

Amendment 1 5 December 2014
To
AIS-089:2005
Approval of Rear Marking Plates for Heavy and Long Vehicles

1.0 Page 29/31, ANNEX 13, Clause 3,

Substitute following text for existing text.

3.0 NUMBER

3.1 One, two, or four.

3.2 Where rear marking plates conforming to this standard are installed these may be considered, at the discretion of the manufacturer, as part of the conspicuity marking to the rear as referred in clause 7.4 of Annex 7 of AIS-090, for the purposes of calculating the length of the conspicuity marking and its proximity to the side of the vehicle.

3.3 Where rear conspicuity markings conforming to AIS-090 is installed, the vehicle, except for trailers and semi-trailers of length exceeding 8m and vehicles conforming to clause 1.2.3 of Annex 7 of AIS-090, shall be deemed to have complied with the requirements of rear marking plates as per AIS-089.

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THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832, PUNE 411 004
ON BEHALF OF

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE
UNDER

CENTRAL MOTOR VEHICLES RULES - TECHNICAL STANDING COMMITTEE
SET-UP BY

MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

5 December 2014

Automotive Industry Standard

**Approval of Rear Marking Plates for
Heavy and Long Vehicles**

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MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

December 2005

Status chart of the standard to be used by the purchaser
for updating the record

Sr. No.	Corr-igenda	Amend-ment	Revision	Date	Remark	Misc.

General remarks:

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MoST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No.RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR -Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the Secretariat of the AIS Committee, has published this standard. For better dissemination of this information ARAI may publish this document on their Web site.

The standard purports to enhance visibility of vehicles, even in darkness. It will aid the trailing / following vehicles to judge the length of this vehicle and thus facilitate right decisions while overtaking.

Rain simulation test specified vide clause 1.4.3 in Annex-6 to be exempted during component approval till such time the test method and acceptance criteria are clarified.

While preparing this AIS considerable assistance is derived from ECE regulation 70, Amendment 3 (Supp. 3 to the 01 series of amendments- Date of entry into force: Sept.12, 2001) Uniform provisions concerning the Approval of Rear Marking Plates for Heavy and Long Vehicles

The Automotive Industry Standards Committee responsible for preparation of this standard is given in Annex: 14

Approval of Rear Marking Plates for Heavy and Long Vehicles

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Approval of Rear Marking Plates for Heavy and Long Vehicles

1. SCOPE

These provisions apply 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 applicability is as follows:

- 1.1 Category N2, with a maximum mass exceeding 7.5 tonnes and N3, with the exception of tractors for semi-trailers.
- 1.2 Category T1, T2 and T3 - Trailers and semi-trailers whose length exceed 8m (including the draw bar)
- 1.3 Category T4
- 1.4 Articulated buses

2. REFERENCES

- 2.1 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.
- 2.2 IS 14272 (Part-1) : Automotive Vehicles-Types- Terminology-Part 1 Three and Four Wheelers

3. DEFINITIONS

3.1 For the purpose of these provisions, the following definitions shall apply:

- 3.1.1 **"Rear marking plate"** a rectangular plate with a characteristic pattern faced with retro reflective and fluorescent materials or devices;
- 3.1.2 **"Sample unit"** a complete, finished marking plate ready to be mounted on a vehicle and representative of current production;

3.1.3 Class(es) of rear marking plates

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

3.2 "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:

3.2.1 **"Retro reflective material"** a surface or device from which, when directionally irradiated, a relatively large portion of the incident radiation is retro reflected;

3.2.2 **"Retro reflecting device"** an assembly ready for use and comprising one or more retro reflecting optical units;

3.3 Geometric definitions (See Annex 1, Figure 1 and 2)

3.3.1 **"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;

3.3.2 **"Illumination axis"** a line segment from the reference centre to the light source;

3.3.3 **"Observation axis"** a line segment from the reference centre to the photometer head;

3.3.4 **"Observation angle (symbol 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: $0 \leq \alpha \leq 180^\circ$;

3.3.5 **"Observation half-plane"** the half-plane which originates on the illumination axis and which contains the observation axis;

3.3.6 **"Reference axis"** a designated line segment originating on the reference centre which is used to describe the angular position of the retro reflector;

3.3.7 **"Entrance angle (symbol 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 ;

3.3.8 **"First axis"** an axis through the reference centre and perpendicular to the observation half-plane;

3.3.9 **"First component of the entrance angle (symbol β_1)"** the angle from the illumination axis to the plane containing the reference axis and the first axis. Range: $-180^\circ < \beta_1 \leq 180^\circ$;

- 3.3.10 **"Second component of the entrance angle (symbol β_2)"** the angle from the plane containing the observation half-plane to the reference axis.
Range: $-90^\circ \leq \beta_2 \leq 90^\circ$;
- 3.3.11 **"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 1, Figure 1;
- 3.3.12 **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 (e.g TOP), this marking governs the starting position. The angle of rotation ε lies in the range $-180^\circ < \varepsilon \leq 180^\circ$.

