SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2694 SEP2009

Issued 2009-09

Anti-Noise Brake Pads Shims: T-pull Test

RATIONALE

This recommended practice standardizes the measurement of the bond strength between the anti-noise shims and the disc brake pads. The development of sufficient bond strength is necessary for the correct performance of bonded anti-noise shims.

1. SCOPE

This recommended practice covers the attachment of bonded anti-noise brake pad shims only. Mechanically attached shims (those without bonding) are not covered by this procedure.

1.1 Purpose

To measure the strength of the adhesive bond for the attachment of anti-noise shims to disc brake pads or a test specimen to a standard steel plate. Its primary use is as a quality tool.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein.

2.1.1 DIN Publications

Available from Deutsches Institut für Normung e.V., Burggrafenstrasse 6, 10787 Berlin, Germany, www.din.de.

DIN 53 282 Winkelschälversuch (T-peel Test)

DIN 50 014 Standard Climatic Conditions

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 618 Standard Practice for Conditioning Plastics for Testing

ASTM D 1876 Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)

3. DEFINITIONS

3.1 Pull Strength

The pull strength (P) or initial peel resistance of the shim adhesive is defined as the force per width (N/mm) which is needed to pull a shim from the backing plate of a pad at a 90° angle.

$$P = F / b \qquad \text{(Eq. 1)}$$

where F is the peak pull force (N) and b is the shim bend width (mm).

This value is used to assess the bond quality.

3.2 Shim Bend Width

The shim bend width is the width of the adhesive bond at the start of the test.

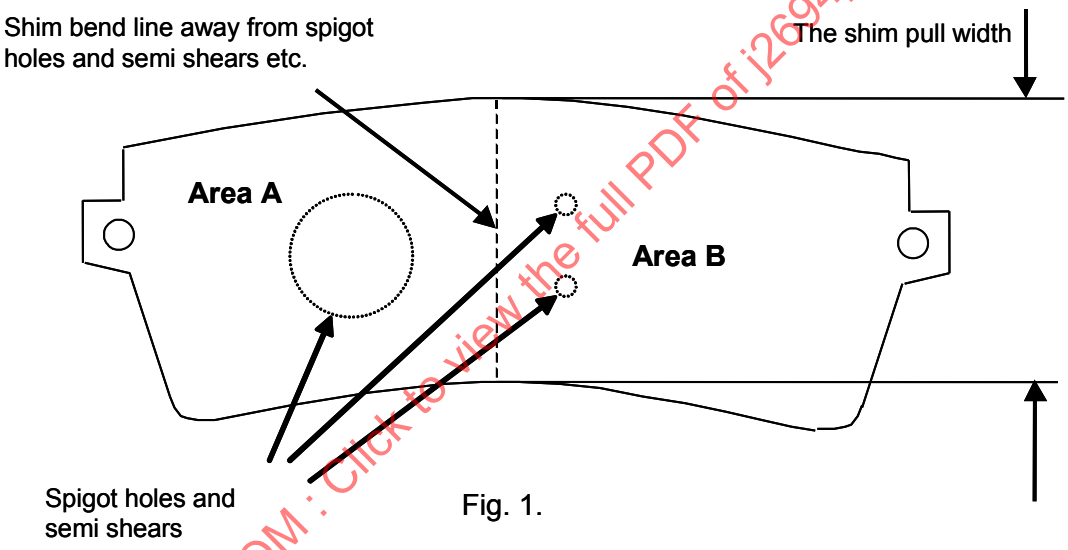

Fig. 1.

