भारतीय मानक **IS 17132 : 2024**

Indian Standard

शक्ति-चालित वाहनों और उनके ट्रेलरों के प्रतिस्थापित ब्रेक लाइनिंग समुच्चय एवं ड्रम ब्रेक लाइनिंग के लिए मार्गदर्शक — विशिष्टि

(पहला पुनरीक्षण)

Replacement Brake Lining Assemblies and Drum Brake Linings for Power-Driven Vehicles and Their Trailers — Specification

(First Revision)

ICS 43.040

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

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Braking Systems, Vehicle Testing, Steering and performance Evaluation Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in 2019. This revision has been brought out 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 standards, wherever applicable have been updated.

Brake lining is a consumable safety critical sub-component of brake system. Need of adequate quality of such crucial part is of paramount importance. Though standards are available for performance verifications of original equipment fitted brake systems, no standards were available for replacement brake lining assemblies.

While preparing this standard, considerable assistance is derived from ECE R 90-Revision 3 — Amendment 10 [supplement 10 to the 02 series of amendments – date of entry into force June 5, 2023 (issue 20 June 2023)]. Uniform provisions concerning the approval of replacement brake lining assemblies and drum brake linings for power-driven vehicles and their trailers.

To facilitate the testing of replacement brake linings used on vehicles/brake linings tested as per IS 11852 : 2019, IS 15986 : 2015, IS 14664 : 2010, AIS 150 and AIS 151, the references of IS 11852: 2001, IS 11852 : 2013, IS 15986 : 2015, IS 14664 : 2010, AIS 150 and AIS 151, have been made at relevant places in the text.

The composition of the Committee responsible for formulating this standard is given in Annex N.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this draft standard.

Indian Standard

REPLACEMENT BRAKE LINING ASSEMBLIES AND DRUM BRAKE LININGS FOR POWER-DRIVEN VEHICLES AND THEIR TRAILERS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard applies to replacement service brake lining assemblies intended for use in friction brakes forming part of the braking system of power-driven vehicles of category M, N, L and T trailers and semi-trailers authorized for use on public roads.

1.2 Replacement brake lining assemblies and drum brake lining to be approved for fitment and use on power-driven vehicles and their trailers and semi-trailers having type approval in accordance with IS 11852/IS 15986/IS 14664/AIS 150/AIS 151. Also riveted type replacement drum brake linings designed for a brake shoe may be approved for fitment and use on power driven vehicles and trailers having type approval in accordance with IS 11852/IS 15986/ IS 14664/AIS 150/AIS 151 and classified in categories M1, M2, M3, N1, N2, N3, T3, T4 and L.

The replacement brake lining assemblies and drum brake lining used for separate parking brake systems being independent of the vehicle service brake system will be subject only to the technical prescriptions defined in Annex K of this regulation.

1.3 Original brake lining assemblies and drum brake linings fitted at time of manufacturing of the vehicle, as referenced in the vehicle type approval and original replacement brake lining assemblies and drum brake linings intended for the servicing of the vehicle are not subject of this standard.

2 REFERENCES

The standards listed in Annex A contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 DEFINITIONS

For the purposes of this standard, the following definitions shall apply.

3.1 Braking System — Has the meaning assigned in IS 11852, IS 15986, IS 14664, AIS 150 and AIS 151.

3.2 Friction Brake — The part of a braking system in which the forces opposing the movement of a vehicle are developed by friction between a brake lining and a wheel disc or drum moving relatively to each other.

3.3 Brake Lining Assembly — A component of a friction brake, which is pressed against a drum or disc, respectively, to produce the friction force.

3.3.1 *Shoe Assembly* — A brake lining assembly of a drum brake.

3.3.2 *Shoe* — A component of a shoe assembly, which carries the brake lining.

3.3.3 *Pad Assembly* — A brake lining assembly of a disc brake.

3.3.4 *Back plate* — A component of a pad assembly, which carries the brake lining.

3.3.5 *Brake Lining* — The friction material component with the shape and final dimension to be fixed on to the shoe or backplate.

3.3.6 *Drum Brake Lining* — A brake lining for a drum brake.

3.3.7 *Friction Material* — The product of a specified mixture of materials and processes, which together determine the characteristics of a brake lining.

3.4 Brake Lining Type — Means wheel sets of brake lining assemblies, which do not differ in brake lining type, functional dimension or functional characteristics.

3.5 Brake Lining Assembly Type — Means wheel sets of brake lining components, which after fitment to the shoes do not differ in brake lining type, functional dimensions or functional characteristics.

3.6 Drum Brake Lining Type — Wheel sets of brake lining components, which after fitment to the shoes do not differ in brake lining type, dimensions or functional characteristics.

3.7 Original Brake Lining — Brake lining assemblies fitted at time of manufacturing of the vehicle as referenced in the vehicle type approval documentation (for example, AIS 007 or equivalent) and original replacement brake lining assemblies intended for the servicing of the vehicle. These brake linings are not subject of this standard.

3.8 Identical Brake Lining — A replacement brake lining assembly identical to the brake lining assembly supplied and fitted as original equipment and included in the vehicle type approval documentation (for example, AIS 007 or equivalent) or any documental reference of supply to vehicle manufacturer with the exception of the vehicle/brake assembly manufacturers mark. These brake linings are not subject of this standard.[1)]

3.9 Original Brake Lining Assembly — A brake lining assembly conforming to the data attached to a vehicle type approval documentation.

3.10 Original Drum Brake Lining — Drum brake linings fitted at time of manufacturing of the vehicle as referenced in the vehicle type approval documentation (for example, AIS 007 or equivalent) and original replacement drum brake linings intended for the servicing of the vehicle. These drum brake linings are not subject of this standard.

3.11 Identical Drum Brake Lining — A replacement drum brake lining assembly identical to the brake lining assembly supplied and fitted as original equipment and included in the vehicle type approval documentation (for example, AIS 007 or equivalent) or any documental reference of supply to vehicle manufacturer with the exception of the vehicle/brake assembly manufacturers mark not subjected to this standard.[1)]

3.12 Replacement Brake Lining Assembly — A brake lining assembly of a type approved under this standard as a suitable service replacement for an original brake lining assembly as per vehicle type approval documentation (for example, AIS 007 or equivalent).

3.13 Replacement Drum Brake Lining — A drum brake lining of a type approved under this standard as a suitable service replacement when fitted to a shoe for an original drum brake lining as per vehicle type approval documentation (for example, AIS 007 or equivalent).

3.14 Manufacturer — The organization, which can assume technical responsibility for the brake lining assemblies or drum brake linings and can demonstrate that it possesses the necessary means to achieve conformity of production.

3.15 Parking brake system — A replacement brake lining assemblies and drum brake lining belonging to a separate parking brake system which is independent from the service brake system.

[1)] Identical replacement brake lining assemblies and identical drum brake linings do not need to be tested according to the requirements 5, provided the following conditions are fulfilled:

a) That the applicant for approval demonstrates that they produce and supply the submitted brake lining assemblies or drum brake linings to the vehicle or brake manufacturer as original equipment for the specific vehicle models, axles and brakes mentioned as per Annex B, with supply related documents (make, brake size and lining grade etc).
b) That the certification authority may verify that the applicant is producing and supplying the relevant part mentioned as per type approval documentation CMVR 96 brakes requirement Table 5 of AIS 007, in paragraph related to 'Make and type of brake linings'.[2)]
c) The applicant for approval continues to produce the original and identical parts:

1) From the same formulation;
2) With the same manufacturing process;
3) With the same quality assurance system; and
4) With the same results of the conformity of production tests as for the original parts.

The demonstration of compliance to requirements specified in this paragraph shall be supported by an onsite audit, conducted by the certification authority in charge of the approval. To support the audit, the manufacturer shall provide generic data for the process flow chart, control plan with quality check data.

[2)] At the request of applicant(s) for certification against IS 17132, the information shall be provided by the certification authority as contained to with IS 11852 or IS 15986 or IS 14664 or AIS 150 or AIS 151 vehicle, brake and brake performance. However, this information shall not be provided for purposes other than IS 17132 certifications.

4 APPLICATION FOR APPROVAL

4.1 An application for approval of a replacement brake lining assembly type or a replacement drum brake lining type for (a) specific vehicle type (s) shall be submitted by the manufacturer of the replacement brake lining assembly/replacement drum brake lining or his duly accredited representative.

4.2 An application may be submitted by the holder of (a) vehicle type approval(s) to CMV rule No. 96 in respect of replacement brake lining assemblies or replacement drum brake linings conforming to the type recorded in the vehicle type approvals(s) documentation or any documental reference of supply to vehicle manufacturer.

4.3 An application for approval shall be accompanied, in triplicate, by a description of the replacement brake lining assembly or replacement drum brake lining with regard to the items specified in Annex B and by the following particulars:

4.3.1 Diagrams showing functional dimensions with minimum lining area (L × B) and thickness of the proposed replacement brake lining assembly or replacement drum brake lining. Worst case criteria models list to be submitted along with Annex B as per Table 1, if applicable.

4.3.2 An indication of the positions of the replacement brake lining assembly or replacement drum brake lining on the vehicles for which approval to fit is sought.

4.3.3 In the case of brake lining assemblies for vehicles of category L, the list of brake lining assemblies belonging to the same group defined according to **H-2**. This list shall indicate for each brake lining assembly: name of brake lining assembly manufacturer, the brake lining assembly manufacturer's code, the friction material area (cm^2).

4.4 Brake lining assemblies or drum brake linings of the type for which approval is sought shall be made available in sufficient quantity to perform the approval tests by the applicant.

4.5 The applicant shall agree with and make available to the technical service responsible for conducting approval tests the suitable representative vehicles(s) and/or brake(s).

4.6 The notified certifying agency shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted (*see* Annex M). The applicant may submit values for friction behavior in accordance with **J-2.4.1** or **J-3.4.1** respectively.

5 SPECIFICATIONS AND TESTS

5.1 General

A replacement brake lining assembly or a replacement drum brake lining shall be so designed and constructed that, when substituted for the brake lining assembly or drum brake lining originally fitted to a vehicle, the braking efficiency of that vehicle accords with that of the approved vehicle type, specifically:

a) Vehicle equipped with replacement brake lining assemblies or replacement drum brake linings shall satisfy the relevant braking prescriptions of IS 11852 or IS 15986 or IS 14664 or AIS 150 or AIS 151;

b) A replacement brake lining assembly or a replacement drum brake lining shall display performance characteristics similar to that of the original brake lining assembly or original drum lining it is intended to replace;

c) A replacement brake lining assembly or a replacement drum brake lining shall possess adequate mechanical characteristics; and

d) Brake linings shall not contain asbestos.

5.1.1 Replacement brake lining assemblies or replacement drum brake linings conforming to the type specified in vehicle type approval documentation (for example, AIS 007 or equivalent) are deemed to satisfy the requirements of **5** of this regulation.