3.4 Definition of photometric terms

- 3.4.1 "Coefficient of retro-reflection R' " coefficient (R') obtained from the luminous intensity" (I) of the retro-reflective area in the direction of observation and the illuminance (E_\perp) on the retro-reflective plane at right angles the direction of the incident light and the illuminated plane sample surface A,

$$R' = I / (E_\perp * A)$$

The coefficient of retro-reflective R' is expressed in candle per square meter per lux ($\text{cd. m}^{-2} \cdot \text{lx}^{-1}$).

- 3.4.2 **"Angular diameter of the retro reflector sample (symbol 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;
- 3.4.3 **"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.

3.5 Fluorescence

When certain substances are brought near to a source of ultraviolet or blue radiations, they emit radiations, which are nearly always of longer wave-length than those producing the effect. This phenomenon is called fluorescence. 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.

3.6 Description of Goniometer

A goniometer which can be used in making retro reflection measurements in the CIE geometry is illustrated in Annex 1, Figure 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.

3.7 Definition of "type"

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

- 3.7.1 The trade name or mark;
- 3.7.2 The characteristics of the retro reflective material;
- 3.7.3 The characteristics of the fluorescent material;
- 3.7.4 The parts affecting the properties of the retro reflective material or devices.
- 3.7.5 Differences in the shape and dimensions of the rear marking shall not constitute a different type.

4. TECHNICAL INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

Sr. No.	Particulars
1.	Manufacturer's name and address
2.	Telephone No
3.	FAX. No.
4.	E mail address
5.	Contact person
6.	Plant/(s) Address(es) of manufacture.
7.	The intended function(s) of the device.
8.	Authenticated drawings, in duplicate, 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.
9.	A brief description giving the technical specifications of the materials of which the retro reflective areas and / or fluorescent areas are made;
10.	Samples of the retro reflective and of the fluorescent areas; the number of samples to be submitted is specified in Annex 2.

5. MARKINGS

- 5.1 Every plate submitted for approval shall bear:
 - 5.1.1 The trade name of the applicant and unique mark of type;

- 5.1.2 On the plates whose retro reflective system is not omni-rotational, the word "TOP" is inscribed horizontally on the part of the plates which is intended to be the highest part of the plate when mounted on the vehicle.
- 5.2 The markings shall be applied on either the retro reflective or the fluorescent area of the plate, or on the edge, and must be visible from the outside when the marking plate is fitted on the vehicle.
- 5.3 The markings shall be clearly legible and shall be indelible.

6. Clause reserved

7. GENERAL SPECIFICATIONS

- 7.1 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.
- 7.2 The components of retro-reflective/fluorescent or retro reflective only marking plates shall not be capable of being easily dismantled.
- 7.3 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
- 7.4 The outer surface of the retro reflective/ fluorescent or retro-reflective only marking plate(s) shall be easy to clean. The surface shall therefore not be rough and any protuberances it may exhibit shall not prevent easy cleaning.

8. SPECIAL SPECIFICATIONS (TESTS)

- 8.1 Rear marking plate(s) shall also satisfy the conditions as to shape and stripe slope and the colorimetric, photometric, physical and mechanical requirements set forth in Annexes 3 to 10 to this standard.
- 8.2 Guidelines for installation of rear marking plates on heavy and long vehicles shall be as per Annex 13

9. MODIFICATIONS AND EXTENSION OF APPROVAL OF REAR MARKING PLATES FOR HEAVY AND LONG VEHICLES

- 9.1 Every modification pertaining to the information, even if the changes are non-technical in nature declared in accordance to para 4 above, shall be intimated to the test agency by the manufacturer.
- 9.2 If the changes are in parameters not related to the provisions, no further action needs to be taken

- 9.3 If the changes are in parameters related to the provisions, the testing agency, which has issued the certificate of compliance, may then consider, whether:
 - 9.3.1 The type or model with the changed specification still complies with the provisions,
 - or
 - 9.3.2 Any further verification is required to establish compliance
- 9.4 For deciding whether testing is required or not: - till details are finalized, this will be as agreed between the test agency and the manufacturer.
- 9.5 In case of 9.3.2, only tests pertaining to the affected specification shall be performed.
- 9.6 In case of fulfillment of criterion as per 9.3, the approval of compliance shall be extended for the changes carried out.