FIGURE 1 - SHIM WITH BEND LINE AND SHIM BEND WIDTH

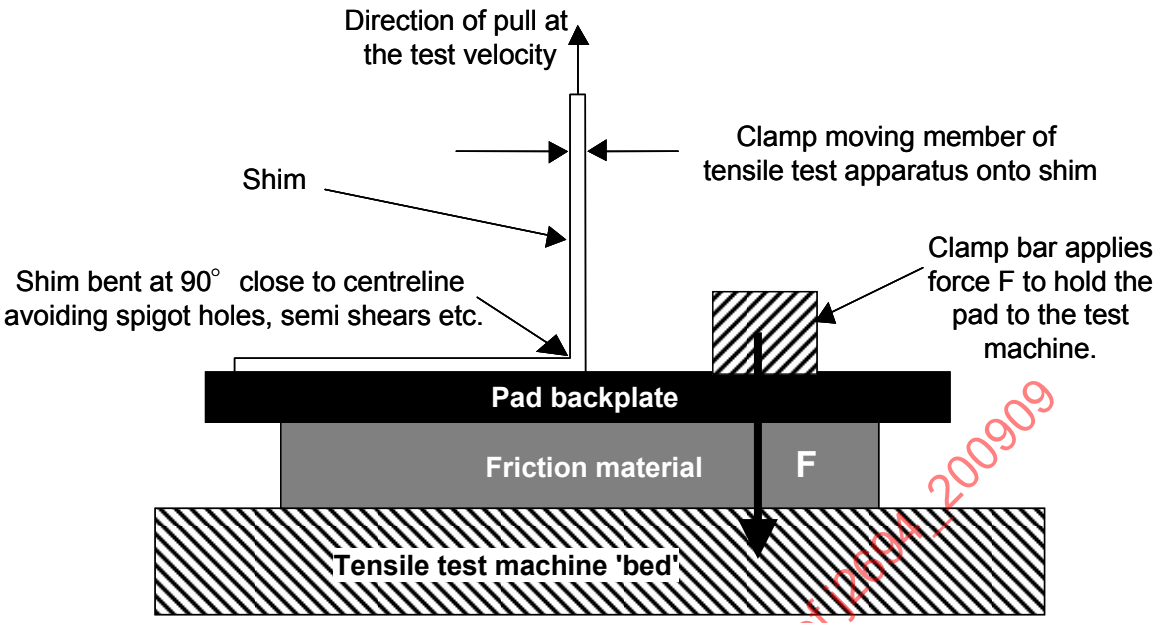

FIGURE 2 - 90° PULL TEST SETUP

3.3 Peak Force

The peak pull force F is the intial force necessary to start the peel of the adhesive. See Figure 3.

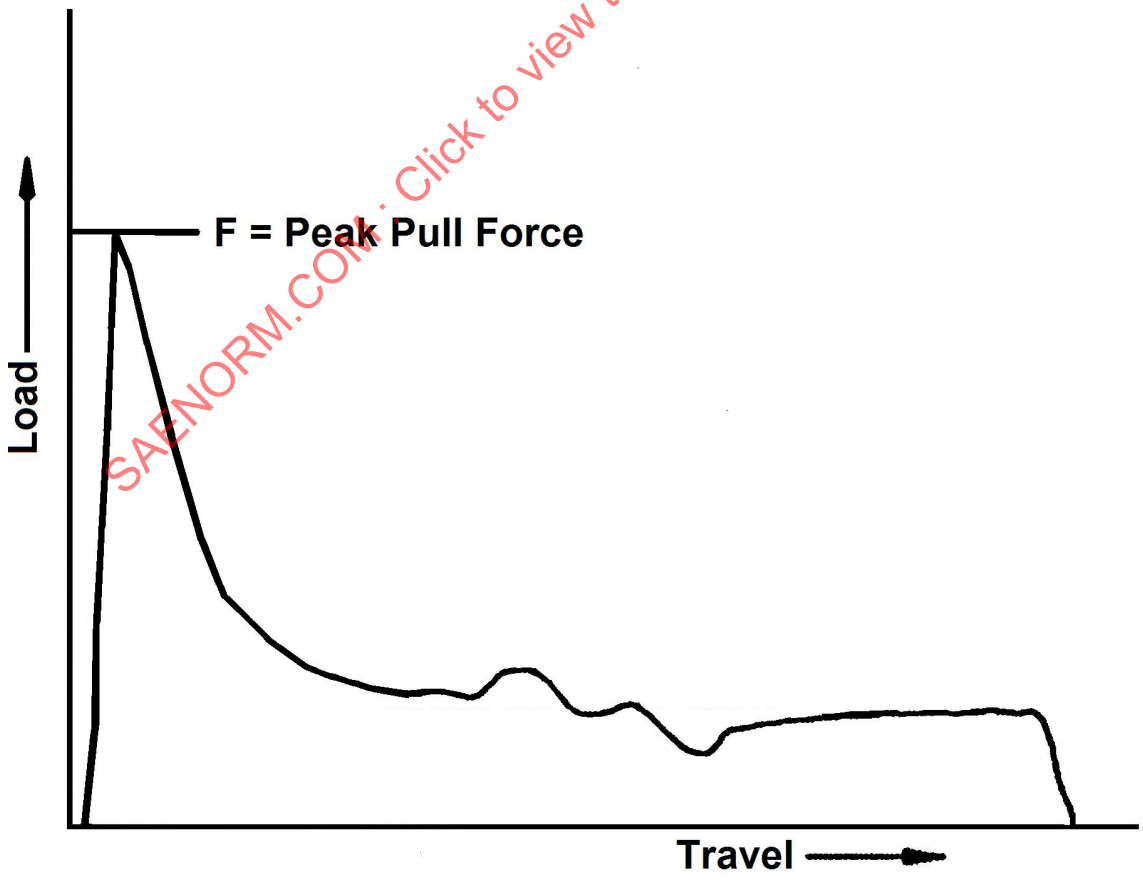

FIGURE 3 - LOAD VS. TRAVEL CHART DEFINING PEAK PULL FORCE (F)

3.4 Failure Mode

The failure mode of the assembly describes the visual inspection of the bonding interface and of the adhesive layer after separation. For example, the adhesive can remain completely on the pad back plate, be found in patches on both back plate and shim, or remain completely on the shim.