5.1.2 Identical brake lining or identical drum brake linings conforming to the type specified in vehicle type approval documentation or any documental reference of supply to vehicle manufacturer are deemed to satisfy subject to fulfilling of the following:

The applicant for approval submits the documents, that they confirm to the type approval certificate as original equipment for the specific vehicle models, axles and brakes mentioned as per Annex B, with procurement related documents (make, brake size and lining grade etc).

5.2 Performance Requirements

5.2.1 *Replacement Brake Lining Assemblies for Vehicles of Categories M1, M2 and N1*

Replacement brake lining assemblies and

replacement drum brake linings shall be tested according to the Annex D using one of the two methods described in **D-1** (vehicle test) or in **D-2** (inertia dynamometer test) and shall satisfy the requirements stipulated in this Annex D. The representative vehicle(s) shall be selected from among the application range using a worst case analysis.[3)]

5.2.2 *Replacement Brake Lining Assemblies and Replacement Drum Brake Linings for Vehicles of Categories M3, N2 and N3*

Replacement brake lining assemblies and replacement drum brake linings shall be tested according to the Annex D, using one of the two methods described in **E-1** (vehicle test) or in **E-2** (inertia dynamometer test) and shall satisfy the requirements stipulated in this Annex E. The representative vehicle(s) shall be selected from among the application range using a worst case analysis.[3)]

5.2.3 *Replacement Brake Lining Assemblies for Vehicles of Categories T_1 and T_2*

Replacement brake lining assemblies shall be tested according to the prescriptions of Annex F and shall satisfy the requirements stated in this Annex F.

5.2.4 *Replacement Brake Lining Assemblies and Replacement Drum Brake Linings for Vehicles of Categories T_3 and T_4*

Replacement brake lining assemblies and replacement drum brake linings shall be tested according to the prescriptions of Annex G and shall satisfy the requirements stated. For the tests one of the two methods described in IS 11852 or AIS 150 shall be used.

5.2.5 *Replacement Brake Lining Assemblies for Two and Three Wheeled Vehicle Categories*

It is allowed the verification of a brake lining assembly deemed to be representative of a group of brake lining assemblies, grouped according to the criteria defined in **H-2**.

The representative brake lining assembly is deemed to identify the most severe application. Results obtained with that representative brake lining assembly are considered valid for all the brake lining assemblies belonging to the same group defined according to the grouping criteria as from **H-2**.

Replacement brake lining assemblies shall be tested according to the prescriptions of **H-1** and shall satisfy the requirements stated in this **H-1**.

5.3 Mechanical Characteristics

5.3.1 *Replacement Brake Lining Assemblies and Replacement Drum Brake Linings for Vehicles of Categories M1, M2, N1, T1, T2 and L Vehicle Categories*

a) Replacement brake lining assemblies and replacement drum brake lining (applicable for bonded drum brake lining) of the type for which approval is requested shall be tested for shear strength according to ISO 6312; and

b) The minimum acceptable shear strength is 250 N/cm^2 for pad assemblies and 100 N/cm^2 for shoe assemblies.

5.3.1.1 Replacement brake lining assemblies and replacement drum brake linings of the type for which approval is requested shall be tested for compressibility strength according to standard ISO 6310 or material hardness as per **5.3.1.2**.

The compressibility values shall not exceed 2 percent at ambient temperature and 5 percent at 400°C for pad assemblies and 2 percent at ambient temperature and 4 percent at 200 °C for shoe assemblies. This requirement does not apply to parking brake lining assemblies.

5.3.1.2 *Material Hardness*

a) Replacement brake lining assemblies or replacement drum brake linings of the type for which approval is requested shall be tested for hardness according to standard ISO 2039-2; and

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[3)] Worst case analysis shall include the following technical characteristics (as a minimum) of each vehicle type in the application range:

a) Rotor/drum diameter;
b) Rotor/drum thickness;
c) Ventilated or solid rotor/solid or finned drum;
d) Piston or wheel cylinder diameter/brake chamber size;
e) Slag adjuster length;
f) S-cam radius;
g) Piston lever ratio;
h) Tyre dynamic radius;
j) Vehicle mass;
k) Axle mass and percentage of braking effort of the axle; and
m) Maximum speed of the vehicle.

The testing conditions shall be specified in the test report and worst case criteria proposed vehicle models list to be submitted along with Annex B as per Table 1, if applicable.

b) The hardness figure for the friction material at the rubbing surface shall be the mean value out of five sample linings from different production batches (if available) by taking five measurements at different places of each brake lining.

5.3.2 *Replacement Brake Lining Assemblies and Replacement Drum Brake Linings for Vehicles of Categories M3, N2, N3, T3 and T4*

a) Shear strength — This test applies only to brake lining assemblies. Replacement brake lining assemblies of the type for which approval is requested shall be tested for shear strength according to standard ISO 6312. Brake lining assemblies may be divided into two or three parts to match the test machine's capability. The minimum acceptable shear strength is 250 N/cm^2.

b) Compressibility — Replacement brake lining assemblies and replacement drum brake linings of the type for which approval is requested shall be tested for compressibility according to standard ISO 6310. Flat specimens according to sample Type I may be used. The compressibility values shall not exceed 2 percent at ambient temperature and 5 percent at 400 °C for pad assemblies and 2 percent at ambient temperature and 4 percent at 200 °C for shoe assemblies and drum brake linings.

c) Material hardness — This requirement applies to drum brake lining assemblies and drum brake linings. Replacement brake lining assemblies or replacement drum brake linings of the type for which approval is requested shall be tested for hardness according to standard ISO 2039-2. The hardness figure for the friction material at the rubbing surface shall be the mean value out of five sample linings from different production batches (if available) by taking five measurements at different places of each brake lining.

NOTE — Material hardness test may be done as an alternative to compressibility test.

d) Cross braking strength — Replacement drum brake linings of the type for which approval is requested shall be tested for cross breaking strength as per IS 2742 (Part 3).

5.3.3 *Heat Swell Test for Replacement Brake Lining Assemblies and Replacement Drum Brake Linings for Vehicles of Categories M3, N2, N3, T3 and T4*

Heats shall be tested for drum brake linings as per IS 2742 (Part 3) and for disc-brake-pads as per ISO 6313.

6 PACKAGING AND MARKING

6.1 Replacement brake lining assemblies or replacement drum brake linings conforming to a type approved in accordance with this standard shall be marketed in axle sets.

6.2 Each axle set shall be contained in a sealed package constructed to show previous opening.

In the case of replacement drum brake linings, with details of rivets of suitable size and material or rivets of suitable size and material shall be provided together with the brake linings.

6.3 Each package shall display the following information:

a) The quantity of replacement brake lining assemblies or replacement drum brake linings in the package;
b) Manufacturer's name or trade mark;
c) Make and type of replacement brake lining assemblies or replacement drum brake linings;
d) The vehicles/axles/brakes for which the contents are approved; and
e) The approval mark.

6.4 Each package shall contain fitting instructions in English and Hindi languages, supplemented by the corresponding text in the language of the country where it is sold.

6.4.1 With particular reference to auxiliary parts.

6.4.2 Stating that replacement brake lining assemblies or replacement drum brake linings should be replaced in axle sets.

6.4.3 With, in the case of replacement drum brake linings, a general statement calling attention to the following points:

a) the integrity of the shoe platform, abutment and pivot;
b) freedom of the shoe from distortion, deformation and corrosion;

c) the type and size of rivet to be used; and

d) the required riveting tools and forces.

6.5 Each replacement brake lining assembly or replacement drum brake lining shall display permanently one set of approval data (*see* Annex C):

a) The approval mark;

b) The date of manufacture, at least month and year; or batch number; and

c) Make and type of brake lining.

7 BIS CERTIFICATION MARKING

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No./Other Standards	*Title*	*IS No./Other Standards*	*Title*
IS 2742 (Part 3) : 1994	Automotive vehicles — Brake linings: Part 3 Methods of test		pad and drum brake shoe assemblies
IS 11852 : 2019	Automotive vehicles — Uniform provisions concerning the approval of vehicles of categories M2, M3, N and T with regard to braking (*third revision*)	ISO 6313 : 1980	Road vehicles — Brake linings — Effects of heat on dimensions and form of disc brake pads — Test procedure
IS 14664 : 2010	Automotive vehicles — Performance requirements and testing procedure for braking system of two and three wheeled motor vehicles (*first revision*)	ISO 2039-2 : 1987	Plastics — Determination of hardness — Part 2: Rockwell hardness
IS 15986 : 2015	Automotive vehicles — Uniform provisions concerning the approval of vehicles of categories M_1 and N_1 regard to braking (*third revision*)	AIS-007 : 2015	Information on technical Specification to be submitted by the vehicle manufacturer
ISO 6310 : 2009	Road vehicles — Brake linings — Compressive strain test methods	AIS-151 : 2018	Automotive vehicles — Uniform provisions concerning the approval of vehicles of categories M1 (N1 optional) with regard to braking
ISO 6312 : 2010	Road vehicles — Brake linings — Shear strength of disc brake	AIS-150 : 2018	Automotive vehicles — Uniform provisions concerning the approval of vehicles of categories M2, M3, N and T with regard to braking’

ANNEX B

(*Clauses* 3.11, 4.3, 4.3.1, 5.1.2 *and* 5.2.2)

REQUEST FOR APPROVAL/REQUEST FOR APPROVAL EXTENSION OF A REPLACEMENT BRAKE LINING ASSEMBLY OR REPLACEMENT DRUM BRAKE LINING PURSUANT TO IS 17132

APPROVAL NO. .....
EXTENSION NO. .....

B-1 APPLICANT'S NAME AND ADDRESS

B-2 MANUFACTURER'S NAME AND ADDRESS

B-3 MAKE AND TYPE OF BRAKE LINING ASSEMBLY/DRUM BRAKE LINING

B-4 MAKE AND TYPE OF BRAKE LINING

B-5 Vehicles/axles for which the brake lining assembly type/drum brake lining type qualifies as original brake lining assembly/original drum brake lining: (as per the vehicle type approval documentation).

B-6 Vehicles/axles for which the brake lining assembly type/drum brake lining type qualifies as identical brake lining assembly/identical drum brake lining: (as per the vehicle type approval documentation or any documental reference of supply to vehicle manufacturer).

B-7 Vehicles/axles for which the brake lining assembly type/drum brake lining type qualifies as replacement brake lining assembly/replacement drum brake lining: [The representative vehicle(s) shall be selected from among the application range using a worst case analysis as per **5.2.1** and **5.2.2**, and as per **B-15** to be enclosed].

B-7.1 Additionally in the case of combined braking systems in the meaning of IS 14664, approved brake lining assembly combination(s):

B-7.2 Submitted for approval on ……

B-8 CERTIFYING AGENCY RESPONSIBLE FOR APPROVAL TESTS

B-8.1 Date of Test Report

B-8.2 Number of Test Report

B-9 APPROVAL GRANTED/EXTENDED/REFUSED/WITHDRAWN

B-10 PLACE

B-11 DATE

B-12 SIGNATURE

B-13 Annexed to this communication is a list of documents in the approval file deposited at the certification authority having delivered the approval and which can be obtained upon request.

