

For comments only

Draft Indian Standard

**Rear Marking Plates for Heavy and Long Vehicles
(ICS 13.340.01; 43.040)**

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**Last date for receipt of
comments is 18 08 2020**

Automotive Electrical Equipment and Instruments Sectional Committee, TED 11

FOREWORD

This draft Indian Standard shall be adopted by Bureau of Indian Standards, after the draft finalized by the Automotive Electrical Equipment and Instruments Sectional Committee is approved by the Transport Engineering Division Council.

Rear marking plates purports to enhance visibility of vehicles, even in darkness. It will aid the trailing / following vehicles to judge the length of vehicle ahead of it and thus facilitate right decisions while overtaking.

In the preparation of this standard considerable assistance has been drawn from

AIS 089 (Rev 1):2019 ‘Approval of Rear marking plates for Heavy and long vehicles’ issued by Automotive Industry Standards Committee.

The installation requirements of rear marking plates are covered under AIS 008 (Rev 2):2019.

The definitions of technical terms are those adopted by the International Commission on Illumination (CIE) (*see* technical report on retro-reflection, CIE Publication No. 54.)

Central Motor Vehicle Rules, 1989 (CMVR) may be referred for latest update on statutory requirements related to rear marking plates. In case of any inadvertent variance between the Indian Standard and *Central Motor Vehicles Rules* 1989, latter shall prevail.

Central Motor Vehicles Rules refers to many Automotive Industry Standards (AIS) formulated by Automotive Industry Standards Committee (AISC) till such time corresponding BIS specifications are notified. Under the same provision Automotive Industry Standards

(AIS) referred in this Indian Standard will be replaced by BIS Standards after corresponding BIS Standards are formulated and notified.

Rain simulation test will be incorporated in the standard after the test method and acceptance criteria is clarified by Automotive Industry Standards Committee.

The composition of committee responsible for formulation of this standard is given at Annex M.

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 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard applies to the approval of marking plates used to increase the visibility of the rear of certain heavy and long motor vehicles and their trailers and semi-trailers.

The standard is applicable to vehicles of categories N2 (maximum mass exceeding 7.5 tonnes), N3 (with the exception of tractors for semi-trailers), categories T1, T2 and T3 (in all cases the length shall exceed 8m, including the draw bar), category T4 and articulated buses.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision 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 standard indicated below:

<i>IS No.</i>	<i>Title</i>
IS 14272 : 2011	Automotive vehicles - Types - Terminology
IS/ ISO105 (Part B 02):2014	Textiles — Tests for colour fastness Part B02: Colour fastness to artificial light : Xenon arc fading lamp test
AIS 010 (Part 5) : 2010	Requirements of chromaticity co-ordinates of colour of light emitted from lighting and light-signalling devices

3 DEFINITIONS

For the purpose of this standard, definitions given in IS 14272 and AIS 010 (Part 5) shall apply, in addition to the following:

3.1 Rear Marking Plate — A plate faced with retro-reflective and fluorescent material or devices intended to increase the visibility and permit easy identification of heavy and long vehicles.

3.2 Sample Unit — A complete, finished marking plate ready to be mounted on a vehicle and representative of current production.

3.3 Class(es) of rear marking plates

a) Class 1: Rear marking plates for heavy motor vehicles (trucks and tractors) with red fluorescent and yellow retro-reflective alternative stripes.

b) Class 2: Rear marking plates for long motor vehicles (trailers and semi trailers) with red fluorescent border and yellow retro-reflective centre.

c) Class 3: Rear marking plates for heavy motor vehicles (trucks and tractors) with red retro-reflective and yellow retro-reflective alternative stripes.

d) Class 4: Rear marking plates for long vehicles (trailers and semi trailers) with red retro reflective border and yellow retro-reflective centre.

e) Class 5: Rear marking plates for motor vehicles or trailers with red and white retro-reflective alternative stripes.

3.4 Retro Reflection — Reflection in which radiation is returned in directions close to the direction from which it came, this property being maintained even over wide variations of the direction of the incident radiation:

3.4.1 Retro Reflective Material — A surface or device from which, when directionally irradiated, a relatively large portion of the incident radiation is retro reflected.

3.4.2 Retro Reflecting Device — An assembly ready for use and comprising one or more retro reflecting optical units.

3.5 Geometric Definitions (see Annex A, Fig. 1 and 2)

3.5.1 Reference Centre — A point on or near a retro reflective area which is designated to be the centre of the device for the purpose of specifying its performance.

3.5.2 Illumination Axis — A line segment from the reference centre to the light source.

3.5.3 Observation Axis — A line segment from the reference centre to the photometer head.

3.5.4 Observation Angle (α) — The angle between the illumination axis and the observation axis. The observation angle is always positive and, in the case of retro reflection, is restricted to small angles.

Maximum range: $0 \leq \alpha \leq 180^\circ$;

3.5.5 Observation Half-Plane — The half-plane which originates on the illumination axis and which contains the observation axis.

3.5.6 Reference Axis — A designated line segment originating on the reference centre which is used to describe the angular position of the retro reflector.

3.5.7 Entrance Angle (β) — The angle from the illumination axis to the reference axis. The entrance angle is usually not larger than 90° but, for completeness, its full range is defined as $0 \leq \beta \leq 180^\circ$. In order to specify the orientation in full, this angle is characterized by two components, β_1 and β_2 .

3.5.8 First Axis — An axis through the reference centre and perpendicular to the observation half-plane.

3.5.9 First Component of the Entrance Angle (β_1) — The angle from the illumination axis to the plane containing the reference axis and the first axis.

Range: $-180^\circ < \beta_1 \leq 180^\circ$

3.5.10 Second Component of the Entrance Angle (β_2) — The angle from the plane containing the observation half-plane to the reference axis.

Range: $-90^\circ \leq \beta_2 \leq 90^\circ$

3.5.11 Second Axis — An axis through the reference centre and perpendicular to both the first axis and the reference axis. The positive direction of the second axis lies in the observation half-plane when $-90^\circ < \beta_1 < 90^\circ$; as shown in Annex A, Fig. 1.

3.5.12 Angle of Rotation (ε) — Angle through the which the sample is turned about its mean vertical from any arbitrary established position counter clock ($+\varepsilon$) or clockwise ($-\varepsilon$) viewed in the direction of illumination. If retro-reflective materials or devices have a marking (namely TOP), the marking governs the starting position. The angle of rotation ε lies in the range $-180^\circ < \varepsilon \leq 180^\circ$.

