Doc TED 04 (XXXX) WC
IS 2742 (Part 7): XXXX
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For Comments Only

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भारतीय मानक **मसौदा**

स्वचल वाहन — ब्रेक अस्तर
भाग 7 डिस्क ब्रेक पैड एवं ड्रम ब्रेक शू एसेंबली के लिए
कतरनी परीक्षण पद्धती

(पहला पुनरीक्षण)

Draft *Indian Standard*

AUTOMOTIVE VEHICLES —BRAKE LININGS
PART 7 SHEAR TEST PROCEDURE FORDISC BRAKE
PAD AND DRUM BRAKESHOE ASSEMBLIES

(First Revision)

ICS 43.040

Automotive Braking Systems, Vehicle Testing, Steering and performance Evaluation Sectional Committee, TED 04	**Last date for receipt of comments is 16/06/2024**

Automotive Braking Systems, Vehicle Testing and Performance Evaluation Sectional Committee, TED 04

FOREWORD
(Formal Clause to be added later)

This standard was first published in 2018, The present revision has been taken up with a view to incorporating the modifications found necessary as a result of experience gained on the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standard, and references to Indian Standards, wherever applicable have been updated. In this standard the brake linings for automotive vehicles are considered as of significant importance because of their role in overall safety of the vehicle.

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 Standard take into account current practice, based upon an examination of equipment in use.

AIS 061 'Replacement brake lining assemblies and drum brake linings for power-driven vehicles and their trailers' is calling for inspection of lining shear load test as per ISO 6312. This standard part 7 has been made to add in present IS 2742 based on ISO 6312 standard.

Approval of the brake liner for application on a specific vehicle model is based on vehicle test as laid down in this standard applicable to the category to which the vehicle model belongs. As the tests in this standard are not intended to replace the testing of the brakes on a vehicle or dynamometer, it being accepted that a full assessment of a lining can be made only under operating conditions.

This standard is hence intended to be used for checking consistency of the brake linings manufacture. The properties shall be identified with particular brake lining and not with the brake or vehicle on which this lining is used.

This Indian Standard is published in seven parts. The other parts in this series are:

IS 2742: 1994 (Part 1)	Automotive vehicles — Brake linings (Non-rubberized) Part 1 Specification (*first revision*)
IS 2742: 1999 (Part 2)	Automotive vehicles — Brake linings — Rubberized Part 2 Specification
IS 2742: 1994 (Part 3)	Automotive vehicles — Brake linings Part 3 Methods of test
IS 2742 : 1994 (Part 4)	Automotive vehicles — Brake linings Part 4 Co-efficient of friction — Method of test
IS 2742: 1994 (Part 5)	Automotive vehicles — Brake linings Part 5 Internal shear strength — Method of test
IS 2742: 2018 (Part 6)	Automotive vehicles — Brake linings Part 6Compressive strain test methods

The composition of the Committee responsible for formulating this standard is given in Annex C (Will be added later)

In reporting the result of a test or analysis made in accordance with this standard, if the final value observed or calculated, is to be rounded off, it shall be done in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*).

Draft *Indian Standard*

AUTOMOTIVE VEHICLES — BRAKE LININGS PART 7 SHEAR TEST PROCEDURE FOR DISC BRAKE PAD AND DRUM BRAKE SHOE ASSEMBLIES

(First Revision)

1 SCOPE

This 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 Standard is applicable to assemblies that are integrally moulded, bonded or that use mechanical retention systems (MRS) of both types used for brakes on road vehicles. This Standard does not apply to riveted assemblies.

2 REFERENCES

The standard given below contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated were valid. All standard is subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

IS No.	*Title*
IS 11852 : 2013	Automotive vehicles — Brakes and braking systems

3 TERMS AND DEFINITIONS

For the purposes of this standard, the terms and definitions given in IS 11852 and the following shall 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 material is attached.

3.3 Bond Area A — Contact area between lining and carrier.

3.4 Mechanical Retention System MRS — Attachment method where mechanical protrusions on the backing plate aid the retention of the friction material or the under layer.

