IS 11827 (2008): Automotive Vehicle - Calibration of Speedometer - Method of Evaluation [TED 4: Automotive Braking Systems]

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(दूसरा पुनरीक्षण)

Indian Standard

AUTOMOTIVE VEHICLES — CALIBRATION OF SPEEDOMETER — METHOD OF EVALUATION

(Second Revision)

ICS 43.040

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Price Group 3

FOREWORD

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

This standard was first published in 1986 and was first revised in 1995. This revision has been taken up to align the requirements of this standard with ECE Regulation No. R39 Revision 1 (as updated last Supplement 5 to the original version of the Regulation — Date of entry into force: 7 December 2002). In this revision following changes have been made:

a) Tests are to be done on unladen vehicle in line with R39, instead of earlier GVW condition.
b) Speedometer accuracy requirements have now been specified separately for type approval and conformity of production.
c) Test speeds and accuracy requirements have been aligned with R39.
d) Roller diameter 0.4 m instead of 2 m.

The following, though not spelt out in ECE Regulation R39, have been incorporated as it was felt that these are required:

a) Increase in the inflation pressure of the tyre by 20 kPa has been made optional (*see* **3.4**).
b) Requirement 'Within two adjacent marked numerical values, the graduations shall be of uniform speed' incorporated in **5.3**.
c) Requirement 'The marked numerical values shall be in Arabic numerals' incorporated in **5.3.1**.
d) Requirements of digital display speedometers added (*see* **5.4** and **5.5.1**).
e) Rounding of test speeds to nearest 10 km/h (*See* Note 2 of Table 1).

The following provisions of ECE Regulation R39 are not included in this standard:

a) Use of imperial units of speed (*see* clause 5.1.2 of ECE Regulation No. R39).
b) Reference temperature for speedometer test (*see* clause 5.2.3 of ECE Regulation No. R39).
c) Administrative procedures given in clause 3, 3.3, 3.4, 4, 5.1.2, 5.1.4, 7, 8, 9, Annex 1 and Annex 2 of ECE Regulation R39.

IS 11086 : 1984 'Speedometer and odometer system for automotive application' is an important adjunct to this standard.

Since IS 14272 (Part 1) : 1995 'Automotive vehicles — Types — Terminology: Part 1 Three and four wheelers' is under revision, AIS 053 'Automotive Vehicles — Types and Terminology' may be referred, if required.

In reporting the result of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

AUTOMOTIVE VEHICLES — CALIBRATION OF SPEEDOMETER — METHOD OF EVALUATION

(Second Revision)

1 SCOPE

This standard covers the method of evaluation of calibration of speedometer fitted on automotive vehicle of L, M and N categories as defined in IS 14272 (Part 1).

2 REFERENCES

The following standards 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 editions of the standards indicated below.

IS No.	*Title*
9211 : 2003	Terms and definitions of weights of road vehicles other than 2 and 3 wheelers (*second revision*)
11422 : 2001	Terms and definitions of weights of two wheeled motor vehicles (*first revision*)
14272 (Part 1) : 1995	Automotive vehicles — Types — Terminology: Part 1 Three and four wheelers

3 DEFINITIONS

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

3.1 Approval of a Vehicle — The approval of a vehicle type with regard to the speedometer including its installation.

3.2 Type of Vehicle in Respect of its Speedometer — Vehicles which do not among themselves display any essential differences, where those differences can apply, in particular, to the following:

a) Size designation of the tyres.

b) Overall transmission ratio of the drive for speedometer, including any reduction drives.

c) Type of speedometer as characterized by:

1) Tolerances of the speedometer's measuring mechanism (*see* **3.5.1**);

2) Speedometer ratio (technical constant) of the speedometer (*see* **3.5.2**); and

3) Range of speeds displayed.

3.3 Tyres Normally Fitted — The type or types of tyre provided by the manufacturer on the vehicle type in question, as declared by the vehicle manufacturer (*see* **4.1**).

NOTE — Snow tyres shall not be regarded as tyres normally fitted.