3.6 Definition of Photometric Terms

3.6.1 Coefficient of Retro-Reflection (R') — The quotient of the coefficient of luminous intensity R of a plane retro-reflecting surface by its area A .

$$R' = \frac{I}{E_{\perp} \times A}$$

$$R = \frac{I}{E_{\perp}}$$

Where

R' = coefficient of retro-reflection, in $\text{cd.lx}^{-1}.\text{m}^{-2}$;

I = luminance, in candela;

E_{\perp} = illumination, in lux;

A = Area, in m^2 ; and

R = coefficient of luminous intensity, in cd.lx^{-1} .

3.6.2 Angular diameter of the Retro Reflector Sample (η) — The angle subtended by the greatest dimension of the retro reflective sample, either at the centre of the source of illumination or at the centre of the receiver;

3.6.3 Luminance Factor — The ratio of the luminance of the body under consideration to the luminance of a perfect diffuser under identical conditions of illumination and observation.

3.6.4 Colour of the Reflected Light of the Device — The definitions of the colour of the reflected light shall be as given in AIS 010 (Part 5).

3.7 Fluorescence — The phenomenon of emittance of radiations by certain substances, when brought near to a source of ultraviolet or blue radiations. The radiations emitted are nearly always of longer wave-length than those producing the effect.

By day and in twilight, fluorescent colours are brighter than normal colours because they reflect part of the light falling upon them, and in addition they emit light. At night they are not brighter than ordinary colours.

3.7.1 Colour of the Fluorescent Light of the Device — The definitions of the colour of the fluorescent light shall be as given in AIS-010 (Part 5).

3.8 Description of Goniometer

A goniometer, which can be used in making retro reflection measurements in the CIE geometry, is illustrated in Annex A, Fig. 2. In this illustration, the photometer head is arbitrarily shown to be vertically above the source. The first axis is shown to be fixed and horizontal and is situated perpendicular to the observation half-plane. Any arrangement of the components, which is equivalent to the one shown, can be used.

3.9 Type — Rear marking plates of different types means marking plates, which differ, in such essential respects as:

- a) The trade name or mark,
- b) The characteristics of the retro reflective material,
- c) The characteristics of the fluorescent material, and
- d) The parts affecting the properties of the retro reflective material or devices.

3.9.1 Differences in the shape and dimensions of the rear marking shall not constitute a different type.

4 CLASSES OF REAR MARKING PLATES

- a) Class 1: Rear marking plates for heavy motor vehicles (trucks and tractors) with red fluorescent and yellow retro-reflective alternative stripes.
- b) Class 2: Rear marking plates for long motor vehicles (trailers and semi trailers) with red fluorescent border and yellow retro-reflective centre.
- c) Class 3: Rear marking plates for heavy motor vehicles (trucks and tractors) with red retro-reflective and yellow retro-reflective alternative stripes
- d) Class 4: Rear marking plates for long vehicles (trailers and semi trailers) with red retro reflective border and yellow retro-reflective centre.
- e) Class 5: Rear marking plates for motor vehicles or trailers with red and white retro-reflective alternative stripes.

5 TEST PROCEDURE

Retro-reflective material shall be subjected to testing in accordance with test procedure given in Annex B.

6 GENERAL SPECIFICATIONS

6.1 Retro-reflective/ fluorescent or retro-reflective only marking plates shall be so constructed that they function satisfactorily and will continue to do so in normal use. In addition, they shall not have any defect in design or manufacture that is detrimental to their efficient operation or to their maintenance in good condition.

6.2 The components of retro-reflective/ fluorescent or retro reflective only marking plates shall not be capable of being easily dismantled.

6.3 The means of attachment of the rear marking plate must guarantee a stable and durable connection between the rear marking plate and the rear end of vehicles, for instance by screws,

rivets or adhesives.

6.4 The outer surface of the retro reflective/ fluorescent or retro-reflective only marking plate(s) shall be easy to clean. The surface shall not be rough and any protuberances shall not prevent easy cleaning.

7 SPECIAL SPECIFICATIONS (TESTS)

Rear marking plate(s) shall conform to requirements related to shape, stripe slope and colorimetric, photometric, physical and mechanical requirements given in Annex C to Annex J.

8 INFORMATION TO BE SUBMITTED BY THE MANUFACTURER

Manufacturer shall submit the information related to rear marking plate as given in Annex K.

9 MARKINGS

9.1 Every rear marking plate shall bear:

- a) The trade name of the applicant and unique mark of type;
- b) On the plates whose retro reflective system is not omni-rotational, the word 'TOP' shall be inscribed horizontally on the part of the plates which is intended to be the highest part of the plate when mounted on the vehicle.

9.2 The markings shall be applied on either the retro reflective or the fluorescent area of the plate, or on the edge, and shall be visible from the outside when the marking plate is fitted on the vehicle.

9.3 The markings shall be clearly legible and shall be indelible.

9.4 BIS Certification Marking

The rear marking plates may also be marked with the Standard Mark.

9.4.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the BIS Act, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

ANNEX A
(Clause 3.5 & 3.8)

THE CIE CO-ORDINATE SYSTEM

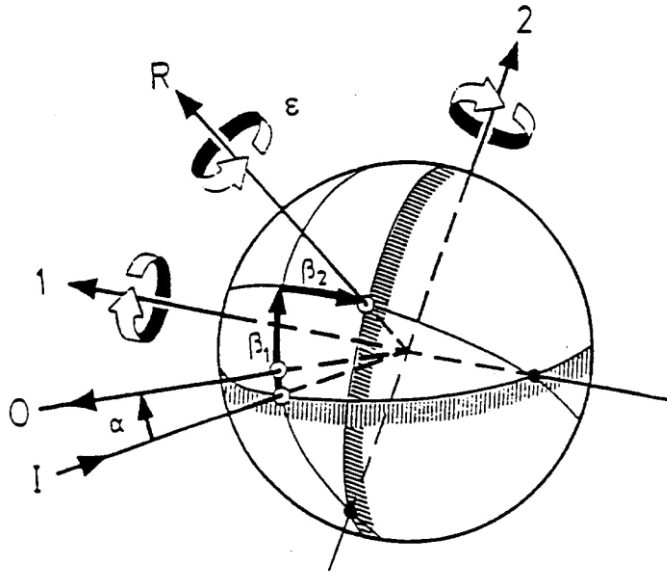


Fig. 1 CIE Angular System

<i>I</i> : First Axis	<i>I</i> : Illumination Axis	α :	Observation angle
2: Second Axis	<i>O</i> : Observation Axis	β_1, β_2 :	Entrance angles
	<i>R</i> : Reference Axis	ϵ :	Rotation angle

A-1 The CIE angular system for specifying and measuring retro-reflectors. The first axis is perpendicular to the plane containing the observation axis and the illumination axis. The second axis is perpendicular both to the first axis and to the reference axis. All axes, angles, and directions of rotation are shown positive.

