear reservoir chamber (to bottom of plastic reservoir).

5.3.1.4 Refill reservoir to specified full mark.

5.3.1.5 Allow fluid to drain from rear reservoir chamber and record amount of fluid drained (to bottom of plastic reservoir).

5.3.1.6 Measure the remaining fluid which can be drained out of front reservoir chamber (to bottom of plastic reservoir).

5.3.1.7 Determine common fluid by subtracting amount found in 5.3.1.6 from amount found from 5.3.1.2.

5.3.2 Requirement

5.3.2.1 Volumes recorded must exceed minimum values specified on master cylinder assembly drawings for common fluid and each chamber.

5.3.2.2 Volumes recorded must exceed Federal (FMVSS 105 or FMVSS 135) and/or other applicable requirements.

5.4 Entrapped Debris Test

5.4.1 Procedure

5.4.1.1 With the exterior of the reservoir assembly clean, wash internal portion of the reservoir with isopropyl alcohol and collect the solution.

5.4.1.2 Filter the solution through a dried (90 °C ± 5 °C (200 °F ± 10 °F) for 10 min) and weighed 5 mm filter.

5.4.1.3 Place the filter in a 90 °C ± 5 °C (200 °F ± 10 °F) oven for 10 min.

5.4.1.4 Weigh and examine filter under a microscope.

5.4.2 Requirement

5.4.2.1 Total residue must not exceed 5 mg per reservoir assembly and must be in accordance with the following:

a. 75 μm or less wide; 4500 μm length

b. 75 to 150 μm wide; 3500 μm maximum length

c. 150 to 500 μm wide; 2000 μm maximum length

No metallic particles permitted.

5.5 Chemical Resistance Test

5.5.1 Apparatus

Thermostatic chamber conforming to ASTM D 570.

5.5.2 Test Fluid

5.5.2.1 Gasoline for automotive use with not less than 87.0 octane.

5.5.2.2 Nonfreezing solution for automotive use usable through the year for the purpose of freeze proofing coolant and corrosion prevention.

5.5.2.3 Motor Oil SAE 10W-30 or 20W.

5.5.2.4 Dilute Sulfuric Acid (10% by weight concentration).

5.5.3 Procedure

5.5.3.1 Using a minimum of three reservoir assemblies, carry out the drying treatment for the reservoir assemblies under the conditions of ASTM D 570, and maintain them at 25 °C ± 3 °C (70 °F ± 5 °F) after the drying treatment. Using a clean cloth and wiping lightly, wet the surface of each assembly two or three times with the test fluid. Maintain 25 °C ± 3 °C (70 °F ± 5 °F) for 24 h ± 1 h. Thereafter, treat them in accordance with the instruction specified in Table 1 (ASTM D 570).

5.5.3.2 After testing, visually inspect for appearance of reservoir assemblies and conduct Leakage Test (5.1.1).

5.5.4 Requirement

5.5.4.1 Shall not be sticky, soft, distorted, or attacked by fluids.

5.5.4.2 Shall meet requirement of 5.1.2.

5.6 Reservoir Cap Installation, Removal, and Failure Test

5.6.1 Procedure

5.6.1.1 For Twist Cap Designs

5.6.1.1.1 Using a minimum of three reservoir assemblies installed to the master cylinder (including caps). Wet the diaphragm of the caps with brake fluid. Install cap assemblies using torque measuring fixture representative of location of forces for hand assembly and equipped to measure torque to install. Record torque to install caps. Reverse the procedure and measure torque to remove caps.

5.6.1.1.2 Proceed to increase cap torque until failure occurs. Measure the torque level at failure and observe the failure mode.

5.6.1.2 For Cover and Other Type Designs

A wide variety of cover type designs exist in the industry and it therefore becomes impractical to develop specifications for all designs. It is recommended that the manufacturer use twist type designs or develop designs which are optimized for:

a. Ease of installation and removal without loosening during normal vehicle vibrations and extended use

b. Failure does not occur with the use of excess force (generally 50% higher than the value of either the installation or removal force)

5.6.2 Requirement

5.6.2.1 Torque to install or remove cap to be 4.0 N·m (3.0 lb-ft) maximum.

5.6.2.2 Required torque at failure of the cap to be 6.0 N·m (4.4 lb-ft) minimum.

5.6.2.3 Reservoir must not become dislodged from master cylinder during assembly or removal.

5.7 Fluid Level Sensor (FLS) Test (If Applicable)

5.7.1 Procedure

5.7.1.1 Using a minimum of three master cylinder assemblies mounted at designed vehicle installation angle (reservoir assemblies attached). Plug outlets, fill reservoir to maximum fill level (full mark). Connect FLS switch to 12 to 14 V DC for measuring activation or 22 to 24 V DC if applicable to vehicle usage.