10. CONFORMITY OF PRODUCTION

The conformity of production procedures shall comply with those set out in the AIS-037 with following requirements;

- 10.1 Rear marking plate approved to this standard shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraphs 7 and 8 above.
- 10.2 The minimum requirements for conformity of production control procedures set forth in Annex 11 to this standard shall be complied with.
- 10.3 The minimum requirements for sampling by an inspector set forth in Annex 12 to this standard shall be complied with.
- 10.4 The test agency may at any time verify the conformity control methods applied in each production facility as detailed in AIS-037. The normal frequency of these verification shall be as per AIS-037 or as decided by CMVR-TSC.

ANNEX 1
(See 3.3)

THE CIE CO-ORDINATE SYSTEM

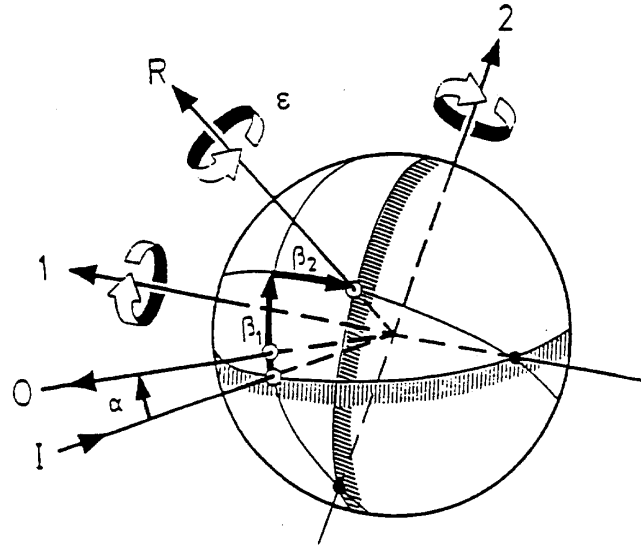


Figure 1

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

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: (a) The principle fixed axis is the illumination axis.
 (b) The first axis is fixed perpendicular to the plane containing the observation and illumination axis.
 (c) The reference axis is fixed in the retro-reflectors and moveable with β_1 and β_2 .

GONIOMETER MECHANISM EMBODYING THE CIE ANGULAR SYSTEM

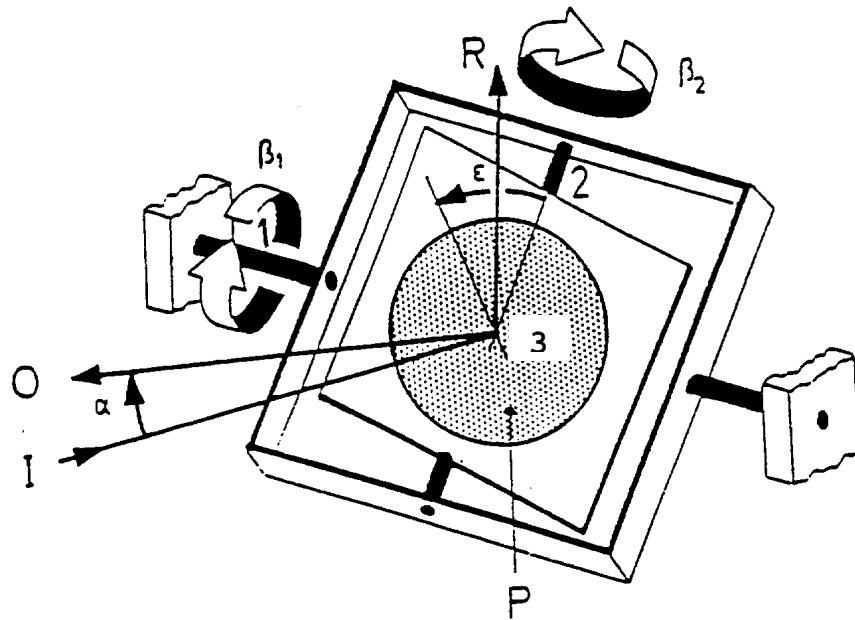


Figure 2

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

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 2
(See 4.11)

TEST PROCEDURE

TEST SAMPLES

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.
2. 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.
3. After verification of the general specifications (paragraph 7 of the standard) and the specifications of shape and dimensions (Annex 3) the samples shall be subjected to the heat resistance test described in Annex 7 to this standard, prior to the tests described in Annexes 4, 5 and 6.
4. The photometric and colorimetric measurements may be made on the same sample.
5. For the other tests, samples which have not undergone any testing should be used.