Notes —

- 1 The principal fixed axis is the illumination axis.
- 2 The first axis is fixed perpendicular to the plane containing the observation and illumination axis.
- 3 The reference axis is fixed in the retro-reflector and moveable with β_1 and β_2 .

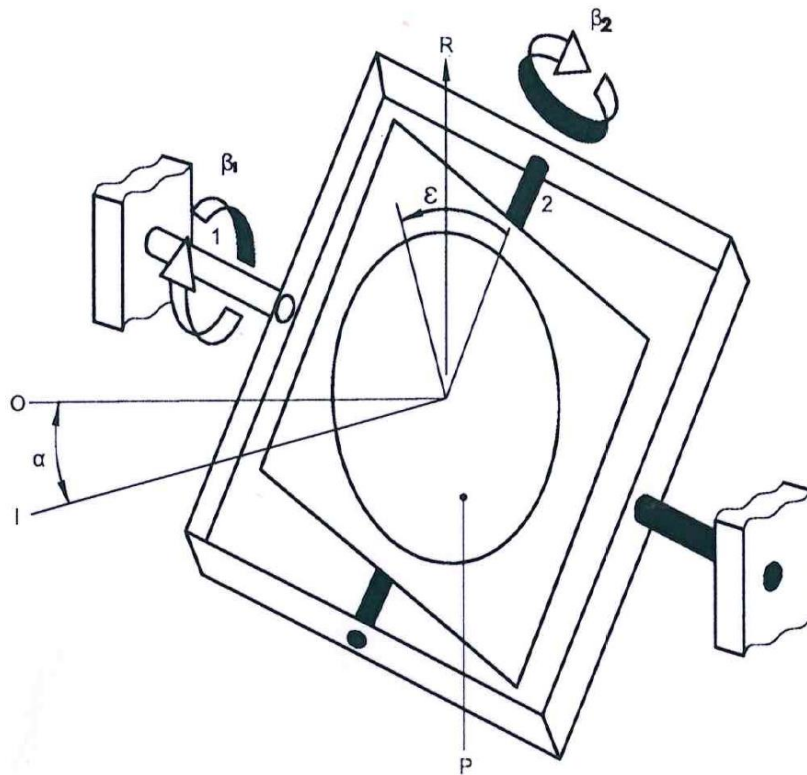


Fig. 2 Goniometer Mechanism

- | | | |
|-----------------------|------------------------------|--------------------------------------|
| <i>I</i> : First Axis | <i>I</i> : Illumination Axis | α : Observation angle |
| 2: Second Axis | <i>O</i> : Observation Axis | β_1, β_2 : Entrance angles |
| 3: Reference Centre | <i>R</i> : Reference Axis | ϵ : Rotation angle |
| | <i>P</i> : Retro-reflector | |

A-2 Representation of a goniometer mechanism embodying the CIE angular system for specifying and measuring retro-reflectors. All angles and directions of rotation are shown positive.

ANNEX B

(Clause 5)

TEST PROCEDURE

TEST SAMPLES

B-1 Two large chevron rear marking plates for trucks and tractors and two large rear marking plates for trailers and semi-trailers (or their equivalent in smaller plates) shall be supplied to the testing laboratory for the various tests to be conducted.

The test samples shall be representative of current production, fabricated in accordance with the recommendations of the manufacturer(s) of the retro-reflective or retro-reflective / fluorescent materials or devices.

B-2 The sample shall be checked for verification of the general specifications as per **6** and specifications of shape and dimensions (*see* Annex C). Before tests described in Annexes D, E and F are carried out, the sample shall be subjected to Resistance to Heat test (*see* Annex G).

B-3 The photometric and colorimetric measurements may be taken on the same sample.

B-4 For other tests, samples which have not undergone any testing, should be used.

ANNEX C
(Clause 7)

SPECIFICATIONS OF SHAPE AND DIMENSIONS OF RETRO-REFLECTIVE/ FLUORESCENT REAR MARKING PLATE(S)

C-1 SHAPE

The plates shall be rectangular in shape for mounting at the rear of vehicles.

C-2 PATTERN

For mounting on trailers and semi-trailers, the plates shall have a yellow retro reflective background with a red fluorescent or retro-reflective border.

For mounting on non-articulated vehicles (tractors or trucks), the plates shall be of the chevron type with alternate, oblique stripes of yellow retro-reflective and red fluorescent or retro-reflective materials or devices.

For mounting of Class 5 devices on non-articulated vehicles, the retro reflective material shall be made with alternate, oblique stripes of white and red colour.

C-3 DIMENSIONS

C-3.1 The total summarized length of a set of rear marking plates consisting only of one, two or four marking plates with retro reflective and fluorescent materials shall be 1 130 mm *Min.* and 2 300 mm *Max.*

C-3.2 The width of a rear marking plate shall be:

a) For trucks and tractors: 140 ± 10 mm

b) For trailers and semi-trailers: $200 \begin{smallmatrix} +30 \\ -5 \end{smallmatrix}$ mm

C-3.3 The length of the each rear marking plates in a set consisting of two plates for trucks and tractors [*see Annex J Fig 3(b) and 3(c)*] can be reduced to 130 mm *Min.* and width increased such that area of each marking is 735 cm² *Min.* and 1725 cm² *Max.* The marking plates shall be rectangular in shape.

C-3.2.1 Class 5 devices shall incorporate a minimum of 9 standard areas as described in **C-3.6** on large vehicles with available mounting space, but may be reduced to a minimum of 4 standard areas on vehicles with limited mounting space.

C-3.4 The width of the red fluorescent border of the rear marking plates for trailers and semi-trailers shall be 40 ± 1 mm.

C-3.5 The slope of the oblique stripes of the chevron band shall be $45 \pm 5^\circ$. The width of the stripes shall be 100 ± 2.5 mm.

C-3.5.1 Shapes, patterns and dimensional features of rear marking plates shall be as shown in Fig. 3 and 4.

C-3.6 Class 5 retro-reflective materials shall consist of red and white diagonal stripes, each 100 mm wide sloping outwards and downwards at 45° . The basic standard area is a square of 141 mm in length subdivided diagonally into a half white and half red, which represents one standard area.