4. TEMPERATURE AND HUMIDITY FOR TESTING

The ambient condition for the test is 23 °C ± 2 °C. In critical cases, standard climatic conditions (according to agreed specifications such as ASTM D 618 or DIN 50 014-23/50-2) should be applied.

5. EQUIPMENT AND APPARATUS

5.1 Testing Machine

This test can be conducted on a universal tensile test machine or specifically designed test equipment.

The load measurement accuracy required for peak pull force (F) is 1% of full range, and 0.5 N for force ranges less than 100 N. Preferably, the load vs. travel should be recorded.

The moving member velocity shall be 50 mm/min ± 10%. The travel range of the moveable member should be a minimum of 5 mm. However, travel must be sufficient to overcome the peak pull force as shown in Figure 3.

6. TEST SAMPLES

6.1 Testing During the Development Phase

“Test specimen” samples are standard shim samples, 40 mm wide and 100 mm long, bonded to a steel block, sufficiently sized to accommodate the shim sample, with a minimum thickness of 5 mm.

The steel block shall be either steel with a defined surface finish approximating a production steel pad back plate, or plates cut from the same type of steel as used for the back plates.

The steel block must be either de-greased or treated in the same process as the standard pads/backing plates before the shims are mounted, such as painted or otherwise coated.

6.2 Testing as a Production Check

The test has to be completed with the intended or series back plate and shim. Production or production intent conditions apply.

7. BONDING

Both during development and production, bonding of the shim to the supporting plate has to be performed according to a bonding specification. During the development phase, the bonding should be performed as intended for production. During production the bonding shall be done to an agreed upon production specification. For improved test repeatability, the bonding method must be defined and recorded with sufficient precision, including items as pressures, temperatures and holding times. If the strength of the bond changes after the bonding operation due to subsequent curing, the samples shall be held until the curing occurs.

8. PREPARATION OF TEST SAMPLES

In the description which follows, the term “pad assembly” is used inter-changeably for a bonded shim specimen and steel block or pad specimen.

8.1 Clamp the assembled damping shim in the area close to the bending point with a special clamping device (see Figure 4).

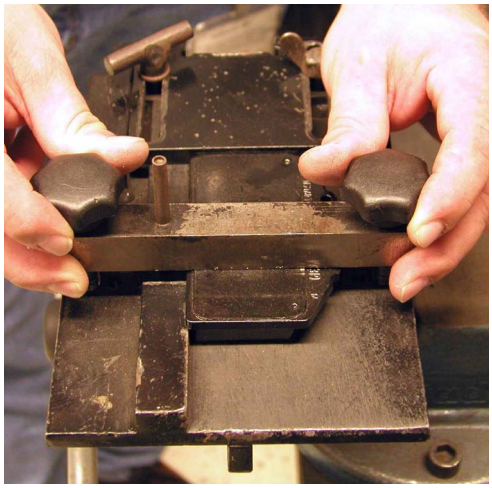

FIGURE 4 - CLAMPING DEVICE TO PROVIDE A 90° ANGLE WITHOUT INFLUENCE TO THE ADHESIVE LAYER

8.2 Pry the exposed half of the shim away from the back plate, using a suitable flat-bladed utensil such as a putty knife or chisel to start the detachment, then complete the operation by hand.

8.3 Bend the unattached half of the shim until it attains an angle of 90° to the pad back plate. The shim bending radius should be in the range of 1 to 2 mm for simple shims and 2 to 4 mm for multi-layer shims.

8.4 Clamp the pad assembly in a fixture or vice in a position such that the top of the vice is as close as possible to the noise shim centerline without passing over a back plate spigot hole, indentations, alpha-numeric stamping, or semi shear. The purpose of the clamping is to prevent the shim from experiencing a preload or lifting prior to the actual test.

9. TEST PROCEDURES

9.1 The tensile test rig consists of a static and a moveable cross-member. During tensile testing the test sample is attached to both the static and the moveable member. When the moveable member is moved away from the static member, tensile forces are applied to the test sample (see Figure 2).

9.2 The prepared pad assembly must be clamped to the static part of the tensile rig. A suitable method is to use a clamp bar across the exposed area of the pad assembly. No additional load or pressure shall be exerted by this clamp bar.

9.3 The part of the shim that is bent 90° upward needs to be attached to the moveable part of the tensile test rig. Suitable methods are using a hole in the shim or by means of a clamp, where it has to be assured, that no slip should occur between the clamp and the clamped shim specimen. For repeatability of results, the attachment method needs to be defined with sufficient precision, and reported. The clamp should not be a rigid body but should provide a balance of the tangential forces by means of a chain or steel cable (see Figure 5).