3.4 Normal Running Pressure — The cold inflation pressure, as declared by the vehicle manufacturer (*see* **A-10**), increased by 20 kPa.

NOTE — At the option of manufacturer, increasing the tyre pressure by 20 kPa need not be carried out.

3.5 Speedometer — That part of the speedometer equipment, which indicates to the driver the speed of the vehicle at any given moment. The speed-indicating part of a tachograph may be considered as the speedometer, if it complies with the requirements specified in this standard.

3.5.1 *Tolerances of the Speedometer's Measuring Mechanism* — The accuracy of the speedometer instrument itself, expressed as the upper and the lower speed indication limits for a range of speed inputs.

3.5.2 *Speedometer Ratio (Technical Constant of the Speedometer)* — The relationship between the input revolutions or pulses per minute and a specified displayed speed.

NOTE — It is preferred that this ratio is expressed as rev/min of the speedometer cable or pulses/minute divided by 1 000 to indicate 60 km/h. This is also equal to 1/1000th of revolutions of the speedometer cable or the number of pulses to read 1 km.

3.6 Unladen Vehicle — The vehicle in the kerb weight condition, as per IS 11422 or IS 9211 plus a maximum of 75 kg for the driver and any necessary test equipment or instrumentation.

NOTE — Even though the scope of IS 11422 does not cover L_5 category vehicles, for the purpose of this standard, the definition of kerb weight applies for L_5 category also.

3.7 Marked Numerical Values — The numerical values of speed displayed on the dial of the speedometer.

3.8 Graduation — The markings appearing in between the two marked numerical values, displayed on the dial of the speedometer.

4 TECHNICAL SPECIFICATION OF VEHICLE

4.1 Technical specifications of vehicle as relevant to speedometer system shall be declared by the vehicle manufacturer and shall contain at least the details given in Annex A.

NOTE — If the specifications submitted for complete type approval of a vehicle contain the details given in Annex A, there is no necessity of submitting this information again.

4.2 Modifications/Changes

In case test is conducted for verification of compliance to statutory requirements, the following shall be carried out:

4.2.1 Every functional modification pertaining to the information declared in accordance with **4.1** shall be intimated by the manufacturer to the certifying agency. The certifying agency may then consider, whether,

(a) the model with the changed specifications still complies with provisions; or

(b) any further verification is required to establish compliance.

4.2.2 For considering whether any further verification is required or not, guidelines given in Annex B may be used.

4.2.3 In case of **4.2.1**(a), tests for only those parameters, which are affected by the modifications, need to be carried out.

4.2.4 In case of fulfillment of criterion of **4.2.1**(a) or after results of further verification as per **4.2.1**(b) are successful, the approval of compliance shall be extended for the modifications carried out.

4.2.5 These conditions are applicable irrespective of any change in commercial name of the vehicle model.

5 REQUIREMENTS

5.1 The display of the speedometer shall be located within the direct field of view of the driver and shall be clearly legible by both day and night.

5.2 Range

5.2.1 The range of speeds displayed shall be sufficiently wide to include the maximum design speed of vehicle as stated by the manufacturer.

5.2.2 In the case of speedometers intended for vehicles of categories L_1 the marked numerical values shall not exceed 80 km/h.

5.3 Graduations

The graduation shall be 1, 2, 5 or 10 km/h. Within two adjacent marked numerical values, other than those between the first (zero) and second marked numerical values, the graduations shall be of uniform speed.

5.3.1 The marked numerical values shall be in Arabic numerals.

5.3.2 The interval between marked numerical values of the speed shall be as follows:

a) In the case of L_1 category of vehicles, not exceeding 10 km/h.

b) In the case of other vehicles:

1) When the range of display does not exceed 200 km/h, not exceeding 20 km/h.

2) When the range of display exceeds 200 km/h, not exceeding 30 km/h.

5.3.3 The intervals between marked numerical values need not be uniform.

5.4 Additional Requirements (for Digital Display Instruments)

5.4.1 The sampling or update rate shall be such that the indicated speed is legible at all times and does not become illegible due to flickering or rapid change of values.