C-3.6.1 Shapes, patterns and dimensional features of rear marking plates of Class 5 shall be as shown in Fig. 5.

C-3.6.2 Rear marking plates or Class 5 devices supplied in sets shall form matching pairs.

ANNEX D
(Clause 7)

COLORIMETRIC SPECIFICATIONS

D-1 Rear marking plates for heavy vehicles and trailers shall be composed of yellow retro reflective and red retro-reflective or yellow retro-reflective and red fluorescent materials or devices.

D-2 YELLOW, RED OR WHITE RETRO-REFLECTIVE MATERIAL

D-2.1 When measured with a spectrophotometer in accordance with the provisions of CIE document No. 15 (1971) and illuminated with the CIE standard illuminant D65 at an angle of 45° to the normal and viewed along the normal (45/0 geometry), the colour of the material in new condition shall be located within the limits as specified in AIS 010 (Part 5).

D-2.1.1 Luminance factor for different colours shall be as given below:

- a) Yellow ≥ 0.16 .
- b) Red ≥ 0.03 .
- c) White ≥ 0.25

D-2.2 When illuminated by the CIE standard illuminant A at an entrance angle $\beta_1 = \beta_2 = 0^\circ$, or, if this produces a colourless surface reflection, an angle $\beta_1 = +5^\circ$, $\beta_2 = 0^\circ$, and measured at an observation angle of 20', the colour of the material in new condition shall be located within the limits as specified in AIS: 010 (Part 5).

Note — The question of the night-time colours of retro reflective materials is at present being studied by CIE/TC/1.6; the above limits are therefore only provisional and will be revised later after CIE TC 1.6 has completed its work.

D-3 RED FLUORESCENT MATERIAL

D-3.1 When measured with a spectrophotometer in accordance with the provisions of CIE document No.15/(1971) and illuminated polychromatically with the CIE standard illuminant D65 at an angle of 45° to the normal and viewed along the normal (geometry 45/0), the colour of the material in new condition shall be within the limits as specified in AIS: 010 (Part 5).

D-3.1.1 Luminance factor for red colour shall be ≥ 0.30 .

D-4 COMPLIANCE WITH THE COLORIMETRIC SPECIFICATION SHALL BE VERIFIED BY A VISUAL COMPARISON TEST.

If any doubt remains after this test, conformity with the colorimetric specification shall

be verified by determining the trichromatic co-ordinates of the most doubtful sample.

ANNEX E
(Clause 7)

PHOTOMETRIC SPECIFICATIONS

E-1 PHOTOMETRIC PROPERTIES

E-1.1 When illuminated with a CIE standard illuminant A and measured as recommended by CIE TC 2.3 (CIE Publication No. 54, 1982), the coefficient of retro reflection R' ($\text{cd.lx}^{-1}.\text{m}^{-2}$) of the yellow retro reflective area in new condition shall be as indicated in Table 1 or 2, according to the class. Devices of class 1 and class 2 shall conform to the values given in Table 1 and devices of class 3 and class 4 shall conform to the values given in Table 2.

Table 1 Coefficient of Retro-reflection R' ($\text{cd.m}^{-2}.\text{lx}^{-1}$) for Colour Yellow of Class 1 and Class 2
(Clause E1.1 & E1.2)

Observation angle α	Colour	Entrance Angle β (°)				
		β_1	0°	0°	0°	0°
20'		β_1	0°	0°	0°	0°
		β_2	5°	30°	40°	60°
R' (Min)	Yellow		300	180	75	10

Table 2 Coefficient of Retro-reflection R' ($\text{cd.m}^{-2}.\text{lx}^{-1}$) for Colour Yellow and Red of Class 3 and Class 4
(Clause E1.1 & E1.2)

Observation angle α	Colour	Entrance Angle β (°)				
		β_1	0°	0°	0°	0°
20'		β_1	0°	0°	0°	0°
		β_2	5°	30°	40°	60°
R' (Min)	Yellow		300	180	75	10
R' (Min)	Red		10	7	4	—

E-1.2 When illuminated with a CIE standard illuminant A and measured as recommended by CIE TC 2.3 (CIE Publication No. 54, 1982), the coefficient of retro-reflection R' ($\text{cd.lx}^{-1}.\text{m}^{-2}$) of the yellow, white or red retro-reflective area in new condition shall be as indicated in Tables 1, 2 or 3 according to the Class. Devices of class 1 and class 2 shall conform to the values given in Table 1, devices of class 3 and class 4 shall conform to the values given in Table 2 and devices of class 5 shall conform to the values given in Table 3.

Table 3 Coefficient of Retro-reflection R' ($\text{cd.m}^{-2}.\text{lx}^{-1}$) for Colour White and Red of Class 5
(Clause E1.1 & E1.2)

Observation angle α	Colour	Entrance Angle β (°)				
		β_1	0°	0°	0°	0°
20'		β_1	0°	0°	0°	0°
		β_2	5°	30°	40°	60°
$R'(Min)$	White		450	200	90	16
$R'(Min)$	Red		120	30	10	2

E-1.3 The subtended angle at the sample shall not be larger than 80'.

E-1.4 Luminance Factor

The Luminance factor β shall be as indicated in Table 4

Table 4 Luminance factor
(Clause E1.4)

Color	Luminance factor β
Red	≥ 0.03
Yellow	≥ 0.16
White	≥ 0.25

ANNEX F
(Clause 7)

RESISTANCE TO EXTERNAL AGENTS

F-1 RESISTANCE TO WEATHERING

F-1.1 Procedure — For each test, two specimens of a sample unit (see 3.2) are taken. One specimen shall be stored in a dark and dry container for subsequent use as reference unexposed specimen.

The second specimen shall be subjected to a source of illumination in accordance with 4.3.1 of IS/ ISO 105 - B02, the retro reflective material shall be exposed until blue standard No. 7 has faded to No. 4 on the grey scale and the fluorescent material until blue standard No. 5 has faded to No. 4 on the grey scale. After the test, the specimen shall be washed in a dilute neutral detergent solution, dried and examined for conformity with the requirements specified in F-1.2 to F-1.4

F-1.2 Visual Appearance — No area of the exposed specimen shall show any evidence of cracking, scaling, pitting, blistering, delamination, distortion, chalking, staining or corrosion.

There shall be no shrinkage in excess of 0.5 percent in any linear direction and no evidence of adhesion failure such as edge lifting from the substrate.