3.5 Shear Force at Failure F — Total load applied at the time of shear failure.

3.6 Shear Strength at Failure — 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 (*see* **8**).

Table 1 Symbols and Units
(*Clause* **4**)

S.No	Quantity	Symbol	Unit
(1)	(2)	(3)	(4)
i)	Shear force at failure	F	N
ii)	Bond area	A	mm^2
iii)	Shear strength at failure	τ	MPa

5 SAMPLING AND CONDITIONING

5.1 This procedure can also apply for samples during product development, on finished products, or after special treatment or usage (inertia-dynamometer testing or field use) with the appropriate preparation.

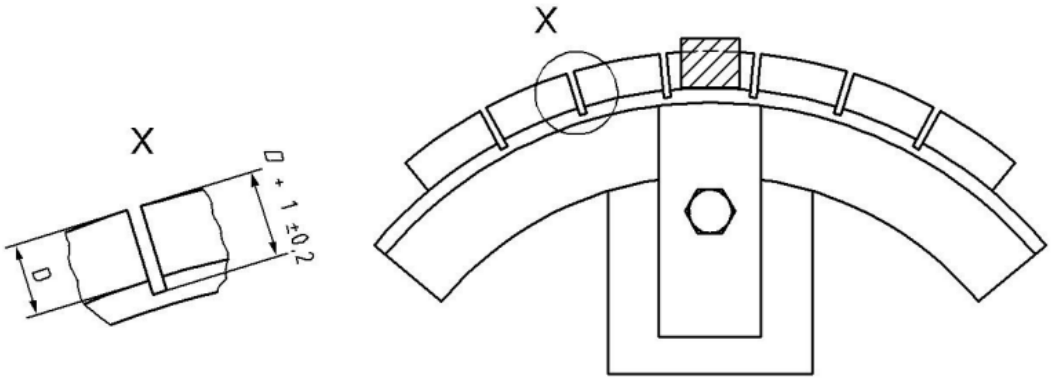
5.2 Perform the testing on a complete assembly or a section (coupon) of the assembly. When testing a section or coupon, apply the load in the radial or tangential direction relative to the vehicle mounting position. Indicate the test orientation on the test report.

5.3 If needed, prepare the sample edges to ensure good contact with the loading and fixed tools. Remove noise insulating shims before the test.

5.4 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* Fig. 1).

5.5 Use five samples for standard testing. Take at random, from the factory output, a minimum of fifteen representative linings or pads of nominally the same shape, size and material.

NOTE — The test procedure applies a load in a direction that might not be in accordance with the loading direction of the product in service. A high aspect ratio, chamfered, or slotted pads might influence the shear behavior of the pad assembly



Dimensions in millimeters
FIG. 1 LINED SHOE IN SEGMENTAL TEST CONDITION

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 provide 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 ± 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. Indicate on the test report the type of machine control (load rate or crosshead speed) used for the test, so that it allows comparisons of results between different test rigs. Avoid any shock loading during the test.

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. To avoid sharp edges, this tool shall have a radius of 2 mm or less at the part in contact with the test sample. If a specific radius is used, note it on the test report as a deviation from the test procedure. If the surface area of the loading tool includes the draft angle of the friction material, note it on the test report.

6.2.2 *Drum Brake Shoe Assembly*

The fixture (*see* Fig. 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 ± 0.2) mm of the shoe platform.