Distinguishing number for which has granted/extended/refused/withdrawn approval (*see* approval provisions in the standard).

Strike out what does not apply.

B-15 Vehicle worst case analysis as per **5.2.1** and **5.2.2** (*see* Table 1).

Table 1 Vehicle Worst Case Analysis

(*Clauses* 4.3.1, 5.2.2 *and* B-15)

Sl No.			Vehicle Make A			Vehicle Make B	Vehicle Make C		Represented Vehicle[4)]		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Maximum
i)	Vehicle speed	kmph									Maximum
ii)	Axel weight	kg									Maximum
iii)	Tyre radius	m									
iv)	Caliper brake size wise group		For example, diameter 51 group or diameter 54 group or diameter 57 group, etc								
v)	Rotor diametre	m									Minimum
vi)	Rotor thickness	mm									Minimum
vii)	Rotor ventilated/solid										Low cooling
viii)	Actual caliper piston size	cm									Minimum
ix)	Pad area	Sq cm									Minimum
x)	Pad thickness	mm									Minimum
xi)	Pad length × width	mm									For reference
xii)	Pad mounting dimensions	mm									For reference
xiii)	Pad grade		Mix 1	Mix 1	Mix 1	Mix 1	Mix 1	Mix 1	Mix 1	Mix 1	
xiv)	Drum brake tyre and size wise group		For example, HASF or HLSS or H2LS and diametre 180 group or diametre 254 group, etc								
xv)	Drum diametre	mm									Minimum

Table 1 (*Concluded*)

Sl No.			Vehicle Make A			Vehicle Make B	Vehicle Make C		Represented Vehicle[4)]		
xvi)	Drum braking area thickness	mm									Minimum
xvii)	Wheel cylinder piston diametre	mm									Minimum
xviii)	Total lining area	Sq cm									Minimum
xix)	Leading shoe area (L mm × B mm)	Sq cm									For reference
xx)	Leading shoe thickness	mm									Minimum
xxi)	Trailing shoe area (L mm × B mm)	Sq cm									For reference
xxii)	Trailing shoe thickness	mm									Minimum
xxiii)	Leading shoe mounting dimensions	mm									For reference
xxiv)	Trailing shoe mounting dimensions	mm									For reference
xxv)	Lining grade		Mix 2	Mix 2	Mix 2	Mix 2	Mix 2	Mix 2	Mix 2	Mix 2	For reference

[4)] The representative vehicle(s) shall be selected from among the application range.

ANNEX C

(*Clauses* 6.5 *and* D-1.2.1.1)

MARKING REQUIREMENTS

C-1 EXAMPLES OF PAD ASSEMBLY MARKING

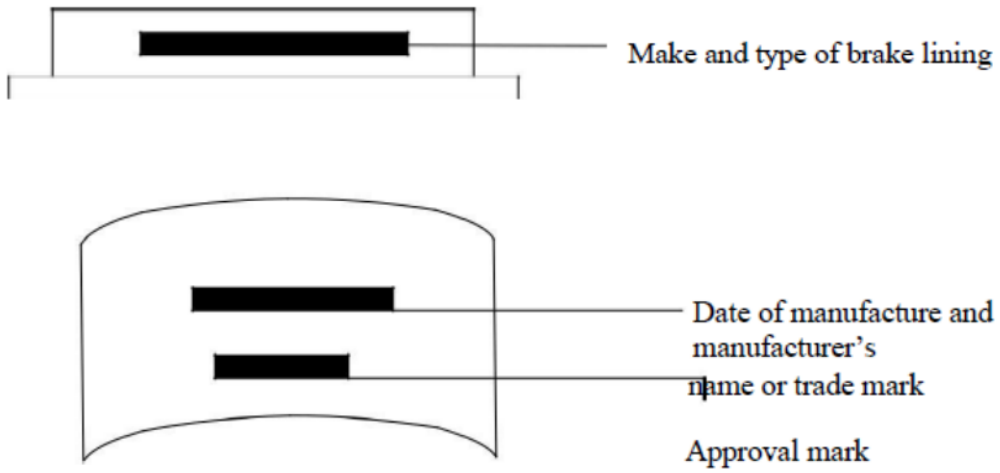

FIG. 1 EXAMPLES OF PAD ASSEMBLY MARKING

C-2 EXAMPLES OF SHOE ASSEMBLY MARKING

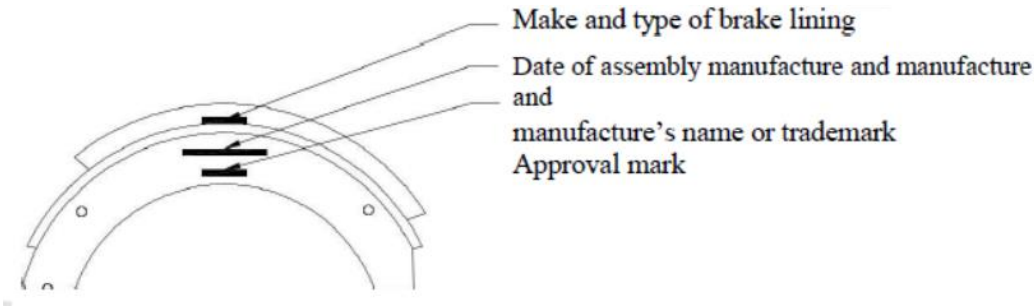

FIG. 2 EXAMPLES OF SHOE ASSEMBLY MARKING

C-3 EXAMPLES OF DRUM BRAKE LINING MARKING

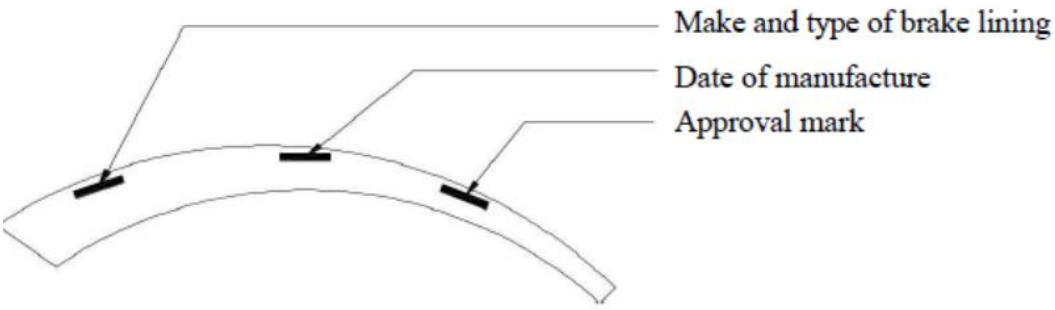

FIG. 3 EXAMPLES OF DRUM BRAKE LINING MARKING

ANNEX D

(*Clause* 5.2.1, 5.2.2, D-1.2.1.1 *and* E-1.2.1.1)

REQUIREMENT FOR REPLACEMENT BRAKE LINING ASSEMBLIES AND DRUM BRAKE LININGS FOR VEHICLES OF CATEGORIES M_1, M_2 AND N_1

D-1 VEHICLE TEST

D-1.1 Test Vehicle

A vehicle which is representative of the type(s) for which the replacement brake lining assembly or drum brake lining approval is required shall be equipped with the replacement brake lining assemblies or drum brake lining of the type for which approval is requested and instrumented for brake testing as required by IS 11852, IS 15986, AIS 150, AIS 151.

Brake linings submitted for test shall be fitted to the relevant brakes and until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency.

D-1.2 Tests and Requirements

D-1.2.1 *Conformance with IS 11852, IS 15986, AIS 150, AIS 151*

D-1.2.1.1 The braking system of the vehicle shall be tested according to the requirements for the vehicle category in question (M1, M2 or N1) as specified in IS 11852 (Annex D), IS 15986 (Annex C), AIS 150 (Annex D), AIS 151 (Annex C). The applicable requirements or tests are:

D-1.2.1.1.1 *Service braking system*

D-1.2.1.1.1.1 Type-O test with engine disconnected, vehicle laden.

D-1.2.1.1.1.2 Type I test.

D-1.2.1.1.2 *Secondary braking system with engine disconnected, vehicle laden*

D-1.2.1.1.3 *Parking braking system*

Only applicable if the brakes for which lining approval is sought are used for parking. Downhill test at 18 percent gradient, vehicle laden as per IS 11852/AIS 150 or Downhill test at 20 percent gradient, vehicle laden as per IS 15986/AIS 151.

D-1.2.2 *Additional Requirements* (*Split Axle Test*)

For the tests mentioned below the vehicle shall be fully laden and all brake applications made with engine disconnected, on a level road.

The vehicle service brake control system shall be equipped with a means of isolating front and rear axle brakes so that either may be used independently of the other.

Where brake lining assembly approval or drum brake lining approval is required for front axle brakes, the rear axle brakes shall remain inoperative throughout the test.

Where brake lining assembly approval or drum brake lining approval is required for rear axle brakes, the front axle shall remain inoperative throughout the test.

D-1.2.2.1 *Cold performance equivalence test*

Cold performance of the replacement brake lining assembly or the replacement drum brake lining shall be tested as per the following method:

a) Make a minimum of six brake applications at spaced increments of pedal effort or line pressure up to wheel lock or alternatively, up to a mean fully developed deceleration of 6 m/s^2 or up to the allowed maximum pedal force for the category of vehicle in question from an initial speed as given in the table below:

Sl No.	*Vehicle Category*	*Test Speed, in* km/h	
		Front Axle	Front Axle
(1)	(2)	(3)	(4)
i)	M_1	70	45
ii)	M_2	50	40
iii)	N_1	65	50

NOTE — The initial brake temperature at the start of each application shall be ≤ 100 °C.

b) Note and plot pedal force or line pressure and mean fully developed deceleration for each application and determine the pedal force line pressure required to achieve (if possible) a mean fully developed deceleration of 5 m/s^2 for front axle brakes and 3 m/s^2 for rear axle brakes. If these values cannot be achieved with the maximum allowed pedal force determine alternatively the pedal force or line pressure required to achieve maximum deceleration.

D-1.2.2.2 *Speed sensitivity test*

a) Using the pedal force derived from **D-1.2.2.1b)** and with initial brake temperature ≤ 100 °C make three brake applications from each of the following speeds:

1) Front axle: 45 km/h, 65 km/h and 80 km/h where V_{Max} exceeds 100 km/h; and

2) Rear axle: 35 km/h, 50 km/h and 65 km/h where V_{Max} exceeds 100 km/h.

b) Average the results for each group of three applications and plot speed against corresponding mean fully developed deceleration; and

c) Mean fully developed decelerations recorded for the higher speeds shall lie within 25 percent of that recorded for the lowest speed.