F-1.3 Colour Fastness — The colours of the exposed specimens shall still meet the requirements in Annex E, Tables 1, 2 and 3.

F-1.4 Effect on the coefficient of retro reflection of the retro reflective material:

F-1.4.1 For this check, measurement shall be made only at an observation angle of 20' and an entrance angle of 5° by the method given in Annex F.

F-1.4.2 The coefficient of retro reflection of the exposed specimen when dry shall be not less than 80 per cent of the value in Annex E, Table 1.

F-2 RESISTANCE TO CORROSION

F-2.1 A specimen of the sample unit shall be subjected to the action of a saline mist for 48 hours comprising of two periods of exposure of 24 hours each, separated by an interval of 2 hours during which the specimen is allowed to dry. The saline mist shall be produced by atomizing at a temperature of $35 \pm 2^\circ\text{C}$ a saline solution obtained by dissolving 5 parts by weight of sodium chloride in 95 parts of distilled water containing not more than 0.02 per cent of impurities.

F-2.2 Immediately after completion of the test, the sample shall show no sign of corrosion liable to impair the efficiency of the device.

F-2.2.1 The coefficient of retro-reflection R' of the retro reflective areas, when measured after a recovery period of 48 hours as specified **E-1.1**, at an entrance angle of 5° and an observation angle of $20'$, shall be not less than the value in Annex E, Table 1. Before measurement, the surface shall be cleaned to remove salt deposits due to saline mist.

F-3 RESISTANCE TO FUELS

A section of a sample unit not less than 300 mm long shall be immersed in a mixture of n-heptane and toluol, 70 percent and 30 percent by volume, for one minute.

After removal, the surface shall be wiped dry with a soft cloth and shall not show any visible change, which would reduce its effective performance.

F-4 BONDING STRENGTH (Applicable for marking plates using adhesive materials as means of attachment)

The adhesion of retro-reflective materials shall be determined after 24 hours curing time by utilizing a 90-degree peel on a tensile strength testing machine.

F-4.1 The adhesion of laminated or coated retro reflective and fluorescent materials shall be determined.

F-4.2 The coated materials, of whatever kind, shall not be removable without tools or without damaging the material.

F-4.3 The laminated materials (adhesive films) shall need a minimum force of 10 N per 25 mm width, at a speed of 300 mm per minute, to be removed from the substrate.

F-5 RESISTANCE TO WATER

A section of a sample unit not less than 300 mm long shall be immersed in distilled water at a temperature of $23 \pm 5^\circ$ C for a period of 18 hours. It shall then be left to dry for 24 hours under normal laboratory conditions.

After completion of the test, the section shall be examined. No part inside 10 mm from the cut edge shall show evidence of such deterioration, which would reduce the effectiveness of the plate.

F-6 RESISTANCE TO IMPACT (Not applicable for plastics corner-cube reflectors)

When a 25 mm diameter solid steel ball is dropped from a height of 2 m onto the retro reflective and fluorescent surfaces of a supported plate, at an ambient temperature of $23 \pm 2^\circ$ C, the material shall show no cracking or separation from the substrate at a distance of more than 5 mm from the impacted area.

F-7 CLEANING

F-7.1 Manual Cleaning

F-7.1.1 A test sample smeared with a mixture of detergent lubricating oil and graphite shall be easily cleaned without damage to the retro reflective or fluorescent surfaces when wiped with a mild aliphatic solvent such as n-heptane, followed by washing with a neutral detergent.

F-7.2 Power Washing

When subjected to a continuous spraying action for 60 seconds on the test component in its normal mounting conditions, a test sample shall show no damage to the retro-reflective surface or delamination from the substrate or separation from the sample mounting surface under the following set-up parameters:

- a) Water/wash solution pressure shall be 8 ± 0.2 MPa,
- b) Water/wash solution temperature shall be $60^{\circ} - 5^{\circ}$ °C,
- c) Water/wash solution flow rate shall be 7 ± 1 litre/min,
- d) The tip of the cleaning wand shall be positioned at a distance of 600 ± 20 mm from the retro-reflective surface,
- e) Cleaning wand shall be held at no greater angle than 45 degrees from perpendicular to the retro-reflective surface,
- f) 40 degree nozzle creating wide fan pattern.

ANNEX G
(Clause 7 & B-2)

RESISTANCE TO HEAT

G-1 A section of a sample unit not less than 300 mm long shall be kept for 12 hours (in the case of moulded plastics reflectors the time shall be 48 hours) in a dry atmosphere at a temperature of $65 \pm 2^{\circ}\text{C}$, after which the sample shall be allowed to cool for 1 hour at $23 \pm 2^{\circ}\text{C}$. It shall then be kept for 12 hours at a temperature of $-20 \pm 2^{\circ}\text{C}$.

G-1.1 The sample shall be examined after a recovery time of 4 hours under normal laboratory conditions.

G-2 No cracking or appreciable distortion of the surfaces, particularly of the optical units, shall be evident.

ANNEX H

(Clause 7)

RIGIDITY OF THE PLATES

H-1 The rear marking plate shall be placed on two supports in such a way that the supports are parallel to the shorter edge of the plate and the distance from either support to the adjacent edge of the plate shall not exceed $L/10$, where L is the greater overall dimension of the plate. The plate shall then be loaded with bags of shot or of dry sand to a uniformly distributed pressure of 1.5 kN/m^2 . The deflection of the plate shall be measured at a point midway between the supports.

H-2 The maximum deflection of the plate under the test load shall not exceed one-twentieth of the distance between the supports. The residual deflection after removal of the load shall not exceed one-fifth of the measured deflection under load.