5.4.2 The interval of display shall be considered to be same as the minimum resolution, which shall preferably be 1 km/h. The ability to indicate increments of speed 1km/h, in the case of speedometers with digital display shall satisfy the requirement of **5.3.2**.

5.5 Accuracy Requirements

When tested as per **6**, the following conditions shall be satisfied, at test speeds specified in **6.4**.

5.5.1 The indicated speed shall not be less than the true speed of the vehicle.

5.5.2 The relationship (δ) between the speed displayed and the true speed shall be:

5.5.2.1 For the purpose of type approval:

$$0 \leq (V_1 - V_2) \leq 0.1\ V_2 + 4 \text{ km/h}$$

5.5.2.2 For the purpose of conformity of production:

5.5.2.2.1 In the case of vehicles of categories M and N:

$$0 \leq (V_1 - V_2) \leq 0.1\ V_2 + 6 \text{ km/h}$$

5.5.2.2.2 In the case of L category other than L_1:

$$0 \leq (V_1 - V_2) \leq 0.1\ V_2 + 8 \text{ km/h}$$

5.5.2.2.3 In the case of L_1 category:

$$0 \leq (V_1 - V_2) \leq 0.1\ V_2 + 4 \text{ km/h}$$

where

V_1 = speed indicated on the display of the speedometer, and

V_2 = true speed.

5.6 Requirements of Marking

5.6.1 The speedometer shall be marked with the following:

a) Manufacturer's name or trade-mark,
b) Country of manufacturer (if imported),
c) Speedometer ratio (Technical constant of the speedometer), and
d) Unit of speed measured, in km/h.

5.6.2 These markings need not be visible in the installed condition.

6 TEST PROCEDURES

6.1 Preparations of Test Vehicle

6.1.1 The vehicle shall be run in as per practice recommended by the vehicle manufacturer.

6.1.2 Before the test the vehicle including all its parts, component and systems shall have reached a stable temperature normal to vehicle operation.

6.1.3 The test shall be carried out with the vehicle at its unladen weight as defined in **3.6**.

In case of a drive away chassis, the test shall be conducted as per declaration of vehicle manufacturer for recommended kerb weight and with a maximum of 75 kg for the driver and any necessary test equipment or instrumentation. In absence of this data, drive away chassis may be loaded applying the cab/body weight allowance as per Table 1.

Table 1 Allowance in Weight

Sl No.	GVW Range kg	Allowance in Weight	
		Load Body Weight kg	Cab Body Weight kg
(1)	(2)	(3)	(4)
i)	Up to 3 000	120	400
ii)	Above 3 000 but below 4 000	200	400
iii)	Above 4 000 but below 6 000	400	400
iv)	Above 6 000 but below 10 000	700	400
v)	Above 10 000	1 000	400

6.1.4 The tyres shall be one of the types normally fitted on the vehicle as defined in **3.3**. The tyres shall be run in at the same time as the vehicle and have operated at least 500 km or distance recommended for running-in of the vehicle, whichever is lower on road prior to test. Declaration of the vehicle manufacturer shall be accepted as compliance to this sub-clause.

6.1.5 Tyres shall be inflated to the pressure declared by manufacturer as per **3.4**.

6.1.6 A test shall be carried out for each type of speedometer, as per **3.2**(c) intended to be fitted by the manufacturer, subject to the details given in Annex B.

6.2 Instrumentation

The instrumentation and a method used for establishing the true speed shall have accuracy within ± 0.5 percent. Fitment and operation of all instruments shall be such as not to hamper the visibility or freedom of the driver/ rider to have proper control of the vehicle at all times.

6.3 Test Track

The test may be carried out on a test track/roadway or on a roller dynamometer.

6.3.1 If tested on a test track/roadway, the surface shall be flat and dry, and provide sufficient adhesion. The test track/roadway shall be capable of allowing the maximum test speed to be achieved and maintained over a straight measuring strip of length specified in **6.5**.