D-2 INERTIA DYNAMOMETER TEST

D-2.1 Test Equipment

For the tests an inertia dynamometer shall be equipped with the vehicle brake in question. The dynamometer shall be instrumented for continuous recording of rotational speed, brake torque, pressure in the brake line and number of rotations after brake application, braking time and brake rotor/drum temperature.

D-2.1.1 *Test Conditions*

a) The rotational mass of the dynamometer shall correspond to half the axle portion of the maximum vehicle mass as listed in the table below and to the rolling radius of the largest tyre that is authorized for that vehicle type(s):

Sl No.	*Vehicle Category*	*Axle Portion of Maximum Vehicle Mass*	
		Front Axle	Rear Axle
(1)	(2)	(3)	(4)
i)	M_1	0.77	0.32
ii)	M_2	0.69	0.44
iii)	N_1	0.66	0.39

b) The initial dynamometer rotational speed shall correspond to the linear vehicle speed as stated in **D-2.2** and shall be based on the dynamic rolling radius of the tyre;

c) Brake lining assemblies or drum brake linings submitted for test shall be fitted to the brake and until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency; and

d) If cooling air is used, the speed of the airflow at the brake shall be:

$$V_{air} = 0.33v$$

where

v = vehicle test speed at initiation of braking.

D-2.2 Tests and Requirements

D-2.2.1 *Tests Derived from IS* 11852/*IS* 15986/ *AIS* 150/*AIS* 151

D-2.2.1.1 *Service Braking System Type-O Test*

From the initial speed listed as per below table or V = 0.8 V_{Max} (whichever is lower) with a brake temperature ≤ 100 °C at the start of each application make a minimum of six brake applications at spaced intervals of line pressure up to the line pressure of ≤ 100 bar that is permanently guaranteed by the braking system of the vehicle type(s). A mean fully developed deceleration of at least as per below table shall be achieved and the given pressure to achieve has to be recorded.

Sl No.	*Vehicle Category*	*Test Speed* (km)	*Deceleration* (m/s^2)
(1)	(2)	(3)	(4)
i)	M1	100	5.9
ii)	M2	60	5
iii)	M2	80	5

D-2.2.1.2 *Type I test*

D-2.2.1.2.1 *Heating procedure*

Test as per the table below according to vehicle category starting at a brake temperature of ≤ 100 °C at the first application. The line pressure shall correspond to a deceleration of 3 m/s^2 at the first application and shall remain constant throughout the succeeding applications.

Sl No.	*Category*	*Condition*			
		v_1 km/h	v_2 km/h	$\triangle t$ s	*n*
(1)	(2)	(3)	(4)	(5)	(6)
i)	M1	80 percent v_{Max} ≤ 120	1/2 v_1	45	15
ii)	M2	80 percent v_{Max} ≤ 100	1/2 v_1	55	15
iii)	N1	80 percent v_{Max} ≤ 120	1/2 v_1	55	15

D-2.2.1.2.2 *Hot performance*

On completion of the heating procedure the hot performance shall be measured under the conditions of D-2.2.1.1, using the guaranteed line pressure as defined in D-2.2.1.1 (the temperature conditions may be different). The mean fully developed deceleration with the heated brake shall not be less than 60 percent of the value achieved with the cold brake performance D-2.2.1.1.

D-2.2.1.2.3 *Recovery performance*

Starting 120 s after the hot performance brake application makes 5 full stops with the line pressure used in D-2.2.1.2.1 above and with intervals of at least 2 min from the initial speed of 50 km/h. At the beginning of the fifth application the brake temperature shall be ≤ 100 °C and the mean fully developed deceleration achieved shall not be less than 70 percent, nor more than 150 percent of that calculated from the relation line pressure/deceleration of the C-2.2.1.1.

D-2.2.1.3 *Static test for parking performance*

D-2.2.1.3.1 For the whole range of applications determine the worst case regarding input force to the brake, maximum vehicle mass to be braked by one axle and tyre radius.

D-2.2.1.3.2 Apply the brake with the input force as determined under D-2.2.1.1.

D-2.2.1.3.3 Put a slowly increasing torque on the dyno shaft in order to turn the drum or disc. Measure the output torque at the brake in the moment the dyno shaft begins to move and calculate corresponding axle braking force using the tyre radius as determined under D-2.2.1.3.1.

D-2.2.1.3.4 The brake force measured under D-2.2.1.3.3 divided by one-half of the vehicle mass as determined under D-2.2.1.3.1 must give at least a quotient of 0.18 for M2, N1 and 0.2 for M1.

D-2.2.3 *Cold Performance Test*

Cold performance of the replacement brake lining assembly or the replacement drum brake lining shall be made by the following method:

a) The Type-O test as prescribed in D-2.2.1.1 shall be performed with one set of the brake lining assembly or drum brake lining; and

b) Note and plot line pressure and mean fully developed deceleration for each application and determine line pressure required to achieve 5 m/s^2.

D-2.2.4 *Speed Sensitivity Test*

a) Using the line pressure derived from D-2.2.1.1 and with initial brake temperature ≤ 100 °C, make three brake applications from rotational speed corresponding to vehicle linear speeds of:

   1) Front axle: 45 km/h, 65 km/h and 80 km/h where V_{Max} exceeds 100 km/h.

   2) Rear axle: 35 km/h, 50 km/h and 65 km/h where V_{Max} exceeds 100 km/h.

b) Average the results for each group of three applications and plot speed against corresponding mean fully developed deceleration; and

c) Mean fully developed decelerations recorded for the speeds shall lie within 25 percent of that recorded for the lowest speed.

ANNEX E

(*Clause* 5.2.2)

REQUIREMENTS FOR REPLACEMENT BRAKE LINING ASSEMBLIES AND DRUM BRAKE LININGS FOR VEHICLES OF CATEGORIES M3, N2 AND N3

E-1 VEHICLE TEST

E-1.1 Test Vehicle

A vehicle which is representative of the type(s) for which the replacement brake lining assembly approval or drum brake lining approval is required shall be equipped with replacement brake lining assemblies or drum brake linings of the type for which approval is sought and instrumented for brake testing as required by IS 11852, AIS 150.

Brake linings submitted for test shall be fitted to the relevant brakes and until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency.

E-1.2 Tests and Requirements

E-1.2.1 Conformance with IS 11852/AIS 150.

E-1.2.1.1 The braking system of the vehicle shall be tested according to the requirements for the vehicle category in question (M3, N2 or N3) as specified in IS 11852 (Annex D), AIS 150 (Annex D). The applicable requirements or tests are:

E-1.2.1.1.1 *Service braking system*

E-1.2.1.1.1.1 Type-O test with engine disconnected, vehicle laden.

E-1.2.1.1.1.2 *Type I test*

E-1.2.1.1.1.3 *Type II test* (*downhill behaviour test*)

The laden vehicle must be tested in such a manner that the energy input is equivalent to that recorded in the same period of time with the laden vehicle driven at an average speed of 30 km/h on a 2.5 percent down gradient for a distance of 6 km with the gear disengaged, the braking energy being taken by the service brakes alone.

E-1.2.1.1.2 *Secondary braking system with engine disconnected, vehicle laden*

E-1.2.1.1.3 Parking braking system (only applicable if the brakes for which lining approval is sought are used for parking also). Downhill test at 18 percent gradient, vehicle laden.

E-1.2.2 *Additional Requirements* (*Split Axle Test*)

For the tests mentioned below the vehicle shall be fully laden and all brake applications made with engine disconnected, on a level road.

The vehicle service brake control system shall be equipped with a means of isolating front and rear axle brakes so that either may be used independently of the other.

Where brake lining assembly approval or drum brake lining approval is required for front axle brakes, the rear axle brakes shall remain inoperative throughout the test.

Where brake lining assembly approval or drum brake lining approval is required for rear axle brakes, the front axle brakes shall remain inoperative throughout the test.

E-1.2.2.1 *Cold performance test*

Cold performance of the replacement brake lining assembly or the replacement drum brake lining shall be tested to the following method:

E-1.2.2.1.1 Make a minimum of six brake applications at spaced increments of pedal or line pressure up to wheel lock or, alternatively, up to a mean fully developed deceleration of 3.5 m/s^2 or up to the maximum allowed pedal force or up to the maximum line pressure from an initial speed of 45 km/h and with a brake temperature ≤ 100 °C at the start of each application.

E-1.2.2.1.2 Note and plot pedal force or line pressure and mean fully developed deceleration for each application and determine the pedal force or line pressure required to achieve (if possible) a mean fully developed deceleration of 3 m/s^2. If this value cannot be achieved determine alternatively the pedal force or line pressure required to achieve maximum deceleration.

E-1.2.2.2 *Speed sensitivity test*

E-1.2.2.2.1 Using the pedal force derived from **E-1.2.2.1.2** and with initial brake temperature ≤ 100 °C, make three brake applications from each of the following speeds:

a) 40 km/h down to 20 km/h;

b) 60 km/h down to 40 km/h; and

c) 80 km/h down to 60 km/h (if $V_{Max} \geq$ 90 km/h).

E-1.2.2.2.2 Average the results for each group of three applications and plot speed against corresponding mean fully developed deceleration.

E-1.2.2.2.3 Mean fully developed decelerations recorded for the higher speeds shall lie within 25 percent of that recorded for the lowest speed.

E-2 INERTIA DYNAMOMETER TEST

E-2.1 Test Equipment

For the tests an inertia dynamometer shall be equipped with the vehicle brake in question. The dynamometer shall be instrumented for continuous recording of rotational speed, brake torque, pressure in the brake line and number of rotations after brake application, braking time and brake rotor/drum temperature.

E-2.1.1 The rotational mass of the dynamometer shall correspond to half the axle portion of 0.55 of the maximum vehicle mass and the rolling radius of the largest tyre that is authorized for that vehicle type(s).

E-2.1.2 The initial dynamometer rotational speed shall correspond to the linear vehicle speed as stated in below and shall be based on the dynamic rolling radius of the smallest tyre that is authorized for that vehicle type(s).

E-2.1.3 Brake lining assemblies or drum brake linings submitted for the test shall be fitted to the brake and until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency**.**

E-2.1.4 If cooling air is used, the speed of the airflow at the brake shall be:

$$V_{air} = 0.33v$$

where

v = vehicle test speed, at initiation of braking.

E-2.1.5 The actuation cylinder fitted to the brake must be of the smallest size that is authorized for that vehicle type(s).

E-2.2 Tests and Requirements

E-2.2.1 *Tests Derived from IS* 11852*/AIS* 150

E-2.2.1.1 *Type-O test, engine disconnected*

From the initial speed of 60 km/h with a brake temperature ≤ 100 °C at the start of each application make a minimum of six brake applications at spaced intervals of line pressure up to the line pressure that is permanently guaranteed by the braking system of the vehicle type(s) (for example, cut in pressure of the compressor for pneumatic brake system or ≤ 120 bar for hydraulic brake system). A mean fully developed deceleration of at least 5 m/s^2 must be achieved.