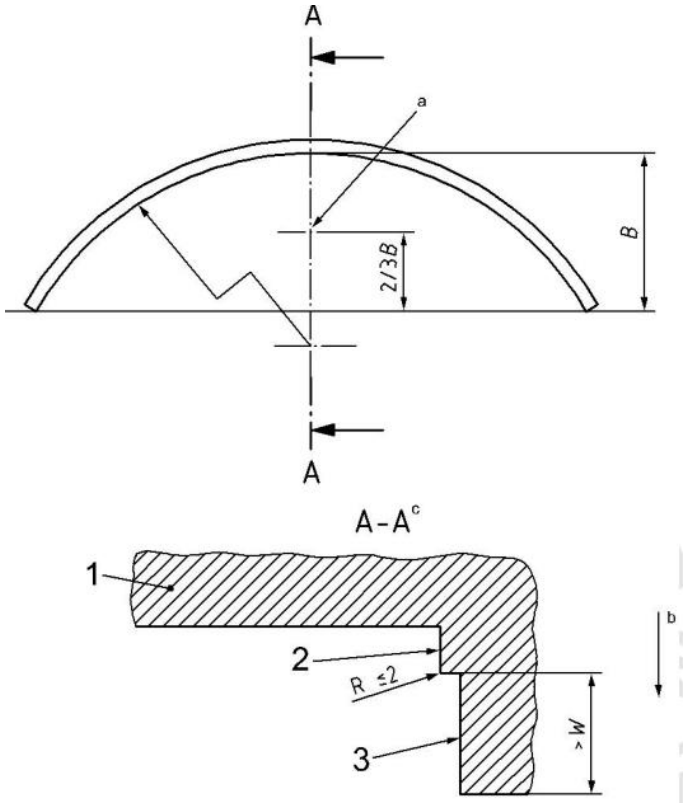
The load application on the loading tool shall be in a direction parallel to the plane of the shoe platform. Support the shoe to maintain uniform loading along the length of the lining sample.

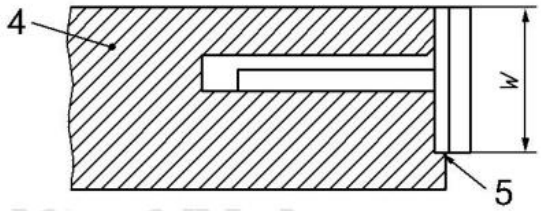
The width of the loading tool shall be greater than the width, *W* of the lining.

6.2.3 *Disc Brake Pad*

Design the test fixture (*see* Fig. 3) such that:

a) The location of the plane of the backplate is parallel to the plane of the loading tool;
b) The loading tool is in contact with the edge of the friction material within (1 ± 0.2) mm of the backing plate (carrier) and conforms to the friction material profile, including as optional draft angles from the moulding process;
c) The loading tool is self-aligning;
d) The loading tool is in contact with the full sample length of the lining edge parallel to the backplate support;
e) The load-bearing edge of the backing plate rests against a rigid support with a thickness no greater than that of the backing plate;
f) In order to prevent assembly movement under testing, a pressure fixture applies a face load of (0.5 ± 0.15) N/mm^2 of the friction material area at a right angle to the shear load; and
g) The face load is applied in such a way that friction force is minimized and does not significantly influence the shear load measurement.





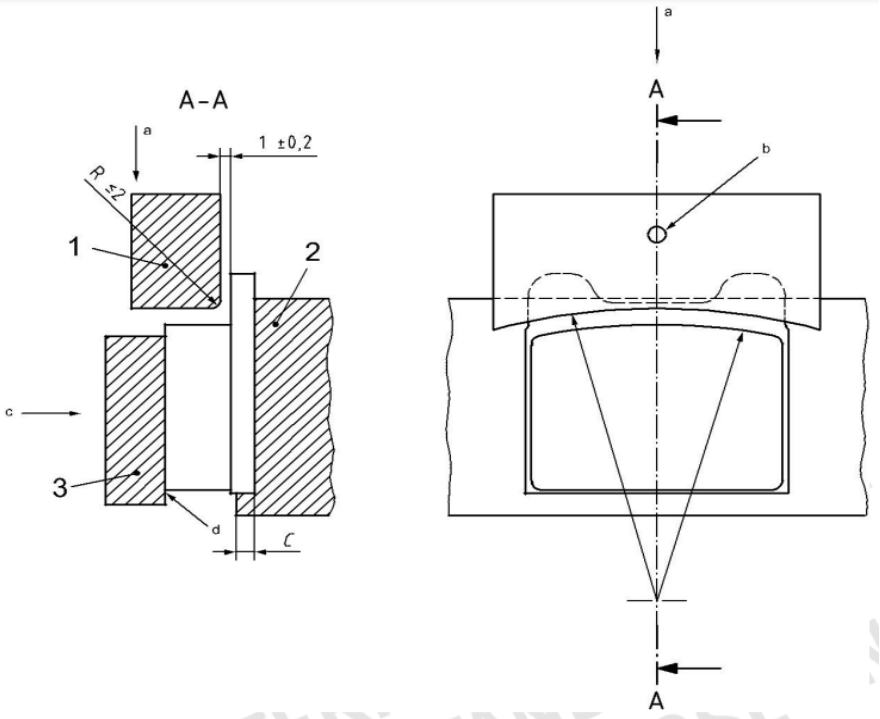
Key

1 Loading tool
2 Loading punch profile, (1 ± 0.2) mm clear off shoe platform
3 Lining face support
4 Fixed bottom tool
5 Shoe platform supported by tool (support u platform thickness)