6.3.2 If a roller dynamometer is used for the test, the diameter of the roller shall be at least 0.4 m.

6.4 Test Speeds

The vehicle shall be tested at the speeds indicated in Table 2.

Table 2 Test Speeds

Sl No.	V_{Max} [1]	Test Speed (V_t) (km/h)
(1)	(2)	(3)
i)	$V_{Max} \leq 45$	80 percent [2] of V_{Max}
ii)	$45 < V_{Max} \leq 100$	40 km/h and 80 percent[2] of V_{Max}, if the resulting speed is ≥ 55 km/h
iii)	$100 < V_{Max} \leq 150$	40 km/h, 80 km/h and 80 percent [2] of V_{Max}, if the resulting speed is ≥ 100 km/h
iv)	$150 < V_{Max}$	40 km/h, 80 km/h and 120 km/h

[1] V_{Max} = Maximum design speed of the vehicle specified by the vehicle manufacturer, in km/h.

[2] The speed calculated shall be rounded off to the nearest 10 km/h for carrying out a test.

6.5 Test

The vehicle shall be driven at the applicable constant speed(s) specified in **6.4** as indicated by the

speedometer and the time *(t)* required for traversing a distance *(s)* shall be measured.

NOTE — The distance "*s*" shall be determined to provide the accuracy as specified in **6.2.1** and shall not be less than 200 m in any case.

If the test is done on a test track/roadway, the vehicle shall be driven along a straight path.

The test shall be repeated 3 times for each test speed.

The true speed of the vehicle shall be calculated as:

$$\text{True speed, km/h} = \frac{\text{Sum of distance}(s) \text{ travelled in 3 passes (m)}}{\text{Sum of time taken } (t) \text{ for three passes (s)}} \times 3.6$$

ANNEX A

(*Clauses* 3.4 *and* 4.1)

TECHNICAL SPECIFICATION TO BE DECLARED BY THE VEHICLE MANUFACTURER

A-1 DETAILS OF VEHICLE MANUFACTURER[1)]

a) Manufacturer's name and address
b) Telephone No.
c) Fax No.
d) E mail address
e) Contact person
f) Name of model and variants
g) Plant(s) of manufacture
h) Name and address of vehicle manufacturing plant
j) Importer's name and address

A-2 CATEGORY OF VEHICLE (*see* IS 14272)

A-3 MAXIMUM DESIGN SPEED, km/h

A-4 WEIGHTS

a) Vehicle kerb weight, kg
b) In the case of drive away chassis, kerb weight declared by the manufacturer
c) Front axle
d) Rear axle
e) Other axle(s)

A-5 SPEEDOMETER

a) Model and type
b) Make, country of origin, if imported and identification
c) Range
d) Marked numerical values
e) Graduations
(In case of the digital display, resolution)
f) In the case of speedometers with analog display, a sketch showing the arrangement of marked numerical values, graduations and the range shall be submitted
g) Speedometer ratio

A-6 RATIO OF SPEEDO DRIVE

A-7 SPEEDOMETER DRIVE (FRONT WHEEL/ REAR WHEEL/GEAR BOX)

(In case of electronic speedometer: Number of pulses per rotation of the wheel.)

A-8 TYRES

a) Front wheel
b) Rear wheel
c) Other wheel(s)

A-9 DYNAMIC ROLLING RADIUS (mm) OF THE TYRE TO WHICH SPEEDOMETER IS LINKED

A-10 INFLATION PRESSURE-UNLADEN, kpa OR kg/cm^2

a) Front
b) Rear
c) Other wheel(s)
d) Option to increase tyre pressure by 20 kPa (*see* **3.4**) (Yes/No)

[1)] In case of imported vehicles, above details shall be supplied for importer also.

ANNEX B

(*Clause* 4.2.2)

CRITERIA FOR EXTENSION OF APPROVAL

B-1 The changes in the parameters affecting requirements of this standard and the verification/tests to be carried out for extending the approval are listed in Table 3.

B-2 Changes in parameters listed in Annex A, other than those covered by Table 3, are considered to have no adverse effect on compliance to the requirements of this standard. For extending approvals for such changes no additional verification/tests are required.