ANNEX 3
(See 8)

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

1. **Shape:** The plates shall be rectangular in shape for mounting at the rear of vehicles.
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.
3. **Dimensions:** The minimum 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, the maximum total length shall be 2,300 mm.
 - 3.1 The width of a rear marking plate shall be:

For trucks and tractors: 140 ± 10 mm.

For trailers and semi-trailers: 200 mm.
 - 3.2 The length of the each rear marking plates in a set consisting of two plates for trucks and tractors, as illustrated in figures 1(b) and 1(c) of Annex. 10 may be reduced to a minimum of 140 mm, provided that the width is increased such that the area of each marking is at least 735 cm^2 , does not exceed 1725 cm^2 and the marking plates are rectangular.
 - 3.3 The width of the red fluorescent border of the rear marking plates for trailers and semi-trailers shall be $40 \text{ mm} \pm 1 \text{ mm}$.
 - 3.4 The slope of the oblique stripes of the chevron band shall be $45^\circ \pm 5^\circ$. The width of the stripes shall be $100 \text{ mm} \pm 2.5 \text{ mm}$.

Prescribed shapes, patterns and dimensional features are illustrated in figures 1 and 2 of Annex 10 to this standard.
 - 3.5 Rear marking plates supplied in sets shall form matching pairs.

ANNEX 4
(See 8)

COLORIMETRIC SPECIFICATIONS

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.
2. **Yellow or red retro reflective material**
 - 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 area defined by the chromaticity co-ordinates in Table 1 and comply with the luminance factor.

Table 1
Chromaticity Co-ordinates x and y

Colour		1	2	3	4	Luminance factor β
Yellow	x	0.545	0.487	0.427	0.465	≥ 0.16
	y	0.454	0.423	0.483	0.534	
Red	x	0.690	0.595	0.569	0.655	≥ 0.03
	y	0.310	0.315	0.341	0.345	

- 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 area defined by the chromaticity co-ordinates in Table 2:

Table 2
Chromaticity Co-ordinates

Colour	1	2	3	4	Luminance factor β
x	0.545	0.487	0.427	0.465	≥ 0.16
Yellow y	0.454	0.423	0.483	0.534	
x	0.690	0.595	0.569	0.655	≥ 0.03
Red y	0.310	0.315	0.341	0.345	

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.

3. Red fluorescent material

- 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 located within the area defined by the chromaticity co-ordinates in Table 3 and comply with the luminance factor.

Table 3
Chromaticity Co-ordinates

Colour	1	2	3	4	luminance factor β
X	0.690	0.595	0.569	0.655	≥ 0.30
Red Y	0.310	0.315	0.341	0.345	

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 5
(See 8)

PHOTOMETRIC SPECIFICATIONS

1. Photometric properties
 - 1.1 When illuminated with a CIE standard d Illuminant A and measured as recommended by CIE TC 2.3 (CIE Publication No. 54, 1982), the coefficient of retro reflection R' in candelas per lux per square metre of the yellow retro reflective area in new condition shall be at least as indicated in Table 1 or 2, according to the class. Devices of Class 1 and Class 2 shall fulfil the values in Table1, devices of Class 3 and Class 4 those in Table 2.

