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Road vehicles — Brake linings — Shear test procedure for disc brake pad and drum brake shoe assemblies

Véhicules routiers — Garnitures de freins — Méthode d'essai au cisaillement des ensembles de plaquettes de freins à disque et segments de freins à tambour

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Contents

Page

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 6312 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 2, *Braking systems and equipment*.

This second edition cancels and replaces the first edition (ISO 6312:1981), which has been technically revised.

Annex A forms a normative part of this International Standard. Annex B is for information only.

Introduction

The shear property relates to stresses at the area of contact between lining and carrier in disc brake pad and drum brake shoe assemblies.

The specification for the average rate of load and the recommendation for variations in the instantaneous rate of load given in this International Standard take into account current practice, being based upon an examination of equipment in use.

Road vehicles — Brake linings — Shear test procedure for disc brake pad and drum brake shoe assemblies

1   Scope

This International Standard specifies a method for measuring the strength of the bond connection between the lining material and the carrier in disc brake pad and drum brake shoe assemblies (shear strength). This International Standard is applicable to integrally moulded, riveted and bonded assemblies of both types of brake on road vehicles.

2   Normative reference

The following normative document contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 611, *Road vehicles — Braking of automotive vehicles and their trailers — Vocabulary.*

3   Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 611 and the following apply.

3.1
lining
friction material component of a brake lining assembly

3.2
carrier
component of a brake lining assembly to which the friction pad is attached

3.3
bond area
contact area between lining and carrier

3.4
shear strength
ratio of the load at failure divided by the bond area

4   Symbols and units

The symbols and preferred units used in this International Standard are given in Table 1.

<p align="center">**Table 1 — Symbols and units**</p>

Quantity	Symbol	Unit
Shear force at failure	F	N
Area of bond	A	mm^2
Shear strength at failure	τ	MPa

5 Sampling and conditioning

This procedure may be used on samples during product development, on finished products, or after special treatment (such as that covered by ISO 6314) or usage.

Testing may be performed on a complete assembly or section of an assembly.

Sample edges may be prepared to ensure good contact with the loading and fixed tools. Shims should be removed.

When testing a lined shoe, the test area may cover the full assembly or segments of an assembly confined by saw cutting down to the carrier (see Figure 1).

Five samples should be used.

NOTE   The test procedure applies a load in a direction which might not be in accordance with the loading direction of the product in service. The shear behaviour could be influenced by high aspect ratio, chamfered or slotted pads.
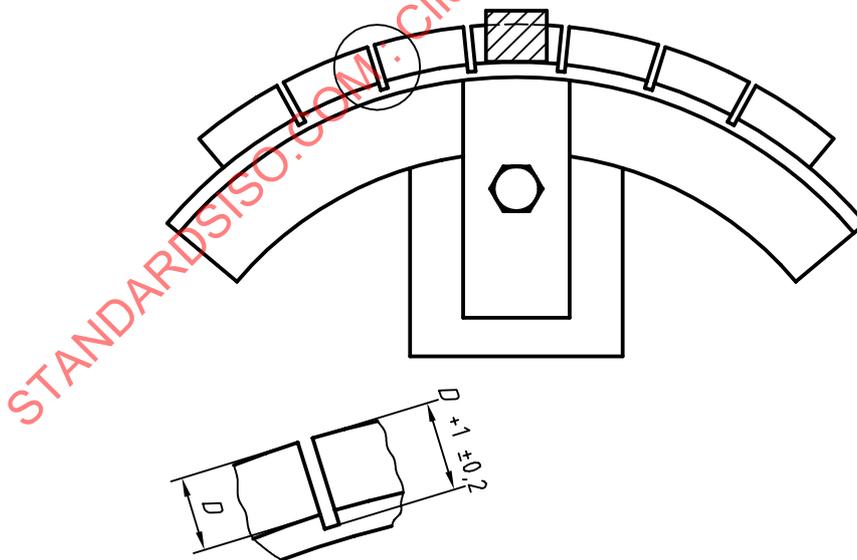
<p align="right">Dimensions in millimetres</p>

<p align="center">**Figure 1 — Lined shoe in segmental test condition**</p>

6 Test rig and fixtures

6.1 Test rig

The test rig shall be a compression or tensile testing machine or similar (shear testing) machine of sufficient capacity to apply the shearing load by activating a ram.

The test rig shall be provided with equipment to register the exact load applied at the instant of shear failure.

The load application rate shall be controlled in such a way that the load increases at an average rate of $(4\,500 \pm 1\,000)$ N/s (as determined from typical vehicle-based evaluation). If a constant crosshead speed machine is being used the load rate shall be set to (10 ± 1) mm/min. This shall be indicated in the results, which, it shall be noted, cannot be compared to tests conducted on machines of the constant load type. Shock loading shall be avoided.

6.2 Fixtures

6.2.1 General

The shearing test fixture shall have the means to hold a test sample such that it is parallel to the loading tool. This tool shall have a radius of 1,5 mm at the part in contact with the test sample.