ANNEX J
(Clause C-3.4)

REAR MARKING PLATES

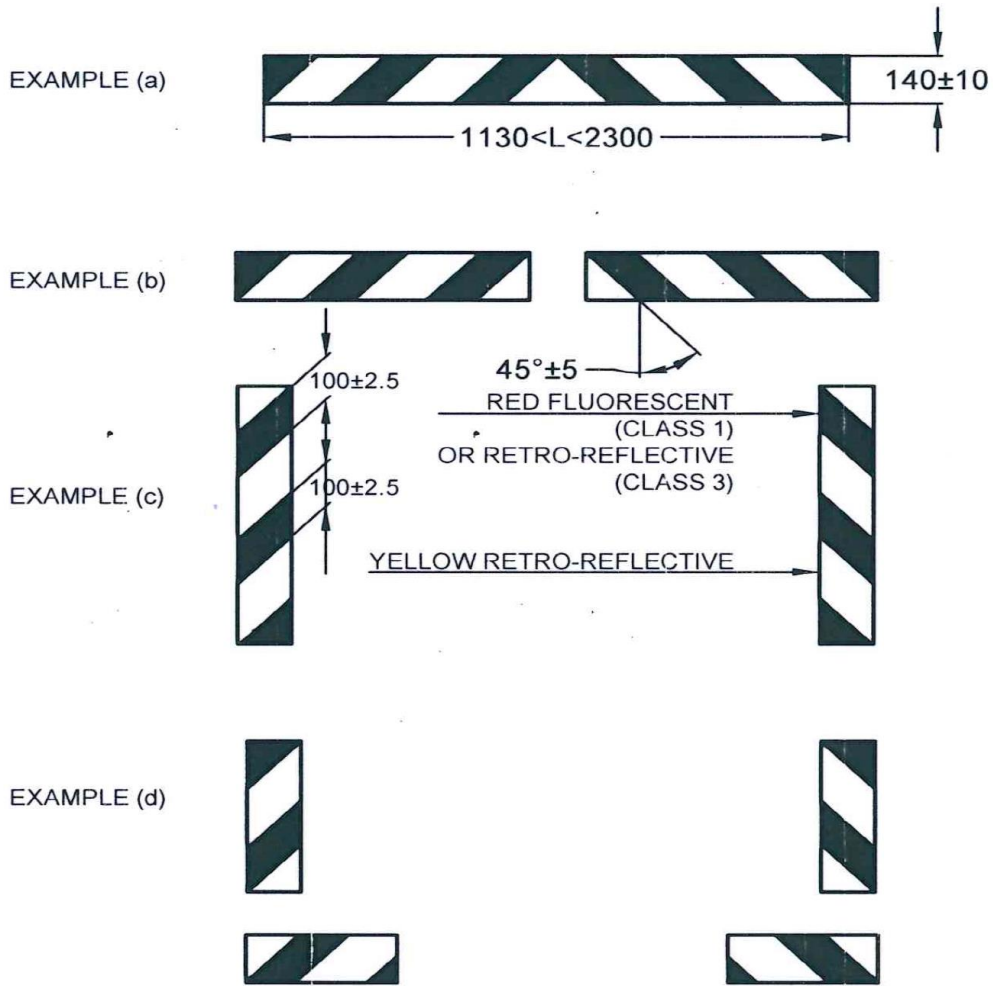


Fig. 3 Rear Marking Plates for Trucks and Tractors (Class 1 and Class 3)

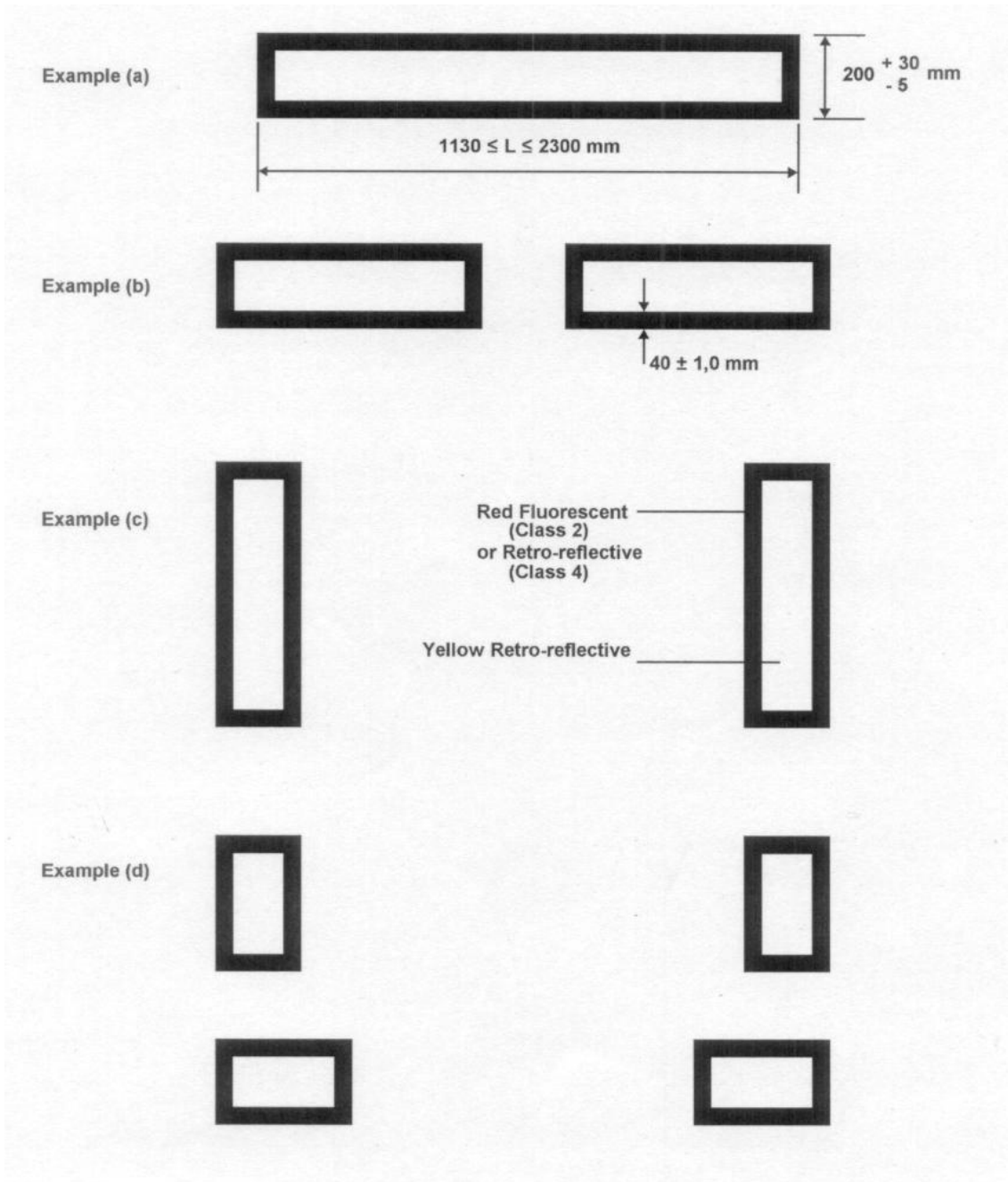


Fig. 4 Rear Marking Plates for Trailers and Semi-Trailers (Class 2 and Class 4)