Table 1
Coefficient of Retro-reflection R' (cd.m⁻².lx⁻¹)

Observation angle α (')	Entrance Angle β (°)				
	β_1	0°	0°	0°	0°
20'	β_2	5°	30°	40°	60°
	Coefficient R' (cd.m ⁻² . lx ⁻¹)	Colour yellow	300	180	75

Table 2
Coefficient of Retro-reflection R' (cd.m⁻².lx⁻¹)

Observation angle α (')	Entrance Angle β (°)				
	β_1	0°	0°	0°	0°
20'	β_2	5°	30°	40°	60°
	Coefficient R' (cd . m ⁻² . lx ⁻¹)	Colour			
Yellow		300	180	75	10
Red		10	7	4	--

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

1.3 Luminance factor

The Luminance factor β shall be at least as indicated in Table 3

Table 3
Luminance factor β

Color	Luminance factor β
Red	≥ 0.03
Yellow	≥ 0.16

ANNEX 6
(See 8)

RESISTANCE TO EXTERNAL AGENTS

1. Resistance to weathering

- 1.1 Procedure - For each test, two specimens of a sample unit (see paragraph 3.1.2 of this standard) 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 ISO/Standard 105 - B02 - 1978, Section 4.3.1; 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 paragraphs 1.2 to 1.4.

- 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 per cent in any linear direction and no evidence of adhesion failure such as edge lifting from the substrate.

- 1.3 Colour fastness - The colours of the exposed specimens shall still meet the requirements in Annex 4, Tables 1, 2 and 3.

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

- 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 5.

- 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 5, Table 1.

- 1.4.3 The specimen shall then be subjected to simulated rainfall and its coefficient of retro reflection under this condition shall be not less than 90 per cent of the value obtained when measured in dry condition, as explained in paragraph 1.4.2 above.

2. Resistance to corrosion

- 2.1 A specimen of the sample unit shall be subjected to the action of a saline mist for 48 hours comprising 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 $35^{\circ} \pm 2^{\circ}\text{C}$ 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.

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

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 in paragraph 1 of annex 5, at an entrance angle of 5° and an observation angle of 20', shall be not less than the value in Annex 5, Table 1. Before measuring, the surface shall be cleaned to remove salt deposits from the saline mist.

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 per cent and 30 per cent 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.

4. Bonding strength (in the case of adhesive materials)

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

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

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

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 $23^{\circ} \pm 5^{\circ}$ 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 deterioration, which would reduce the effectiveness of the plate.

6. Resistance to impact (except 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 $23^{\circ} \pm 2^{\circ}$ C, the material shall show no cracking or separation from the substrate at a distance of more than 5 mm from the impacted area.

7. Cleaning

A test example 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.

ANNEX 7
(See 8)

RESISTANCE TO HEAT

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 this time shall be 48 hours) in a dry atmosphere at a temperature of $65^{\circ} \pm 2^{\circ}\text{C}$, 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 $-20^{\circ} \pm 2^{\circ}\text{C}$.
- 1.1 The sample shall be examined after a recovery time of 4 hours under normal laboratory conditions.
2. After this test, no cracking or appreciable distortion of the surfaces, particularly of the optical units, shall be evident.

ANNEX 8

(See 8)

RIGIDITY OF THE PLATES

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.
2. When tested as described in paragraph 1 above, the maximum deflection of the plate under the test load shall not exceed one fortieth of the distance between the supports in paragraph 1 and the residual deflection after removal of the load shall not exceed one fifth of the measured deflection under load.

ANNEX 9

(Annex reserved)

ANNEX 10
 (See Annex 3, cl. 3.4)

REAR MARKING PLATES FOR TRUCKS AND TRACTORS
 (Class1 and Class 3)