6.2.2 Drum brake shoe assembly

The fixture (see Figure 2) shall be designed so that the loading tool is in contact with the edge of the lining for the full sample length and thickness within $(1 \pm 0,2)$ mm of the shoe platform.
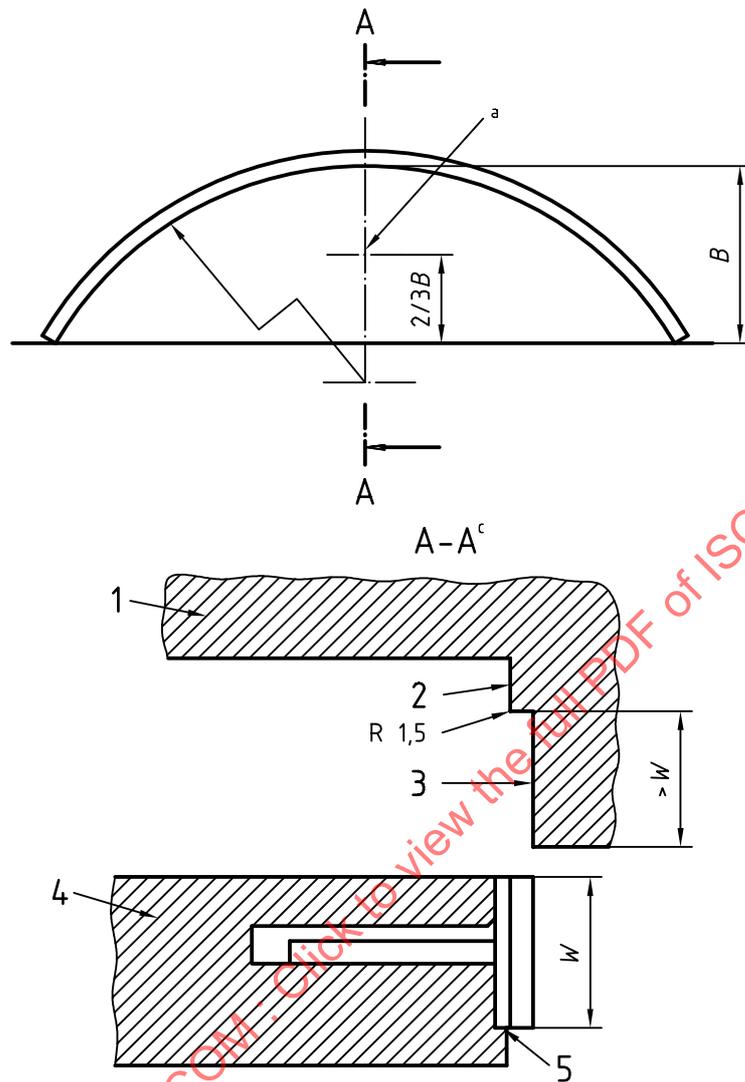
Load application on the loading tool shall be in a direction parallel to the plane of the shoe platform. The shoe shall be supported to maintain uniform loading along the length of the lining sample.

The width of the loading tool shall be greater than the width, W, of the lining.

6.2.3 Disc brake pad

The fixture (see Figure 3) shall be designed such that:

— the location of the plane of the backplate is parallel to the plane of the loading tool;

— the loading tool is in contact with the edge of the lining within $(1 \pm 0,2)$ mm of the backing plate (carrier) and conforms to the sample lining profile including taper angles;

— the loading tool is self-aligning;

— the loading tool is in contact with the full sample length of the lining edge parallel to the backplate support;

— the load bearing edge of the backing plate rests against a rigid support with a thickness no greater than that of the backing plate;

— in order to prevent assembly movement under testing, a pressure fixture applies a face load of $(0,5 \pm 0,15)$ N/mm^2 of the lining area at a right angle to the shear load;

— the face load is applied in such a way that friction force is minimized and does not significantly influence the shear load measurement.