a) Centre of thrust of top ram to be positioned thus.
b) Loading direction, parallel to shoe platform.
c) Through test tool.

Dimensions in millimeters

FIG. 2 DRUM BRAKE SHOE TEST FIXTURE



Key

1 Loading tool (parallel to backing plate support)
2 Backing plate support
3 Face load fixture
C < Backplate thickness
a) Direction of shear force.
b) Pivot.
c) Face load.
d) Minimized friction at interface.

Dimensions in millimeters

FIG. 3 DISC BRAKE PAD TEST FIXTURE

7 TEST PROCEDURE

Carry out the test procedure as described below.

a) Conduct the test at ambient temperature (23 ± 5) °C. Agree with customer prior to testing for other ambient conditions;
b) When conducting a shear tests at elevated temperatures, heat the sample uniformly to the bond line temperature within 30 min and test 60 safter 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 in the orientation indicated for the test (radial or tangential).
d) Apply the load at the rate specified in **6.1**, continuing until complete failure occurs.
e) (Optional) Record the failure load together withthe shear pattern expressed as ~~a~~ percentage. Assess the fracture surface of uncut edges (2 mm from the friction pad or brake shoe outline) and core zones separately. If a visual assessment is doubtful, perform (optional to the test requestor) an analysis with a reference solution as described below:

    1) Prepare 1.0 l of reference solution by mixing:
        i) 80 g of copper(II) sulphate ($CuSO_4$);
        ii) 30 g of sodium chloride (NaCl);
        iii) 100 ml of 0.01 N hydrochloric acid (0,364 6 g HCl in a 1.0 l solution); and
        iv) Add distilled water or de-ionized water to obtain a total solution volume of 1.0 l.

    2) Immerse the back plate in the reference solution for 5 s;
    3) Assess the fracture condition and record as follows:
        i) A material has fractured when the fracture surface is not coloured brown by the reference solution; and
        ii) If there is a bonding fault between the glue and the back plate, there will be a regular and homogeneous brown colouring at the surface of fracture.

8 CALCULATION OF SHEAR STRENGTH

Calculate the shear strength, using equation (1), as follows:

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

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. Report the shear strength 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) Sample type and load orientation when testing using a section or coupon;
c) Number of samples tested (five recommended);
d) Minimum and average shear force, or minimum and average shear strength, values, or both;
e) Loading tool with/without taper angle from moulding process;
f) A description of the shear pattern, based on:
    1) Percentage failure:
        i) Exposing the clean carrier,
        ii) Within adhesive layer, and
        iii) Within the friction material or underlayer.

    2) Location of any clean carrier areas.

g) Comments (including mention of samples used as specified in 5) on deviations from normal test conditions, such as a special test temperature.

ANNEX A

(*Normative*)

Test Procedure Flowchart

A-1 Fig. 4 shows a flowchart of the test procedure.