B-3 The guidelines mentioned in **B-1** are also applicable for selecting a vehicle from its variants/ other models for demonstrating compliance of the range of models and their variants to requirements of this standard.

B-4 In the case of change in dynamic rolling radius of tyre linked to the speedometer [*see* Sl No. (v) of Table 3] and/or change in ratio of speedometer drive transmission [Sl No. (vi) of Table 3], the error δ_N shall be calculated from the following formula for the required indicated speeds V_1:

$$\delta_N = [V_1 \times S \times 2 \times \pi \{(R_T \times C_T) - (R_N \times C_N)\}] + \delta_T$$

where

R_T = dynamic rolling radius of tyre of the system already approved (m);

R_N = dynamic rolling radius of tyre of the system to be approved (m);

C_T = ratio of the RPM of wheel to which the speedocable is linked, to speedocable RPM or pluses per minute, which has been type approved;

C_N = ratio of the RPM of wheel to which the speedocable is linked, to speedocable RPM or pluses per minute, which is to be type approved;

S = speedometer ratio expressed as rev/min or pulses per minute of the speedometer cable divided by 1 000 to indicate 60 km/h;

δ_T = error $= V_1 - V_{2T}$, recorded at the time of type approval;

V_1 = indicated speed in km/h;

V_{2T} = true speed for V_1 for the system type approved;

δ_N = calculation error = $V_1 - V_{2N}$, calculated for the system to be type approved; and

Table 2 Changes in Parameters and Verification/Tests to be Carried Out

(*Clause* B-1)

Sl No.	Type of Change	Verification/Tests Needed to Extend Approval for the Change
(1)	(2)	(3)
i)	Location of the speedometer that affects the parallax from the driver's seat	Tests as per **5.5**
ii)	*Category of vehicle*:	
	a) For extending the type approval of category L_2 to L_1	Verify compliance of **5.2** and **5.3**
	b) Any category change within L_5	No additional verification or tests are required
	c) Any category change within M and N	No additional verification or tests are required
	d) Category change from M or N to L_5 or *vice versa.*	All tests to be conducted
iii)	V_{Max} (*Design maximum speed*)	
	a) Increase in V_{max} causes an increase in the test speed V_1 as per Table 1, by more than 10 km/h.	Verification as per **5.2** and tests as per **5.5**
	b) Increase in V_{Max} causes an increase in the test speed V_1 as per Table 1, by not more than 10 km/h.	Verification as per **5.2**
	c) Decrease in V_{Max}	No additional verification or tests are required
iv)	*Unladen vehicle weight (see 3.6)*	
	a) Decrease in unladen weight on the axle, the tyre of which is linked to the speedometer, by more than 20 percent.	Tests as per **5.5**
	b) Decrease in unladen weight on the axle, the tyre of which is linked to the speedometer, by not more than 20 percent or any increase.	No additional verification or tests are required
v)	Any change in the tyre designation which causes a change in dynamic rolling radius	No test required if condition given in **B-4** is satisfied. Otherwise tests as per **5.5**
vi)	Any change in the ratio of speed-drive transmission (*see* **3.2**)	No test required if condition given in **B-4** is satisfied. Otherwise tests as per **5.5**
vii)	*Type of speedometer*	
	Speedometer ratio	Tests as per **5.5**
	Changes in marked numerical values, graduations, range	All requirements as per **5**
	Mechanical to electronic speedometer or *vice versa*	All requirements as per **5**
	Digital display to analog display or *vice versa*	All requirements as per **5**
	Make of speedometer	As per **B-5**

V_{2N} = calculated true speed for V_1 for the system to be type approved.

If the value of δ_N satisfies the requirement of **5.5.2.1**, no tests are required to confirm compliance of the changes

B-5 In the case of a change of make, no further verification is needed if there are no differences in the details in the parameters described in **A-5.10** and it is established that the tolerances of speedometer's mechanism as per **3.5.1** are in the same range as that for the make already approved. Otherwise, verification and test as per **5** shall be carried out.

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