E-2.2.1.2 *Type I test*

E-2.2.1.2.1 *Heating procedure*

Make 20 consecutive snub applications with V_1 = 60 km/h and V_2 = 30 km/h with a cycle time of 60 s starting at a brake temperature of ≤ 100 °C at the first application. The line pressure shall correspond to a deceleration of 3 m/s^2 at the first application and must remain constant throughout the succeeding applications.

E-2.2.1.2.2 *Hot performance*

On completion of the heating procedure the hot performance shall be measured under the conditions of **E-2.2.1.1** above using the guaranteed line pressure as defined in **E-2.2.1.1** (the temperature conditions may be different). The mean fully developed deceleration with the heated brake must not be less than 60 percent of the value achieved with the cold brake or 4 m/s^2.

E-2.2.1.2.3 *Recovery*

Starting 120 s after the hot performance brake application makes 5 full stops with the line pressure used in **E-2.2.1.2.1** above and with intervals of at least 2 min from the initial speed of 60 km/h. At the beginning of the fifth application the brake temperature shall be ≤ 100 °C and the mean fully developed deceleration achieved shall be within 10 percent of that calculated from the relation line pressure/deceleration of the Type-O test at 60 km/h.

E-2.2.1.3 *Type II test* (*downhill behaviour test*)

E-2.2.1.3.1 *Heating procedure*

The brakes shall be heated by constant braking torque corresponding to a deceleration of 0.15 m/s^2 at a constant speed of 30 km/h during a period of 12 min.

E-2.2.1.3.2 *Hot performance*

On completion of the heating procedure the hot performance shall be measured under the conditions of **E-2.2.1.1** above using the guaranteed line pressure as defined in **E-2.2.1.1** (the temperature conditions may be different). The mean fully

developed deceleration with the heated brake must not be less than 3.75 m/s^2.

E-2.2.1.4 *Static test for parking performance*

E-2.2.1.4.1 For the whole range of applications determine the worst case regarding input force to the brake, maximum vehicle mass to be braked by one axle and tyre radius.

E-2.2.1.4.2 Apply the brake with the input force as determined under **E-2.2.1.1**.

E-2.2.1.4.3 Put a slowly increasing torque on the dyno shaft in order to turn the drum or disc. Measure the output torque at the brake in the moment the dyno shaft begins to move and calculate corresponding axle braking force using the tyre radius as determined under **E-2.2.1.4.1**.

E-2.2.1.4.4 The brake force measured under **E-2.2.1.4.3** divided by one-half of the vehicle mass as determined under **E-2.2.1.4.1** must give at least a quotient of 0.18.

E-2.2.2 *Cold Performance Equivalence Test*

Cold performance of the replacement brake lining assembly or the replacement drum brake lining shall be tested for Type-O test as described in **E-2.2.1.1**.

E-2.2.2.1 The Type-O test as prescribed in **E-2.2.1.1** shall be performed with one set of the brake lining assembly or drum brake lining.

E-2.2.2.2 Note and plot line pressure and mean fully developed deceleration for each application and determine line pressure required to achieve 5 m/s^2.

E-2.2.3 *Speed Sensitivity Test*

E-2.2.3.1 Using the guaranteed line pressure as defined in **2.2.1.1** and with initial brake temperature ≤ 100 °C, make three brake applications from each of the following speeds:

a) 60 km/h down to 30 km/h;

b) 80 km/h down to 60 km/h; and

c) 110 km/h down to 80 km/h (if V_{Max} ≥ 90 km/h).

E-2.2.3.2 Average the results for each group of three applications and plot speed against corresponding mean fully developed deceleration.

E-2.2.3.3 Mean fully developed decelerations recorded for the higher speeds shall lie within 25 percent of that recorded for the lowest speed.

ANNEX F

(*Clauses* 5.2.3 *and* 5.2.4)

REQUIREMENTS FOR REPLACEMENT BRAKE LINING ASSEMBLIES FOR VEHICLES OF CATEGORIES T_1 AND T_2

F-1 GENERAL

The test method described in this annex is based on an inertia dynamometer test. Alternatively, the tests may be carried out on a test vehicle or on a rolling road test bench provided that the same test conditions are achieved and the same parameters measured as in the inertia dynamometer test.

F-2 TEST EQUIPMENT

For the tests an inertia dynamometer shall be equipped with the vehicle brake in question. The dynamometer shall be instrumented for continuous recording of rotational speed, brake torque, pressure in the brake line or actuation force, number of rotations after brake application, braking time and brake rotor temperature.

F-2.1 Test Conditions

F-2.1.1 The rotational mass of the dynamometer shall correspond to half the relevant axle portion of the maximum vehicle mass and the rolling radius of the largest tyre that is authorised for that vehicle type(s).

F-2.1.2 The initial dynamometer rotational speed shall correspond to the linear vehicle speed as stated in **F-3.1** and shall be based on the dynamic rolling radius of the smallest tyre that is authorised for that vehicle type(s).

F-2.1.3 Brake linings submitted for the test shall be fitted to the relevant brake and until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency.

F-2.1.4 If cooling air is used, the speed of the airflow at the brake shall be:

$$V_{air} = 0.33v$$

where

v = vehicle test speed at initiation of braking.

F-2.1.5 The actuation device fitted to the brake must correspond to the vehicle installation.

F-3 TESTS AND REQUIREMENTS

F-3.1 Type-O Test, engine disconnected

From the initial speed of 60 km/h with a brake temperature ≤ 100 °C at the start of each application make a minimum of six consecutive brake applications at spaced intervals of line pressure or application force up to the maximum line pressure or up to 6 m/s^2 deceleration. Repeat the last brake application using an initial speed of 40 km/h.

F-3.2 Type I Test

F-3.2.1 *Heating Procedure*

The brake shall be heated with continuous braking according to the requirement of IS 11852/AIS 150 starting with a brake rotor temperature ≤ 100 °C.

F-3.2.2 *Hot Performance*

On completion of the heating procedure the hot performance from an initial speed of 40 km/h shall be measured under the conditions of **F-3.2.1** above using the same line pressure or application force (the temperature conditions may be different). The mean fully developed deceleration with the heated brake must not be less than 60 percent of the value achieved with the cold brake or 3.5 m/s^2.

F-3.3 Cold Performance Equivalence Test

A comparison of the cold performance of the replacement brake lining assembly shall be tested for Type-O test as described in **F-3.1**.

F-3.3.1 The Type-O test as prescribed in **F-3.1** shall be performed with one set of the original brake lining assembly.

F-3.3.2 The replacement brake lining assembly shall be considered to show similar performance characteristics to the original brake lining assembly if the achieved mean fully developed decelerations at the same line pressure or application force in the upper two thirds of the generated curve are within 15 percent of those obtained with the original brake lining assembly.

ANNEX G

(*Clause* 5.2.4)

REQUIREMENTS FOR REPLACEMENT BRAKE LINING ASSEMBLIES AND DRUM BRAKE LININGS FOR VEHICLES OF CATEGORIES T_3 AND T_4

G-1 TEST CONDITIONS

The tests prescribed in this Annex may be carried out alternatively on a test vehicle or on an inertia dynamometer under the same conditions as mentioned in IS 11852/AIS 150.

Brake linings submitted for test shall be fitted to the relevant brakes and, until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency.

G-2 TESTS AND REQUIREMENTS

G-2.1 Conformance with IS 11852/AIS 150

The brakes shall be tested according to the requirements of IS 11852/AIS 150.

G-2.1.1 The results shall be reported in a form according to IS 11852/AIS 150.

G-2.1.2 The achieved hot performance at the same input torque of the replacement brake lining assembly or the replacement drum brake lining in the Type I test shall be at least 90 percent of the cold performance of the replacement brake lining assembly or the replacement drum brake lining.

The minimum requirements of IS 11852/AIS 150 are applicable for the replacement brake lining assembly or drum brake lining.

G-2.2 Cold Performance Equivalence Test (Type-P)

Under the conditions of **G-1** and from an initial speed of 60 km/h with a brake temperature ≤ 100 °C make 6 brake applications at spaced intervals of control force or line pressure up to 6.5 bar or an achieved deceleration of 6 m/s^2.

ANNEX H

(*Clause* 5.2.5)

REPLACEMENT BRAKE LINING ASSEMBLIES

H-1 REQUIREMENTS FOR REPLACEMENT BRAKE LINING ASSEMBLIES FOR TWO AND THREE WHEELED VEHICLE CATEGORIES

H-1.1 Test Conditions

H-1.1.1 A vehicle which is representative of the type(s) for which the replacement brake lining assembly approval is required shall be equipped with the brake lining assemblies of the type for which approval is requested and instrumented for brake testing as required by IS 14664.

H-1.1.2 Brake lining assemblies submitted for the test shall be fitted to the relevant brakes and, until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions in agreement with the certifying agency.

H-1.2 Tests and Requirements

H-1.2.1 *Conformance with IS* 14664

H-1.2.1.1 The braking system of the vehicle shall be tested according to the vehicle categories mentioned in IS 14664 and applicable requirements or tests are as follows.

H-1.2.1.1.1 *Dry Stop test with engine disconnected*

The test is to be carried out only in the laden condition. Make one brake application according to **5.3.1** and **5.3.2** of IS 14664 up to wheel lock, or up to the deceleration under performance requirements defined in **5.3.3** of IS 14664 or up to the maximum allowed control force.

Where brake lining assembly approval is required for front axle brakes the test is to be carried out on the front brakes only.

Where brake lining assembly approval is required for rear axle brakes the test is to be carried out on the rear brakes only.

H-1.2.1.1.2 *Dry stop test with wet brakes*

Not applicable to vehicles of category L5 or in cases of drum brakes or fully enclosed disc brakes not subjected to this test during approval to IS 14664.

H-1.2.1.1.3 *High speed test*

Only applicable for vehicles of categories L3, L4 and L5.

H-1.2.1.1.4 *Heat fade test*

Only applicable for vehicles of categories L3, L4 and L5.

H-1.2.1.2 The vehicle must satisfy all the relevant requirements stated in IS 14664 for that category of vehicles.

H-1.2.2 *Additional Requirements*

H-1.2.2.1 *Cold performance equivalence test*

The dry stop test as given in **H-1.2.1.1.1** shall be performed with one set of brake lining assembly.

H-1.2.2.1.1 The Dry stop test as prescribed in **H-1.2.1.1.1** shall be performed with one set of the original brake lining assembly.

H-1.2.2.1.2 The replacement brake lining assembly shall be considered to show similar performance characteristics to the original brake lining assembly if the achieved mean fully developed decelerations at the same line pressure in the upper two thirds of the generated curve are within 15 percent of those obtained with the original brake lining assembly.