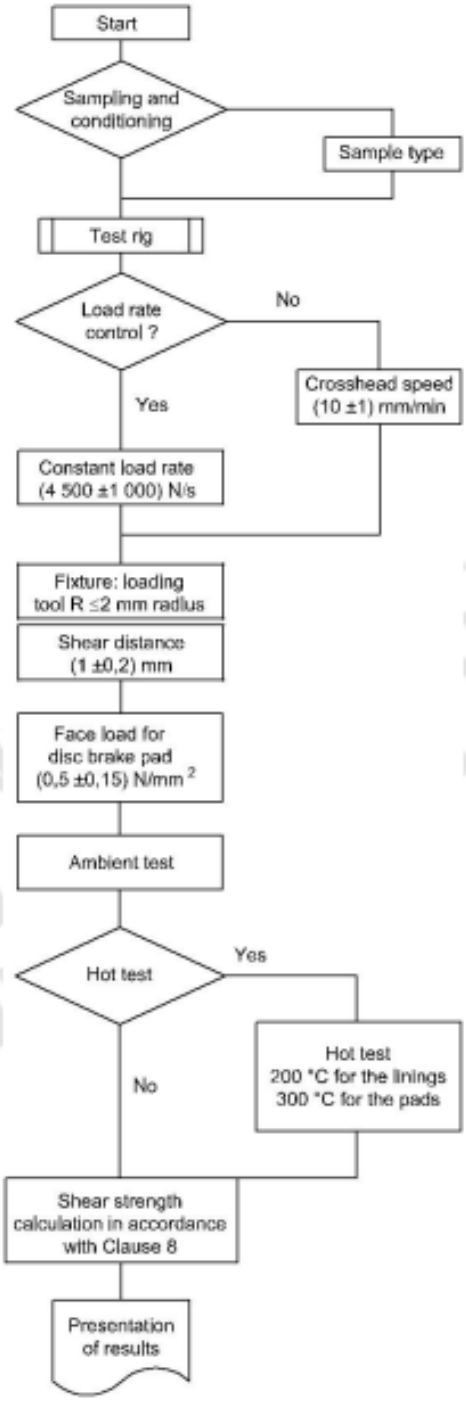


FIG. 4 (COULD BE REMOVED; SEEMS TO BE UNNECESSARY FOR A SIMPLE SHEAR TEST PROCEDURE – COULD BE REMOVED TO SAVE SPACE)

ANNEX B
(*Clasue* **9**)

TEST REPORT

B-1 The presentation of the test parameters and report of results is given in Table 2.

Table 2 — Test Parameters and Report of Results
(*Clause* B-1)

Sl No.	Parameter	Constant Load			Speed Transverse Load	
(1)	(2)	(3)		(4)	(5)	
i)	Load rate	(4 500 ± 1000) N/s			(10 ± 1) mm/min	
ii)	Distance from carrier to loading tool	(1 ± 0.2) mm			(1 ± 0.2) mm	
iii)	Loading tool radius	< 2 mm			< 2 mm	
iv)	Loading tool draft angle (tick box)	with	without		With	without
v)	Face load	(0.5 ± 0.15) N/mm^2			(0.5 ± 0.15) N/mm^2	
vi)	Heating test					
vii)	Heating duration	30 min			30 Min	
viii)	Test dwell time after heating	60 s			60 s	
ix)	Test temperature for drum brake lining	(200 ± 10)°C			(200 ± 10)°C	
x)	Test temperature for drum brake lining	(300 ± 10)°C			(300 ± 10)°C	
xi)	Manufacturer of lining					
xii)	Lining reference					
xiii)	Batch identification					
xiv)	Sample type (tick box)	full pad	pad section or coupon		segment of lined shoe	other
xv)	Sample orientation for pad section or coupon testing (tick box)	load in the radial direction				
xvi)	Sample size					
xvii)	Sample size Sample area at point of shear	mm^2				
xviii)	Special coatings					
xix)	**Ambient Test**			**Hot Test**		
xx)	Number of samples tested (five recommended):			Number of samples tested (five recommended):		
xxi)	Minimum shear strength:	MPa		Minimum shear strength	MPa	
xxii)	Mean shear strength:	MPa		Mean shear strength:	MPa	
xxiii)	Failure mode					
xxiv)	Clean carrier:	Percent		Clean carrier:	Percent	
xxv)	Adhesive:	Percent		Adhesive:	Percent	
xxvi)	Failure in friction material	Percent		Failure in friction material	Percent	
xxvii)	Location of clean areas:			Location of clean areas:		
xxviii)	Deviation from test procedure:					

xxix)	Test date:
xxx)	Name of tester:
xxxi)	Reference number:
xxxii)	Test method adopted (A or B):

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Automotive Braking Systems, Vehicle Testing, Steering and performance Evaluation Sectional Committee, TED 04

Will be added later