Dimensions in millimetres

Key

1   Loading tool

2   Loading punch profile, (1 ± 0,2) mm clear of shoe platform

3   Lining face support

4   Fixed bottom tool

5   Shoe platform supported by tool (support ⩽ platform thickness)

a   Centre of thrust of top ram to be positioned thus

b   Loading direction, parallel to shoe platform

c   Through test tool

Figure 2 — Drum brake shoe test fixture

Dimensions in millimetres
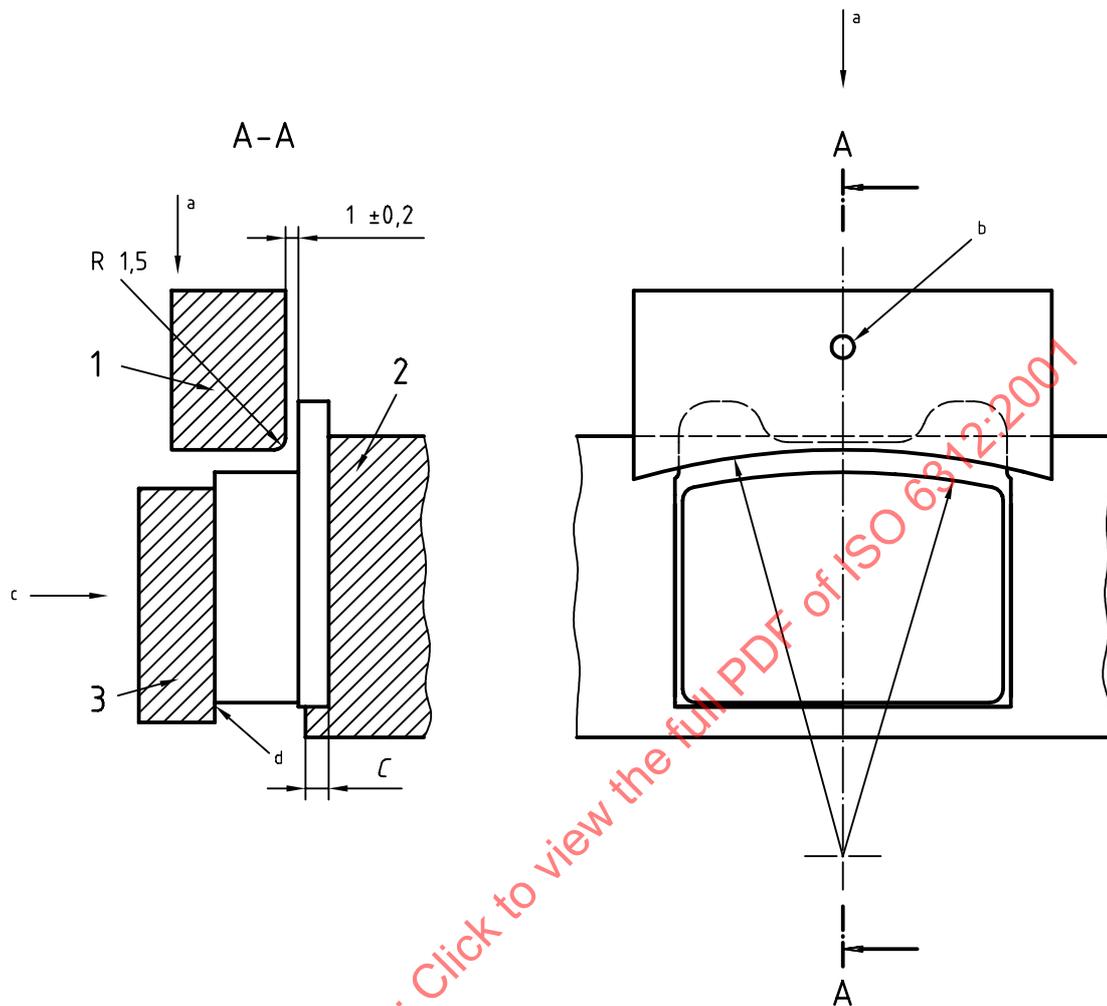
Key

1   Loading tool (parallel to backing plate support)
2   Backing plate support
3   Face load fixture
C ⩽ backplate thickness

a   Direction of sheer force
b   Pivot
c   Face load
d   Minimized friction at interface

Figure 3 — Disc brake pad test fixture

7   Test procedure

The test procedure shall be carried out in accordance with the following (see Figure A.1 for a procedural flow diagram).

a)   Conduct the test at ambient temperature [(23 ± 5) °C].

b)   When shear tests at elevated temperatures are specified, heat the sample uniformly to a stabilized temperature within 30 min and test within 30 s after removal from the heating unit. Recommended temperatures are (200 ± 10) °C for drum brake linings and (300 ± 10) °C for disc pads.

c)   Place the brake shoe or disc brake pad in the appropriate shear-test fixture.

d) Apply the load at the rate specified in 6.1, continuing until complete failure occurs.

e) Record the failure load together with the shear pattern expressed as a percentage as specified in clause 9.

8   Calculation of shear strength

Calculate the shear strength using the formula:

$$\tau = \frac{F}{A}$$

where

   τ is the shear strength, expressed in megapascals;

   F is the shear force at failure, expressed in newtons;

   A is the sample area, expressed in square millimetres.

Calculate A from the friction material profile at the bond line and not at the pad face, as chamfers or slots are pad surface effects.

The shear strength is expressed as the minimum and the average of the results of the number of samples tested.

9   Presentation of results

The test report (see annex B) shall include the following information:

a) type and supplier of the brake shoe assembly or disc brake pad friction material, and batch identification;

b) number of samples tested (five recommended);

c) minimum and average shear-force, or minimum and average shear-strength, values, or both;

d) a description of the shear pattern, based on:

   1) percentage failure:

      — of clean carrier,

      — of adhesive, and

      — in the lining, and

   2) location of any clean carrier areas;

e) comments (including mention of samples used as specified in clause 5) on deviations from normal test conditions such as a special test temperature.