H-1.2.2.2 *Speed sensitivity test*

This test is only applicable for vehicles of categories L3, L4 and L5 and shall be carried out with the laden vehicle under the conditions of the dry stop test with engine disconnected. However, the test speeds are different.

H-1.2.2.2.1 From the results of the dry stop test as described in **H-1.2.1.1.1** determine the control force or line pressure corresponding to the minimum required mean fully developed deceleration for that category of vehicle.

H-1.2.2.2.2 Using the control force or line pressure determined in **H-1.2.2.2.1** and with initial brake temperature ≤ 100 °C, make three brake applications from each of the following speeds:

a) 40 km/h, 80 km/h and 120 km/h (if $V_{Max} \geq$ 130 km/h), for 2 wheelers; and

b) 40 km/h, 60 km/h and 80 km/h (if $V_{Max} \geq$ 130 km/h), for 3 wheelers.

H-1.2.2.2.3 Average the results for each group of three applications and plot speed against corresponding mean fully developed deceleration.

H-1.2.2.2.4 Mean fully developed decelerations recorded for the higher speeds shall lie within 25 percent of that recorded for the lowest speed.

H-1.3 Inertia Dynamometer Test

H-1.3.1 *Test Equipment*

For the tests an inertia dynamometer shall be equipped with the vehicle brake in question. The dynamometer shall be instrumented for continuous recording of rotational speed, brake torque, pressure in the brake line and number of rotations after brake application, braking time and brake rotor temperature.

H-1.3.2 *Test Conditions*

a) The rotational mass of the dynamometer shall correspond to table below for each vehicle category:

Sl No.	*Vehicle Category*	*Axel Proportion of Vehicle Mass* [5]	
		Front	Rear
(1)	(2)	(3)	(4)
i)	L1	0.5	0.5
ii)	L2	0.4	0.6
iii)	L3	0.7	0.3
iv)	L4, L5	0.5	0.5

b) The initial dynamometer rotational speed shall correspond to the linear vehicle speed as stated in **H-1.3.3.1.1**, **H-1.3.3.1.2**, **H-1.3.3.1.3**, **H-1.3.3.1.4** and **H-1.3.3.1.5** and shall be based on the dynamic rolling radius of the tyre;

c) Brake linings submitted for test shall be fitted to the relevant brakes and until a fixed burnishing procedure is established, shall be burnished to the manufacturer's instructions on agreement with the certifying agency; and

d) If cooling air is used, the speed of the airflow at the brake shall be: $V_{air} = 0.33v$.

where

v = vehicle test speed at initiation of braking.

H-1.3.3 *Tests and Requirements*

H-1.3.3.1 Tests derived from IS 14664.

H-1.3.3.1.1 *Burnishing procedure*: [*see* Table 2, Sub-sections 1.0]

H-1.3.3.1.2 *Dry stop test — Single brake control actuated*

The test is to be carried out only in the laden condition. Make a minimum of six brake applications at spaced increments of control force or line pressure equivalent to the actuation force. For test condition, procedure and performance requirements: (*see* Table 2, sub-sections 2.1).

H-1.3.3.1.3 *High speed test*

a) The test is applicable to vehicle categories 3-3, 3-4 and 3-5; and

b) Test is not required for vehicles with $V_{Max} \leq$ 125 km/h.

For test condition, procedure and performance requirements: (*see* Table 2, sub-sections 2.2).

H-1.3.3.1.4 *Heat fade test*

The test is applicable to vehicle categories 3-3, 3-4 and 3-5. The test is to be carried out only in the laden condition for test condition, procedure and performance requirements: (*see* Table 2, sub-sections 3.1, 3.2 and 3.3).

H-1.3.3.1.5 *Dry stop test with wet brakes*

Not applicable to drum brakes or fully enclosed disc brakes. For test condition, procedure and performance requirements: (*see* Table 2, sub-sections 4.1 and 4.2).

[5] To be confirmed with OEM/brake manufacturers.

Table 2 Test Condition, Procedure and Performance Requirement

(*Clause* H-1.3.3.1)

Sl No.	Section	Sub Section	Sub Section No.	Test Speed		IBT	Brake Pressure				No. of Stops	Performance Requirement
							Front Brakes (Equivalent Foot Control Force)		Rear Brakes (Equivalent Foot Control Force)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	Burnish	NA	1.0	Initial speed: 50 km/h or 0.8 V_{Max}, whichever is lower final speed: 5 km/h		≤ 100 ºC	For vehicle categories 3-3, 3-4 and 3.5	Line pressure equivalent to 3.0-3.5 m/s^2	Line pressure equivalent to 1.5-2.0 m/s^2		100	80 percent contact after burnish or as per manufacturer recommendation
							For vehicle categories 3-1 and 3-2	Line pressure equivalent to 1.5 m/s^2 to 2.0 m/s^2				
ii)	Type P-engine disconnected	Normal speed	2.1	Vehicle categories 3-1, 3-2	40 km/h or 0.9 V_{Max}, whichever is lower	60 km/h or 0.9 V_{Max}, whichever is lower	Line pressure equivalent ≤ 200 N		For vehicle categories 3-1, 3-2, 3-3 and 3-4	≤ 350 N	6	i) 3-1 - Front - ≥ 3.4 m/s^2; Rear - ≥ 2.7 m/s^2; ii) 3-2 - Front - ≥ 2.7 m/s^2; Rear - ≥ 2.7 m/s^2; iii) 3-3 - Front - ≥ 4.4 m/s^2; Rear - ≥ 2.9 m/s^2; and iv) 3-4 - Front - ≥ 3.6 m/s^2; Rear - ≥ 3.6 m/s^2 v) 3-5 Not applicable

Table 2 (*Continued*)

Sl No.	Section	Sub Section	Sub Section No.	Test Speed		IBT	Brake Pressure				No. of Stops	Performance Requirement
							Front Brakes (Equivalent Foot Control Force)		Rear Brakes (Equivalent Foot Control Force)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
v)				Vehicle categories 3-3, 3-4 and 3-5	60 km/h or 0.9 V_{Max}, whichever is lower				For vehicle categories 3-5	≤ 500 N		
vi)		High Speed[6)]	2.2	For vehicles with V_{Max} > 125 km/h and < 200 km/h	0.8 V_{Max}	≥ 55 °C and ≤ 100 °C	(*see* sub-section 2.1)				6	The MFDD shall be ≥ 5.8 m/s^2
vii)				For vehicles with V_{Max} ≥ 200 km/h	160 km/h	≥ 55 °C and ≤ 100 °C						
viii)	Type F	Base line	3.1	(see sub-section 2.1)			(*see* sub-section 2.1)				6	i) 3-3 - Front - ≥ 4.4 m/s^2; Rear - ≥ 2.9 m/s^2 ii) 3-4 - Front - ≥ 3.6 m/s^2; Rear - ≥ 3.6 m/s^2 iii) 3-5 - Not applicable

Table 2 (*Continued*)

Sl No.	Section	Sub Section	Sub Section No.	Test Speed		IBT	Brake Pressure				No. of Stops	Performance Requirement
							Front Brakes (Equivalent Foot Control Force)		Rear Brakes (Equivalent Foot Control Force)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
iv)		Heating procedure	3.2	Front	100 km/h or 0.7 $V_{Max,}$ whichever is the lower	First stop - ≥ 55 °C and ≤ 100 °C; 9 stops - 1 000 m	Line pressure equivalent to 3.0 - 3.5 m/s^2				10	NA
				Rear	80 km/h or 0.7 V_{Max}, whichever is lower							
v)		Hot stop	3.3	(see sub-section 2.1)		≥ 55 °C and ≤ 100 °C	(see sub-section 2.1)				6	The MFDD = 60 per cent of the MFDD recorded in the baseline
vi)	Type P - wet brake test	Base line (dry stop test)	4.1	(*see* sub-section 2.1)		≥ 55°C and ≤ 100 °C	Line pressure equivalent to 2.5 m/s^2 to 3.0 m/s^2				3	i) ≥ 60 percent of the average deceleration values recorded in the baseline test - period 0.5 to 1.0 s after the point of actuation of the brake contro

Table 2 (*Concluded*)

Sl No.	Section	Sub Section	Sub Section No.	Test Speed		IBT	Brake Pressure				No. of Stops	Performance Requirement
							Front Brakes (Equivalent Foot Control Force)		Rear Brakes (Equivalent Foot Control Force)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
vii)		Wet brake stop[7)]	4.2			> 500 m	Line pressure equivalent to 2.5 m/s^2 to 3.0 m/s^2			3		ii) ≤ 120 percent of the average deceleration values recorded in the baseline test - during the complete stop but excluding the final 0.5 s

[6)] It is not required for vehicles with $V_{Max} \leq 125$ km/h.
[7)] Water spray amount (15 l/h) the brake(s) being continuously sprayed with water while the test is conducted in order to measure the brake's performance in wet conditions.

H-2 CRITERIA TO DEFINE GROUPS OF BRAKE LINING ASSEMBLY FOR VEHICLES OF CATEGORY L

H-2.1 Grouping Criteria

The grouping is made according to the following approach:

a) According to the individual friction material of the brake lining; and

b) Depending on the area of the friction material area of the brake lining assembly operated by the piston/pistons of only one side of the brake caliper or, in case of drum brakes, of only one brake shoe Friction material area means all the area enclosed within the perimeter of the brake lining (*see* the red cross-hatched area, Fig. 4, Fig. 5), thus excluding the presence of any grooves and/or chamfers:

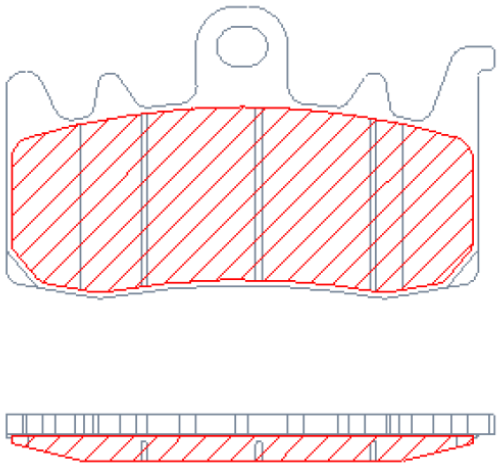

FIG. 4 FRICTIONAL MATERIAL AREA OF DISC BRAKE

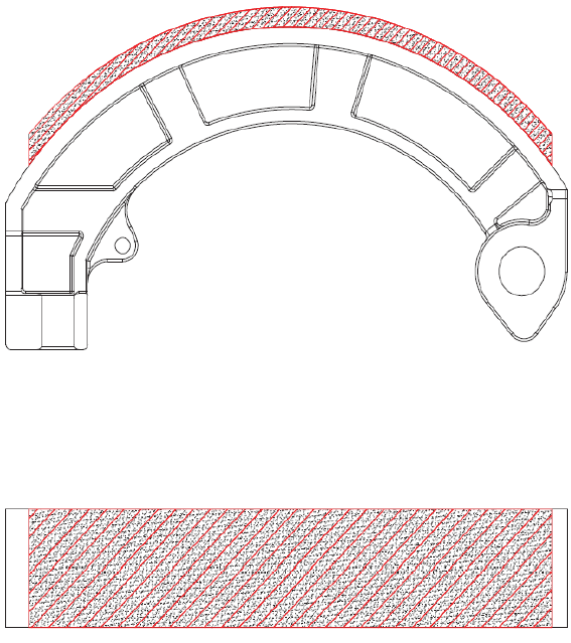

FIG. 5 FRICTIONAL MATERIAL AREA OF DRUM BRAKE

H-2.2 Procedure for selection of the brake lining assembly representative of the group to be approved. The brake lining assembly to be approved is defined, according to the following criteria:

a) Choice of friction material to be approved;

b) Verification of the applications where the chosen friction material is applied;

c) Definition of the area of the selected brake lining assemblies according to Table 3 and Table 4, and classification into groups A – B – C;

d) For each group, selection of the most severe application, according to the highest value of the index Ep (kinetic energy by brake lining area), as follows:

$$E_P = 1/2 \times m \times p \times (V \times c)^2/(S \times q_p)$$

where

E_p = kinetic energy index, in kJ/cm^2;

m = gross vehicle weight of the vehicle, in kg;

p = allocation percentage of the vehicle weight:

1) for front braking system:

i) 75 percent in case of 1 brake disc; and

ii) 37.5 per cent in case of 2 brake discs.