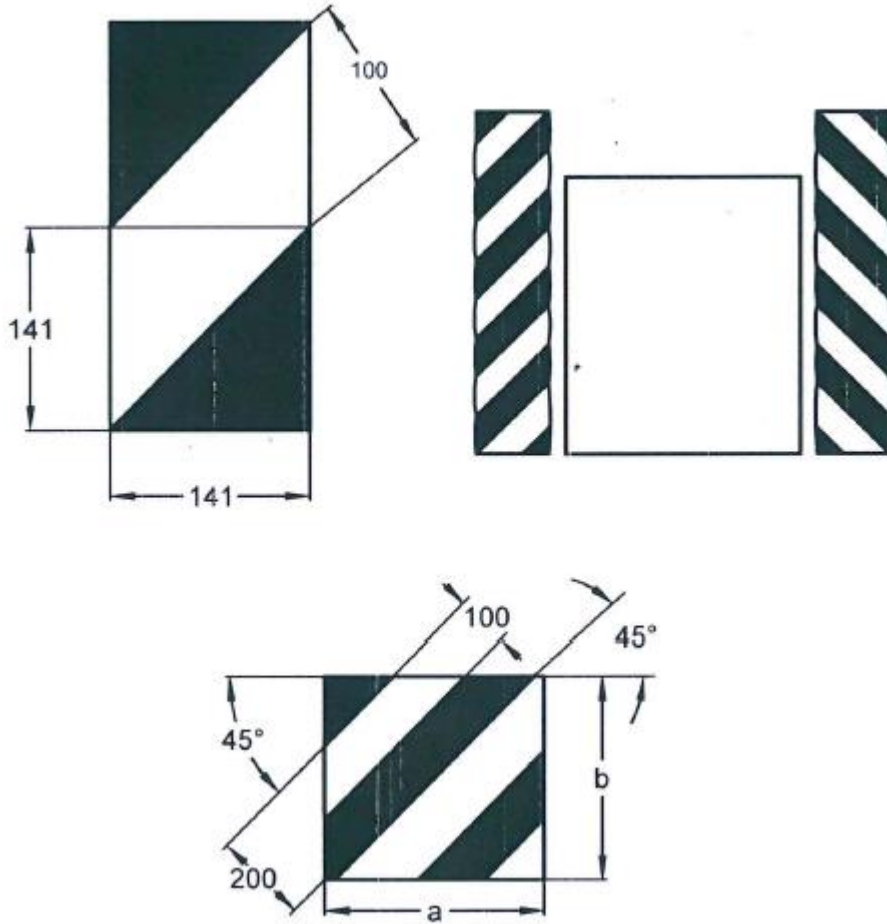


Fig. 5 Rear Marking Plates (Class 5)

ANNEX K
(Clause C-3.4)

INFORMATION TO BE PROVIDED BY THE MANUFACTURER

K-1 Drawing in triplicate, sufficiently detailed to permit identification of the type. The drawings shall show geometrically the position in which the marking plate is to be fitted to the rear end of the vehicle. They shall also show the position intended for the BIS Standard Mark.

K-2 A brief description giving the technical specifications of the materials of which the retro-reflective areas are made.

K-3 A brief description giving the technical specifications of the materials of which the fluorescent areas are made.

ANNEX L
(Sampling Plan)

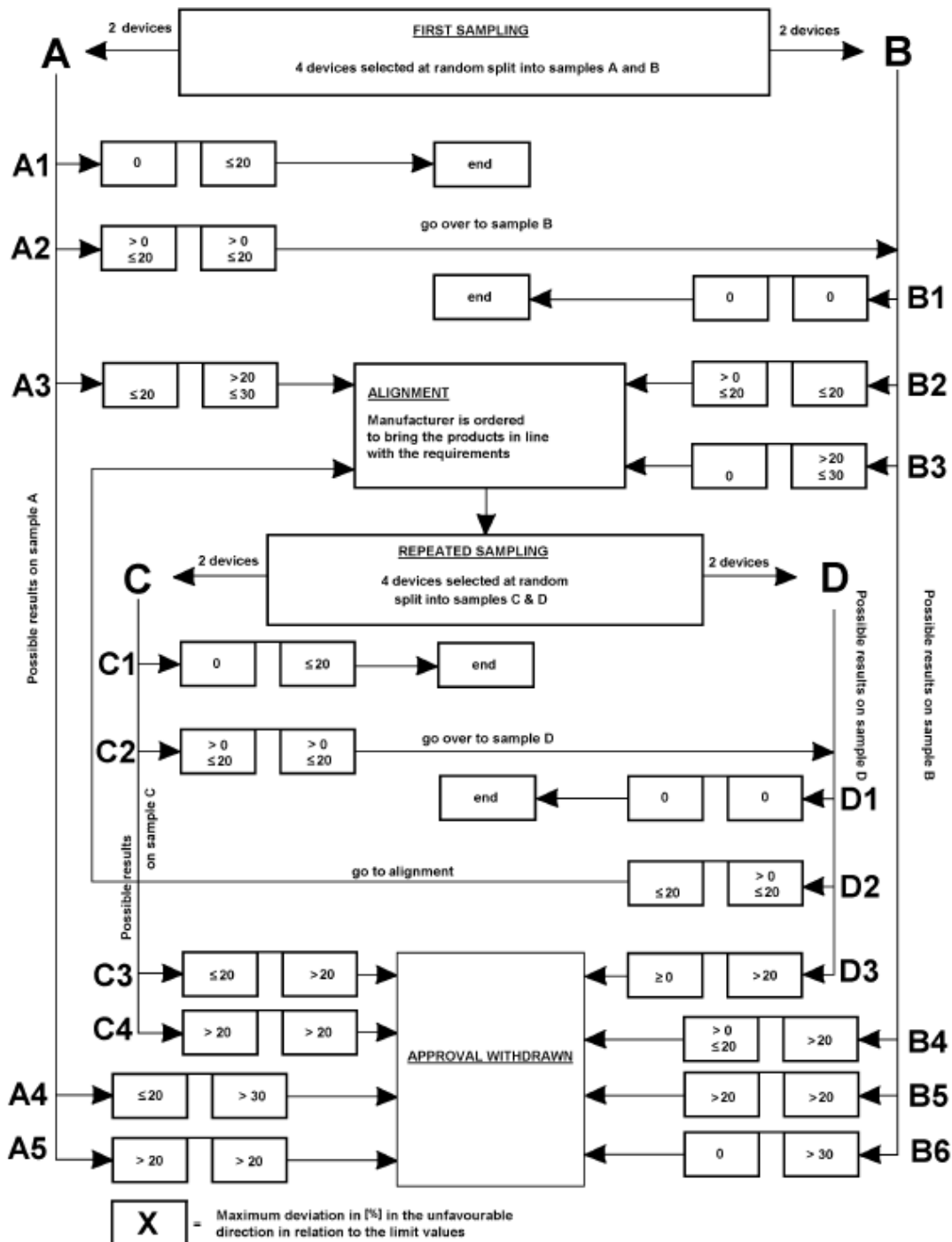


Figure 1

ANNEX M

(Foreword)