5.7.1.2 Open outlet(s) and measure total amount of fluid drained for activation of switch.

5.7.2 Requirement

5.7.2.1 Amount of fluid drained shall exceed total lining wearout volume (all wheels) as specified for the applicable vehicle and the FLS switch shall be activated.

5.8 Impact Resistance (Falling Ball Test)

5.8.1 Apparatus

5.8.1.1 Steel ball of 500 g and fixturing per Figure 1.

5.8.1.2 Cold chamber capable of maintaining a temperature of -30 °C ± 3 °C (-22 °F ± 5 °F).

5.8.2 Procedure

5.8.2.1 Using a minimum of three reservoir assemblies, expose the assemblies to -30 °C ± 3 °C (-20 °F ± 5 °F) for 3.0 to 3.5 h. With the reservoir assemblies at the cooled temperature, immediately place one at a time in the fixture (Figure 1) and drop the 500 g steel ball from 10 cm (4 in) onto the side surface.

5.8.2.2 After test, visually inspect for appearance and conduct Leakage Test (5.1.1).

5.8.3 Requirement

5.8.3.1 Must meet requirements of 5.1.2.

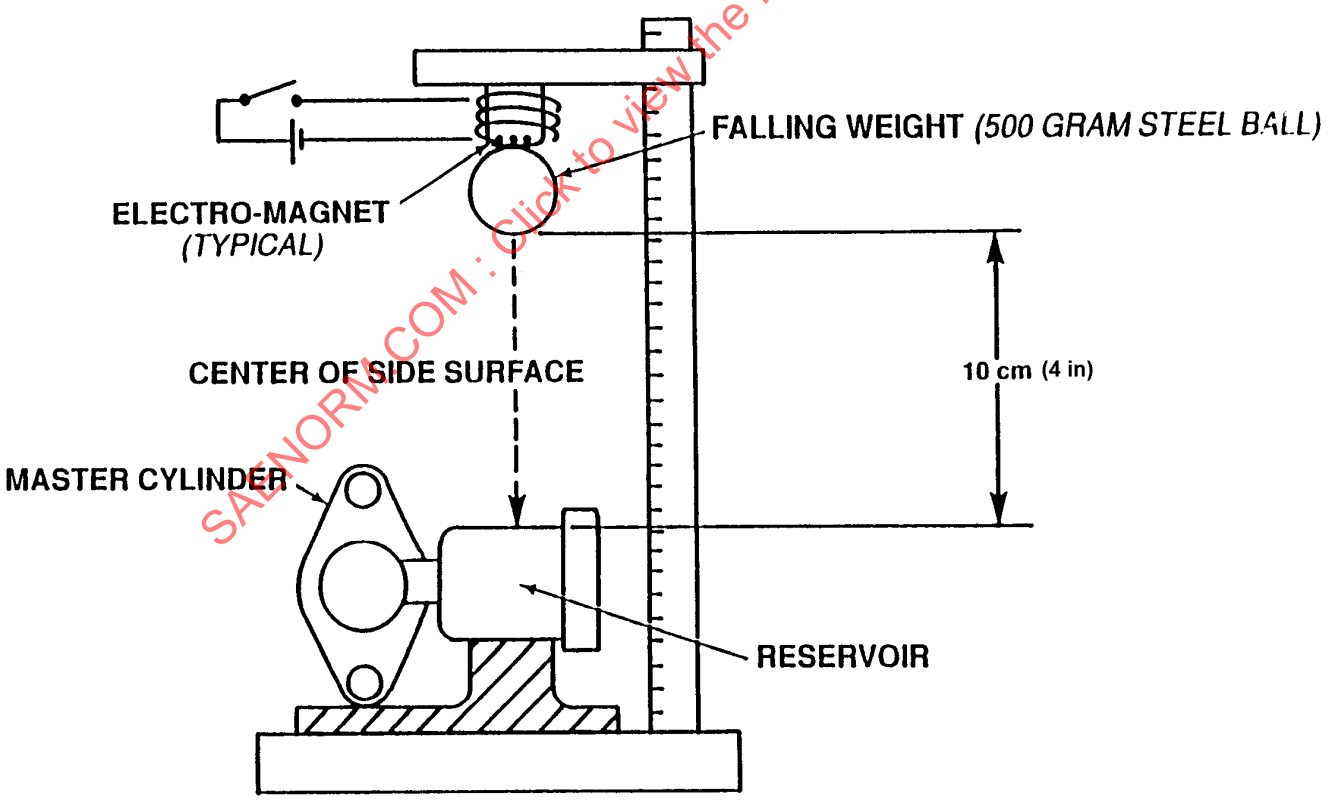

FIGURE 1 - IMPACT RESISTANCE—FALLING BALL TEST