2) for rear braking system:

1) 50 percent;

V = vehicle maximum speed, in m/s;

c = correction coefficient of speed:

1) for front braking system = 0.8

2) for rear braking system: variable according to the brake disc diameter:

i) 0.5 for Ø ≤ 245 (mm);
ii) 0.6 per Ø > 245 < 280 (mm); and
iii) 0.75 per Ø ≥ 280 (mm);

S = brake lining area as defined in Table 3 (cm^2); and

q_p = number of pads in 1 caliper.

H-2.3 Extension of the Homologation for New Application

For new application that will be included into an existing group, an increase of 10 percent *Max* kinetic energy index (Ep = kinetic energy, in kJ/cm^2) is allowed with reference to the value used for the approval of the brake lining assembly of the reference group.

Table 3 Area Groups (For Brake Pads)

(*Clause* H-2.2)

Sl No.	Group	Brake Lining Area cm^2
(1)	(2)	(3)
i)	A	≤ 15
ii)	B	> 15 ≤ 22
iii)	C	> 22

Table 4 Area Groups (For Brake Shoes)

(*Clause* H-2.2)

Sl No.	Group	Brake Lining Area cm^2
(1)	(2)	(3)
i)	A	≤ 21
ii)	B	> 21 ≤54
iii)	C	> 54

ANNEX J

(*Clauses* 4.6 *and* M-4.1)

DETERMINATION OF FRICTION BEHAVIOUR BY MACHINE TESTING

J-1 INTRODUCTION

J-1.1 Samples of a replacement brake lining assembly type shall be tested on a machine capable of generating the test conditions and applying the test procedures described in this annex.

J-1.2 Test results shall be evaluated to determine sample friction behaviour.

J-1.3 The friction behavior of samples shall be compared to assess conformity with the standard registered for a replacement brake lining assembly type.

J-2 Replacement brake lining assemblies for vehicles of M_1, M_2, T_1, T_2, two and three wheeled vehicle categories.

J-2.1 Equipment

J-2.1.1 The machine shall be designed to accept and operate a full size brake similar to those fitted to the vehicle axle used for approval testing as per 5.

J-2.1.2 The disc or drum rotational speed shall be [660 ± 10 min^{-1}][8] without load and shall not fall below 600 min^{-1} on full load.

J-2.1.3 The test cycles and brake applications during the cycles to be adjustable and automatic.

J-2.1.4 Output torque or brake pressure (constant torque method) and working surface temperature shall be recorded.

J-2.1.5 Provision shall be made to direct cooling air across the brake at a rate of:

600 m^3/h ± 60 m^3/h

J-2.2 Test Procedure

J-2.2.1 *Sample Preparation*

The manufacturer's bedding schedule shall ensure a minimum of 80 percent surface contact area for pad assemblies without exceeding a surface temperature of 300 °C and 70 percent surface contact area for leading shoe assemblies without exceeding a surface temperature of 200 °C.

J-2.2.2 *Test Schedule*

The test schedule comprises a number of consecutive braking cycles each containing X braking intervals of 5 s brake applied followed by 10 s brake released.

The following two methods may be used alternatively.

J-2.2.2.1 *Test schedule with constant pressure*

J-2.2.2.1.1 *Pad assemblies*

The hydraulic pressure p under the piston(s) of the calliper shall be constant following the formula:

$$P_1 = \frac{M_d}{0.57 \times R_w \times A_K}$$

where

M_d = 150 N_m for A_K < 18.1 cm^2;

M_d = 300 N_m for A_K > 18.1 cm^2;

R_w = effective radius of disc; and

A_K = area of calliper piston(s).

Sl No.	*No. of Cycle*	*Number of Brake Applications X*	*Initial Brake Rotor Temperature* (°C)	*Max. Brake Rotor Temperature* (°C)	*Forced Cooling*
(1)	(2)	(3)	(4)	(5)	(6)
i)	1	1×10	< 60	Open	No
ii)	2-6	5×10	100	open (350)[9]	No
iii)	7	1×10	100	open	Yes

[8] In case of vehicles of L_1 and L_2, a lower test speed may be used.

[9] In the case of vehicles of category L, the temperature shall be limited to 350 °C. If necessary, the number of applications per cycle must be reduced accordingly. However, in this case, the number of cycles shall be increased to keep the total number of applications constant.

J-2.2.2.1.2 *Shoe assemblies*

The mean contact pressure at the brake lining working surface shall be constant at 22 N/cm^2 ± 6 N/cm^2 calculated for a static brake without self-energizing:

Sl No.	*No. of Cycle*	*Number of Brake Applications X*	*Initial Brake Rotor Temperature* (°C)	*Max. Brake Rotor Temperature* (°C)	*Forced Cooling*
(1)	(2)	(3)	(4)	(5)	(6)
i)	1	1 × 10	< 60	200	Yes
ii)	2	1 × 10	100	open	No
iii)	3	1 × 10	100	200	Yes
iv)	4	1 × 10	100	Open	No

J-2.2.2.2 *Test schedule with constant torque*

This method applies only for pad assemblies. The brake torque shall be constant within a tolerance of ± 5 percent and adjusted to guarantee the maximum brake rotor temperatures given in the Table 5.

J-2.3 Evaluation of Test Results

Friction behaviour is determined from the brake torque noted at selected points in a test schedule. Where brake factor is constant, for example, a disc brake, brake torque may be translated to coefficient of friction.

J-2.3.1 *Pad Assemblies*

J-2.3.1.1 The operational coefficient of friction (μ_{op}) is the mean of the values recorded during cycles two to seven (constant pressure method) or during cycles 2-4, 6-9 and 11-13 (constant torque method); measurement being made one second after commencing the first brake application of each cycle.

J-2.3.1.2 The maximum coefficient of friction (μ_{Max}) is the highest value recorded during all cycles.

J-2.3.1.3 The minimum coefficient of friction (μ_{Min}) is the lowest value recorded during all cycles.

J-2.3.2 *Shoe Assemblies*

J-2.3.2.1 The mean torque (M_{mean}) is the average of the maximum and minimum values of brake torque recorded during the fifth brake application of cycles one and three.

J-2.3.2.2 The hot torque (M_{hot}) is the minimum brake torque developed during cycles two and four. If the temperature exceeds 300 °C during these cycles the value at 300 °C is to be taken as (M_{hot}).

J-2.4 Acceptance Criteria

J-2.4.1 With each application for approval of a brake lining assembly type there shall be submitted.

J-2.4.1.1 For pad assemblies, values for μ_{op}, μ_{Min}, μ_{Max}.

J-2.4.1.2 For shoe assemblies, values for M_{mean} and M_{hot}.

J-2.4.2 During production of an approved brake lining assembly type, test samples must demonstrate compliance with the values registered under paragraph.

J-2.4.3 with the following tolerances:

a) For disc brake pads:

μ_{op} ± 15percent of registered value
μ_{Min} > registered value
μ_{Max} < registered value

b) For simplex drum brake linings:

M_{mean} ± 20 percent of registered value
M_{hot} > registered value

J-3 BRAKE LINING ASSEMBLIES AND DRUM BRAKE LININGS FOR VEHICLES OF CATEGORIES M_3, N_2, N_3, T_3 AND T_4

J-3.1 Equipment

J-3.1.1 The machine shall be equipped with a disc brake of the fixed calliper type with a cylinder diameter of 60 mm and a solid (not ventilated) disc having a diameter of 278 mm ± 2 mm and a thickness of 12 mm ± 0.5 mm. A rectangular piece of the friction material with an area of 44 cm^2 ± 0.5 cm^2 and a thickness of at least 6 mm shall be attached to the backing plate.

J-3.1.2 The disc rotational speed shall be 660 min^{-1} ± 10 min^{-1} without load and shall not fall below 600 min^{-1} on full load.

J-3.1.3 The mean contact pressure at the brake lining working surface shall be constant at 75 N/cm^2 ± 10 N/cm^2.

J-3.1.4 The test cycles and brake applications during the cycles to be adjustable and automatic.

J-3.1.5 Output torque and working surface temperature shall be recorded.

J-3.1.6 Provisions shall be made to direct cooling air across the brake at a rate of:

600 m^3/h ± 60 m^3/h

J-3.2 Test Procedure

J-3.2.1 *Sample Preparation*

The manufacturer's bedding procedure shall ensure a minimum of 80 percent surface contact area without exceeding a surface temperature of 200 °C.

J-3.2.2 *Test Schedule*

The test procedure comprises a number of consecutive braking cycles each containing a number of X braking intervals of 5 s brake applied followed by 10 s brake released (*see* Table 6).

J-3.3 Evaluation of Test Results

Friction behaviour is determined from the brake torque noted in selected cycles of the test schedule. Brake torque shall be translated to coefficient of friction µ. The µ-value of each brake application shall be determined as the mean value of the 5 s brake applied.

J-3.3.1 The operational coefficient of friction μ_{op1} is the mean value of µ recorded for the brake applications in cycles 1 and μ_{op2} is the mean value of µ recorded for the brake applications cycle 9.

J-3.3.2 The maximum coefficient of friction μ_{Max} is the highest value of µ recorded in an applications during cycles 1 to 11 inclusive.

J-3.3.3 The minimum coefficient of friction μ_{min} is the lowest value of µ recorded in an application during cycles to 11 inclusive.

J-3.4 Acceptance Criteria

J-3.4.1 With each application for approval of a replacement brake lining assembly type or a replacement drum brake lining type, there shall be submitted values for μ_{op1}, μ_{op2}, μ_{Min} and μ_{Max}.