COMMITTEE COMPOSITION

Automotive Electrical Equipment and Instruments Sectional Committee, TED 11

Organization

Representative(s)

Vehicle Research & Development Establishment,
Ahmednagar

Shri G.R.M. Rao (*CHAIRMAN*)

Ashok Leyland Ltd, Chennai

Shri Gopalakrishnan S
Ms Suchismita C (*Alternate*)
Ms. Sai Ankitha (*YP*)

Association of State Road Transport Undertakings,
New Delhi

Shri R.R.K. Kishore
Dr. M. Trinath Babu (*Alternate*)

Automotive Research Association of India, Pune

Shri A. A. Deshpande
Shri B. V. Shamsundara (*Alternate*)

Automotive Components Manufacturers Association,
New Delhi

Shri Uday Harite
Ms. Seema Babal (*Alternate*)

Bajaj Auto Ltd, Pune

Shri R. Narsimhan
Shri A.V. Kumbhar (*Alternate*)

Bosch Electrical Drives India Private Ltd,
Chennai

Shri Ullal Subrahmanya
Shri N. J. Devaprasad (*Alternate*)

Cast Master Mobitech India, Faridabad

Shri Rahul Jain
Shri Raju Agarwal (*Alternate*)

Central Institute of Road Transport, Pune

Shri Mukund Vinayak Deo
Shri Santosh Yashwant Deasi
(*Alternate*)

Controller of Quality Assurance Vehicles,
Jabalpur (MP)

Controller (CQA - OFV) Jabalpur
Shri Satyapal Lakhtakia
(*Alternate*)

Daimler India Commercial Vehicles, Chennai

Shri S. V. Sunderson

Denso India, Gurgaon

Shri Noel Alexander Peters
Shri Alok Kumar (*Alternate*)
Ms Alka Sharma (*YP*)

Fiem Industries Ltd, Distt. Sonapat

Shri G. V. George
Shri Arshad Jameel (*Alternate*)

<i>Organization</i>	<i>Representative(s)</i>
Force Motors Ltd, Pune	Shri Aniruddha Kulkarni Shri R.M. Kanitkar (<i>Alternate</i>)
Hero Moto Corp Ltd, Dharuhera	Shri Feroz Ali Khan Shri Subrat Kumar Dash (<i>Alternate</i>)
Honda Cars R & D India	Shri Adish Aggarwal Shri S Muthu Kumar (<i>Alternate</i>)
Indian Society of Lighting Engineers (ISLE), Gurugram	Shri Sameer Sodhi Shri Ramkrishna Maydeo (<i>Alternate</i>)
International Centre for Automotive Technology (ICAT), Gurugram	Shri Madhushudan Joshi Shri Mahender Pal (<i>Alternate 1</i>) Ms Vijayanta Ahuja (<i>Alternate 2</i>)
Indication Instruments Ltd, Faridabad	Shri Vishal Lalani Shri Anuj Garg (<i>Alternate</i>)
Jay Ushin Ltd, Gurgaon	Shri Ramesh Yadav Shri Anil Kumar (<i>Alternate</i>)
John Deere India Pvt Ltd, Pune	Shri Anand Raj Shri Prashant Pulliwar (<i>Alternate</i>)
Lucas TVS Ltd, Chennai	Shri S. Krishna Kumar Shri O. Murigeppa (<i>Alternate</i>)
Lumax Industries Ltd, Gurgaon	Shri Virendra Kumar Sachdev Shri Randhi Kumar (<i>Alternate</i>)
Mahindra & Mahindra Ltd/ MRV Chennai	Shri Kumar Meghanathan Shri S Sakthivelan (<i>Alternate</i>)
Malhotra Cables, Delhi	Shri Rajeev Malhotra Shri Vikas Prasad (<i>Alternate</i>)
Maruti Suzuki India Ltd, Gurgaon	Shri Sandeep Raina Shri Gururaj Ravi (<i>Alternate</i>) Ms M Buaneshwari (<i>YP</i>)
Mercedes – Benz India Pvt. Ltd, Pune	Shri Sanjeev Mandpe Shri Nikhil Desai (<i>Alternate</i>)
Minda Industries, Haryana	Shri V. J. Rao Shri Nirmal Kumar Minda (<i>Alternate</i>)

Organization

MINIBIS Tech India, New Delhi

Ministry of Heavy Industries & Public Enterprises,
New Delhi

Ministry of Micro Smalls Medium Enterprises,
New Delhi

National Highway Authority of India, New Delhi

National Test House, Mumbai

Roots Auto Products Pvt Ltd, Coimbatore

Society of Indian Automobile Mfrs, New Delhi

Tata Motors Ltd, Pune

Toyota Kirloskar Motor Ltd, Bidadi

Tractor Manufacturers Association, New Delhi

Vehicles Research & Dev. Estt. (VRDE),
Ahmednagar

BIS Directorate General

Representative(s)

Shri Wg Cdr I. S. Sabharwal

Shri R K Jaiswal

Shri Suresh Yadavendra
Shri Anil Kumar Singh
(Alternate)

Shri R.C. Palekar
Shri Sanjay Kumar Aggarwal
(Alternate)

Shri D G Basumatry
Shri B R Mandal (Alternate)

Shri K Saravana Sundaram
Shri R Selvaraj (Alternate)

Shri P K Banerjee
Shri Saurabh Rohilla
(Alternate)

Shri Ashish Wadhwa
Shri Gowrishankar P S
(Alternate)

Shri Raju M
Shri Dinesh G M (Alternate)
Shri Vijeth R Gatty (YP)

Shri Philip Koshy
Shri Madhav Bhade
(Alternate)

Shri Manish Sahoo
Shri Narendra Malviya
(Alternate)

Shri R R Singh, Sc E & Head (TED)
[Representing Director General (*Ex-officio*)]

Member Secretary
Shri Sharad Kumar, Sc C (TED)