SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1713 FEB2013

Issued 1998-01
Revised 2013-02

Superseding J1713 JUN2004

Structural Testing of Passenger Car and Truck Disc Brakes

RATIONALE

200 °C exposure for 10 hours could reduce the fatigue life for some aluminum alloys, which is the intent of this test section. Since 200 °C is above the wet boiling point of brake fluids it is unlikely the complete housing will see temperatures this high but the areas of housings in close proximity to the rotor could experience such temperatures. Applying this baking process to the entire housing is a practical method and could be considered slightly conservative.

1. SCOPE

This SAE Recommended Practices specifies a procedure for determining structural strength and fatigue life of disc-brake caliper assemblies which are satisfactory for vehicle usage. It is applicable to new caliper assemblies which are employed in passenger car and truck brake systems utilizing hydraulic brake fluids. Brake design and vehicle performance requirements are not included. Specification limits are left to the discretion of the responsible manufacturer.

This procedure was developed for base brake operation and does not consider some unusual effects of ABS (Anti-Lock-Brake System) or Traction Control systems which may have a significant effect on the caliper. Careful analysis of the particular type ABS and/or Traction Control should be made and additional tests may be required which are not included in this document.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publication

Available from SAE International, 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 J1703 Motor Vehicle Brake Fluid

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J1713_201302

2.1.2 FMVSS Publication

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

FMVSS116 (DOT 3)

3. TEST APPARATUS

The basic apparatus includes:

a. A brake fluid pressure source

b. Means to measure and record pressure and linear deflection

c. An appropriate method of mounting the caliper assembly to represent the actual vehicle installation

d. A mounting oven to be used for caliper heat treatment.

e. The appropriate caliper mounting mechanism for salt spray treatment in accordance to the ASTM B117 procedure.

Brake fluid must conform to SAE J1703 and FMVSS116 (DOT 3) Standards. DOT 4 or DOT 5 Brake Fluid may be used for caliper assemblies intended for the purpose.

3.1 Structural Testing

The pressure source must be rate controllable and capable of developing a maximum of 69 MPa (10 000 psi) with an apply rate of 4.1 MPa/s (600 psi/s) maximum. Appropriate pressure measuring devices are also required. These may be gages or transducers.

3.2 Fatigue Testing

The pressure source must be capable of developing 21 MPa (3000 psi) at an apply rate of 24.1 MPa/s (3500 psi/s) maximum. Devices must also be included to apply, hold, and release the pressure continuously. Capability to count the cycles, measure the pressure, and determine significant change of deflection (0.255 to 0.01 in) which would represent a crack or failure of significance must also be provided.

4. TEST SAMPLES

The caliper assemblies selected to include shoe and linings. Separate samples are required for burst and fatigue tests. It is suggested that a minimum sample size of 8 be used for determination of statistical distribution of the results.

5. STRUCTURAL TEST

Determination of structural integrity (conduct 5.3 Pre-test Procedure before 5.1 when aluminum housings are applied).

5.1 Setup to represent and simulate actual vehicle installation (including rotors or segments of rotors, and linings).

5.1.1 Connect the pressure source to the inlet of the caliper assembly. Connect the pressure-measuring device to represent the pressure within the caliper such as at the inlet, or less desirably at the bleeder screw.

5.1.2 Use DOT 3, 4, or 5 Brake Fluid, whichever is appropriate, and bleed the setup of all air.

5.2 Apply increasing pressure to the caliper at a rate of 2.7 to 3.4 MPa/s (400 to 500 psi/s) until a structural failure occurs as measured by inability to maintain pressure, or 69 MPa (10 000 psi) is reached.

5.3 Preparation Procedure for aluminum housings only

5.3.1 Disassemble caliper assembly (isolate housing machining).

5.3.2 Bake housing machining at a maximum temperature limit of 200 °C or to a maximum limit set by the manufacturer to be applicable. Maintain temperature for minimum of 1 h.

5.3.3 Remove from oven, allow housing to cool.

6. FATIGUE TEST

Determination of fatigue resistance.

6.1 Basic setup and instrumentation to be same as Section 5.

6.1.1 Add pressure-cycling devices, means of counting the cycles that reach proper pressure, and measuring devices for detecting deflections and change of deflections.

6.2 Alternately apply and release pressure to the caliper housing as follows:

6.2.1 Increase pressure at a rate of 6.9 to 24.1 MPa/s (1000 to 3500 psi/s) from 0 to 0.34 MPa (0 to 50 psi) to a maximum of 13.8 MPa ± 0.7 MPa (2000 psi ± 100 psi) or as specified by the manufacturer.

NOTE: 13.8 MPa ± 0.7 MPa (2000 psi ± 100 psi) is the lowest recommended test-cycling pressure.

6.2.2 Maintain the test pressure for 0.2 s minimum.

6.2.3 Release pressure to 0 to 0.34 MPa (0 to 50 psi) and maintain for 0.2 s minimum.

6.2.4 Repeat sequence until test is terminated by the following:

a. Structural crack which results in loss of maintenance of pressure.

b. Increase of deflection exceeding 0.25 mm (0.01 in) over the deflection observed within the first 10 applications.

c. Completion of the required number of applications.

6.2.5 The minimum recommended cycles for completion of one test is 100,000 or to a level that has been determined to be applicable by the manufacturer.

6.2.6 Additional Samples (to a minimum of 10 total) are then recommended to be tested under the 6.2 procedure such that a life exposure of a 95% confidence level can be demonstrated.

6.3 Record data in support of 6.2.4.