J-3.4.2 During production of an approved replacement brake lining assembly type or replacement drum brake lining type, test samples must demonstrate compliance with the values registered under **J-3.4.1** within the following tolerances:

μ_{op1}, μ_{op2}, ± 15 percent of the registered value.
μ_{Min} > registered value.
μ_{Max} < registered value.

Table 5 Brake Rotor Temperatures

(*Clause* J-2.2.2.2)

Sl No.	No. of Cycle	Number of Brake Applications X	Initial Brake Rotor Temperature (°C)	Max. Brake Rotor Temperature (°C)	Forced Cooling
(1)	(2)	(3)	(4)	(5)	(6)
i)	1	1 × 5	< 60	200 - 350 (200-250) [10)]	No
ii)	2-4	3 × 5	100	200 - 350 (200-250)	No
iii)	5	1 × 10	100	200 - 350 (200-250)	No
iv)	6-9	4 × 5	100	200 - 350 (200-250)	No
v)	10	1 × 10	100	200 - 350 (200-250)	No
vi)	11-13	3 × 5	100	200 - 350 (200-250)	No
vii)	14	1 × 5	< 60	200 - 350 (200-250)	No

[10)] Values in brackets are for two and three wheeled vehicle categories.

Table 6 Consecutive Braking Cycles

(*Clause* J-3.2.2)

Sl No.	No. of Cycle	Number of Brake Applications X	Initial Brake Rotor Temperature	Forced Cooling
(1)	(2)	(3)	(4)	(5)
i)	1	5	100	Yes
ii)	2	5	Increasing ≤ 200	No
iii)	3	5	200	No
iv)	4	5	Increasing ≤ 300	No
v)	5	5	300	No
vi)	6	3	250	Yes
vii)	7	3	200	Yes
viii)	8	3	150	Yes
ix)	9	10	100	Yes
x)	10	5	Increasing ≤ 300	No
xi)	11	5	300	No

NOTE — Values in brackets are for two and three wheeled vehicle categories.

ANNEX K

(*Clause* 1.2)

TECHNICAL PRESCRIPTIONS FOR REPLACEMENT BRAKE LINING ASSEMBLIES INTENDED FOR THE USE IN SEPARATE PARKING BRAKE SYSTEMS BEING INDEPENDENT OF THE VEHICLE SERVICE BRAKE SYSTEM

K-1 COMPLIANCE WITH IS 11852 OR IS 15986

Compliance with the requirements of IS 11852 or IS 15986 shall be demonstrated in a vehicle test.

K-1.1 Vehicle Test

A vehicle which is representative of the type(s) for which the replacement brake lining assembly approval is required shall be equipped with the replacement brake lining assemblies of the type for which approval is requested and instrumented for brake testing as required by IS 11852 or IS 15986 whichever is appropriate. The vehicle shall be fully laden. Brake linings submitted for test shall be fitted to the relevant brakes and, shall not be burnished.

K-1.2 The parking braking system of the vehicle shall be tested according to all relevant requirements in IS 11852 or IS 15986, whichever is appropriate taking into consideration the original approval of the system.

ANNEX L

(*Informative*)

MODIFICATIONS AND EXTENSION OF TYPE APPROVAL OF THE REPLACEMENT BRAKE LINING ASSEMBLY OR THE REPLACEMENT BRAKE LINING

L-1 Every modification of replacement brake lining assembly type or replacement drum brake lining type shall be notified to the certifying agency which granted the type approval. The certifying agency may then either:

Consider that the modifications made are unlikely to have appreciable adverse effects and that in any event the brake lining assembly or drum brake lining still complies with the requirements: or require a further test report from the certifying agency responsible for conducting the tests.

ANNEX M

(*Clause* 4.6)

CONFORMITY OF PRODUCTION

M-1 Replacement brake lining assemblies or replacement drum brake lining assemblies approved to this standard shall be so manufactured as to conform to the type approved.

M-2 Original brake lining assemblies or original drum brake linings being the subject of an application under **4.2** are deemed to satisfy the requirements of Annex M.

M-3 To verify the requirements of **M-1** are met suitable controls of the production shall be applied. These shall encompass the mechanical properties of the brake lining/drum brake lining stated in this standard.

M-4 The holder of an approval shall in particular.

M-4.1 Ensure that for each brake lining assembly type or replacement drum brake lining type, at least the relevant tests prescribed in **4.3** and the friction behavior tests described in Annex J are carried out on a statistically controlled and random basis in accordance with a regular quality assurance procedure.

M-4.2 Ensure existence of procedures for effective control of the quality of the products.

M-4.3 Have access to the control equipment necessary for checking the conformity each approved type.

M-4.4 Analyze the results of each type of test in order to verify and ensure the consistency of the product characteristics, making allowance for variation of an industrial production.

M-4.5 Ensure that date data of test results are recorded and that annexed documents remain available for a period to be determined in agreement with certifying agency.

M-4.6 Ensure that any samples or test pieces giving evidence of non-conformity with the type of the test considered shall give rise to another sapling and another test. All the necessary steps shall be taken to re-establish the conformity of the corresponding production.

M-5 The competent authority which has granted the type approval may at any time verify the conformity controls methods applicable to each production unit.

M-5.1 In every inspection, the test books and production survey records shall be presented to the visiting inspector.

M-5.2 The inspector may take samples at random to be tested in manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own verification.

M-5.3 When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of **M-5.2**, the inspector shall select samples to be sent to the certifying agency which has conducted the type approval tests.

M-5.4 The certifying agency may carry out any tests prescribed in this standard.

M-5.5 The normal frequency of inspections may be preferably once in two years. In case where negative results are recorded during any of these visits, the certifying agency shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

ANNEX N

(*Foreword*)

COMMITTEE COMPOSITION

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

Organization	*Representative(s)*
Automotive Research Association of India, Pune	SHRI A. AKBAR BADUSHA **(*Chairperson*)**
Ashok Leyland Ltd, Chennai	SHRI D. BALAKRISHNAN SHRI VED PRAKASH GAUTAM (*Alternate*)
Association of State Road Transport Undertakings, New Delhi	SHRI R. CHANDRABABU SHRI ULHAS BABU (*Alternate*)
Automotive Component Manufacturers Association of India, New Delhi	SHRI SANJAY TANK SHRIMATI SEEMA BABAL (*Alternate*)
Automotive Research Association of India, Pune	SHRI P. D. BETGERI SHRI KONAKI RAMU (*Alternate*)
Bajaj Auto Ltd, Pune	SHRI R. NARASIMHAN SHRI ARVIND V. KUMBHAR (*Alternate*)
Bosch Chassis Systems India Limited. Pune	SHRI CHAITRAY SHINDE SHRI TARUN APPACHU (*Alternate*)
Brakes India Pvt Ltd, Chennai	SHRI B. RUBAN DEVA PRASATH SHRI G. DEVENDRAN (*Alternate*)
Central Farm Machine Training & Testing Institute, Budni	SHRI P. K. PANDEY SHRI C. V. CHIMOTE (*Alternate*)
Central Institute of Road Transport, Pune	SHRI S. N. DHOLE SHRI SANTOSH GUTTE (*Alternate*)
Central Road Research Institute, New Delhi	SHRI P. V. PRADEEP KUMAR SHRI SUDESH KUMAR (*Alternate*)
Continental Automotive Components (India) Pvt Ltd, Gurugram	SHRI RAHUL MARE SHRI RAGHAVENDRA HARIHARAN (*Alternate*)
Daimler India Commercial Vehicles Pvt Ltd, Chennai	SHRI D. KARTHIKEYAN SHRI MOHAN KUMAR MUTHUSAMY (*Alternate*)
Denso International India Pvt Ltd, Gurugram	SHRI NOEL ALEXANDER PETERS SHRI ALOK KUMAR (*Alternate*)
Federal Mogul Motorparts India Limited, Chennai	SHRI R. VENKATARAMAIAH SHRI VENKATESH SANKARAN (*Alternate*)
Global Automotive Research Centre, Chennai	SHRI M. V. RAMACHANDRAN SHRI S. PERUMAL (*Alternate*)
Hero Motocorp Ltd, New Delhi	SHRI FEROZ ALI KHAN SHRI PIYUSH CHOWDHRY (*Alternate*)

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Indian Institute of Petroleum, Dehradun	SHRI M. K. SHUKLA DR SUNIL KUMAR PATHAK (*Alternate*)
International Centre for Automotive Technology (ICAT), Manesar	SHRI GAVENDRA SINGH SHRI VIJAYANTA AHUJA
Knorr-Bremse Systems for Commercial Vehicles India Pvt Ltd, Pune	SHRI ARUN BISHT
Mahindra & Mahindra Ltd, Mumbai	SHRI S. RAGHUPATHI SHRI DEVINDER TANGRI (*Alternate*)
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Maruti Suzuki India Ltd, Gurugram	SHRI GURURAJ RAVI SHRI RAJ KUMAR DWIVEDI (*Alternate*)
Ministry of Heavy Industries and Public Enterprises, Department of Heavy Industry, New Delhi	REPRESENTATIVE
Ministry of Road Transport & Highways, New Delhi	SHRI R. H. URDHWARESHE
National Automotive Testing and R&D Infrastructure Project (NATRIP), Indore	DR P. P. CHATTRARAJ SHRI SAGAR BENDRE (*Alternate*)
Ordinance Factory Board, Jabalpur	SHRI UMESH KUMAR SHRI VIKAS PURWAR (*Alternate*)
Rane TRW Steering Systems Ltd, Trichy	SHRI R. M. THIRUPATHI SHRI K.V. BANUPRASATH (*Alternate*)
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Sundaram Brake Linings Ltd, Chennai	DR J. GOPALAKRISHNAN SHRI R. BALASUBRAMANIAN (*Alternate*)
Suzuki Motorcycle India Private Limited, Gurugram	SHRI AVINASH KHOT
TVS Motor Co Ltd, Hosur	SHRI M. S. ANAND KUMAR SHRI R. NAGARAJAN (*Alternate*)

Organization	*Representative(s)*
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Toyota Kirloskar Motors Pvt Ltd, Bengaluru	SHRI RAJU M. SHRI VIJETH GETTY (*Alternate*)
VE Commercial Vehicles, Dewas	SHRI SHYAM BUTE SHRI MOHAN KUMAR MUTHUSAMY (*Alternate*)
Vehicle Research and Development Establishment, Ahmednagar	SHRI VINOD KUMAR SHRI SAM SHAIKH (*Alternate*)
Volvo Buses India Pvt Ltd, Bengaluru	SHRI PRAMOD KUMAR HUGAR SHRI ATUL KUMAR KATTI *(Alternate)*
ZF Commercial Vehicle Control Systems India Ltd, Pune	SACHIN DESHMUKH SHRI PRABHAKARAN DURAIRAJ *(Alternate)*
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