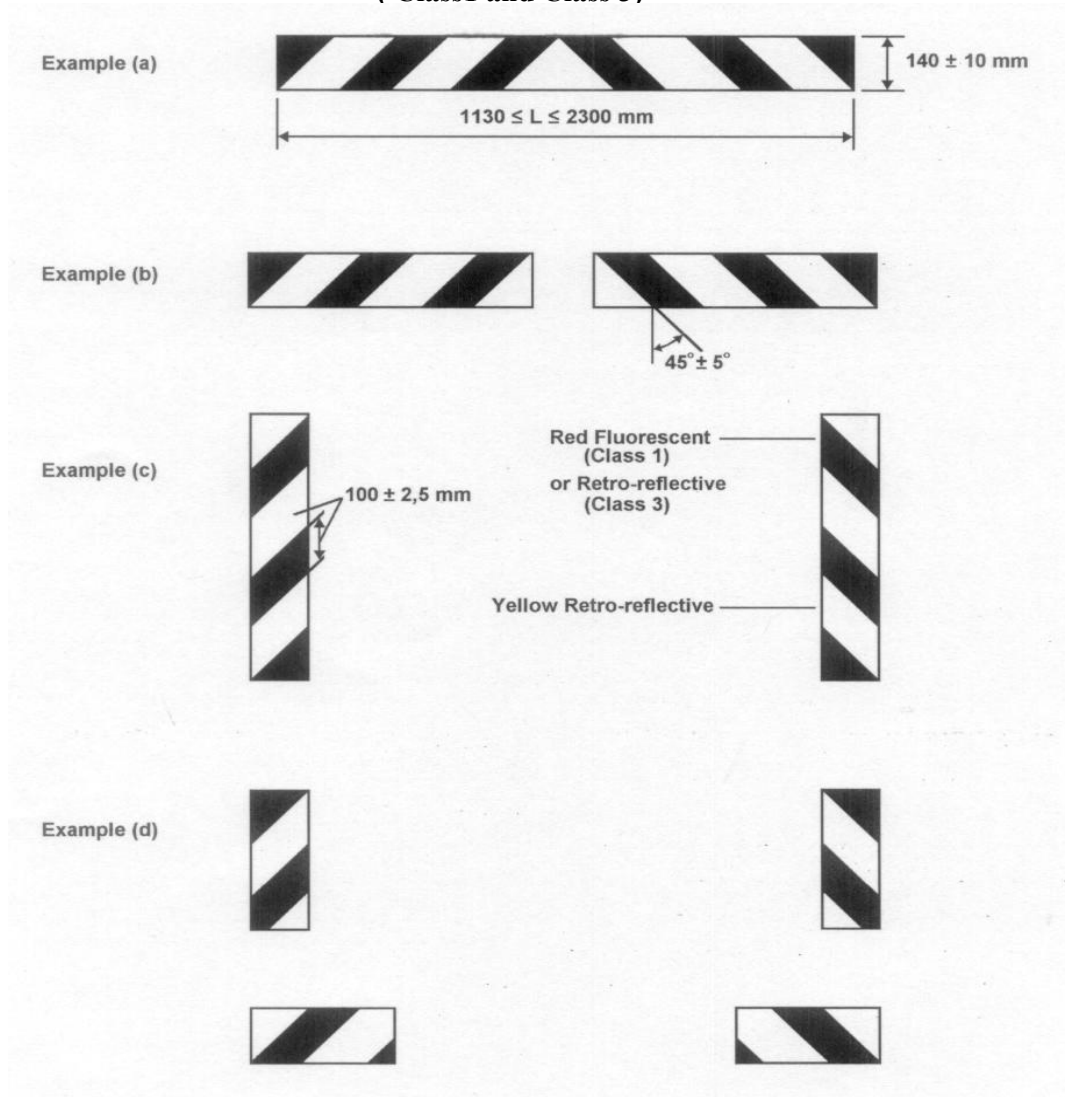


Figure 1

**REAR MARKING PLATES FOR TRAILERS AND SEMI-TRAILERS
(Class 2 and Class 4)**

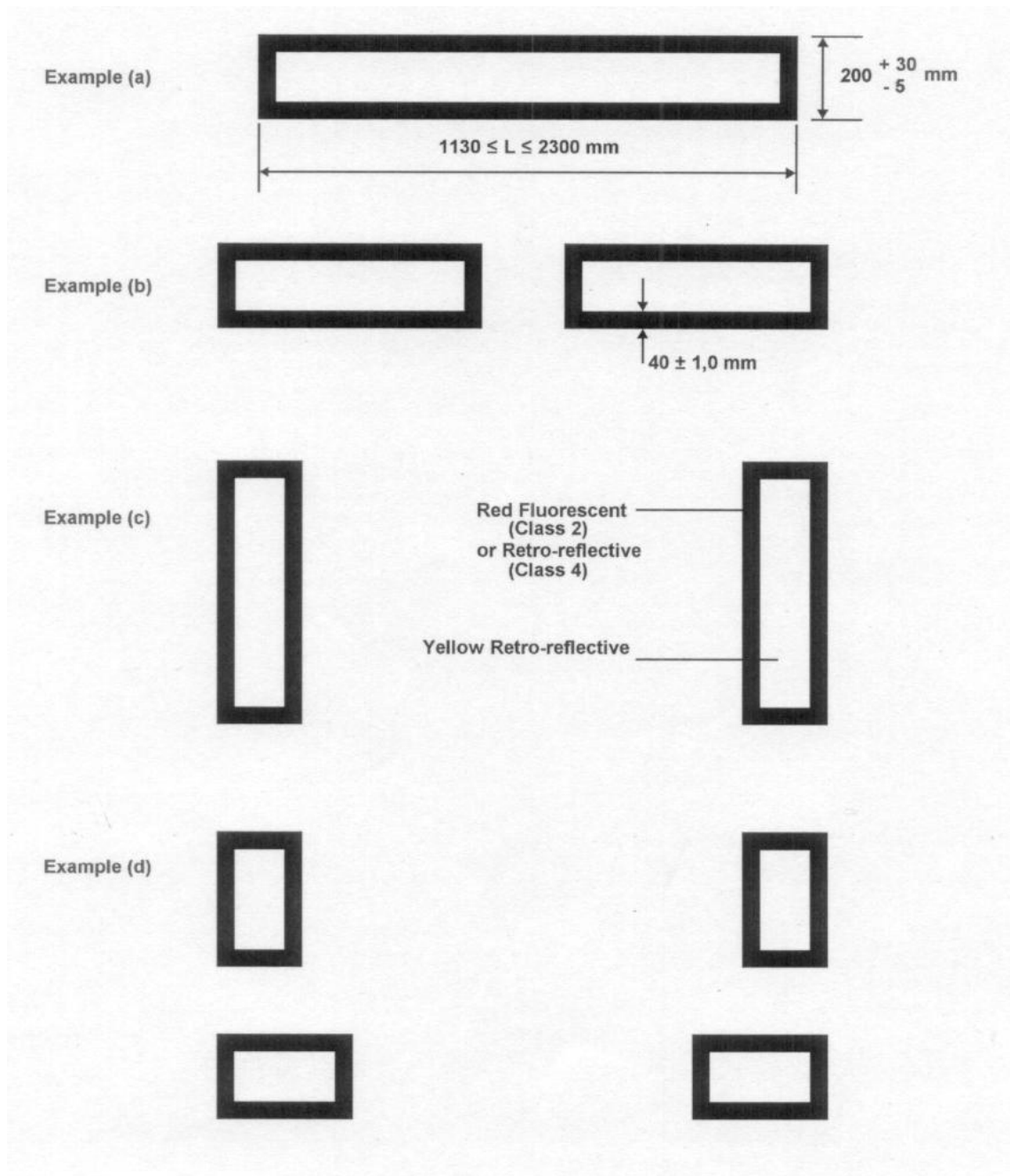


Figure 2

ANNEX 11

(See 10)

**MINIMUM REQUIREMENTS FOR CONFORMITY OF
PRODUCTION CONTROL PROCEDURES****1. GENERAL**

- 1.1. The conformity requirements shall be considered satisfied from a mechanical and geometric standpoint, if the differences do not exceed inevitable manufacturing deviations within the requirements of this standard.
- 1.2. With respect to photometric performances, the conformity of mass-produced rear marking plates shall not be contested if, when testing photometric performances of any rear marking plate chosen at random, no measured value deviates unfavourably by more than 20% from the values prescribed in this standard.
- 1.3. The chromaticity coordinates shall be complied with.

**2. MINIMUM REQUIREMENTS FOR VERIFICATION OF
CONFORMITY BY THE MANUFACTURER**

For each type of rear marking plate the holder of the approval mark shall carry out at least at the following tests, at appropriate intervals. The tests shall be carried out in accordance with the provisions of this standard.

If any sampling shows non-conformity with regard to the type of test concerned, further samples shall be taken and tested. The manufacturer shall take steps to ensure the conformity of the production concerned.

2.1. Nature of Tests

Tests of conformity in this standard shall cover the photometric and colorimetric characteristics and the test of weather resistance of these characteristics.

2.2. Methods Used in Tests

- 2.2.1. Tests shall generally be carried out in accordance with the methods set out in this standard.
- 2.2.2. In any test of conformity carried out by the manufacturer, equivalent methods may be used with the consent of the competent authority responsible for approval tests. The manufacturer is responsible for proving that the applied methods are equivalent to those laid down in this standard.
- 2.2.3. The application of paragraphs 2.2.1. and 2.2.2. requires regular calibration of test apparatus and its correlation with measurements made by a competent authority.

- 2.2.4. In all cases the reference methods shall be those of this standard, particularly for the purpose of administrative verification and sampling.

2.3. Nature of Sampling

Samples of rear marking plates shall be selected at random from the production of a uniform batch. A uniform batch means a set of rear marking plates of the same type, defined according to the production methods of the manufacturer.

The assessment shall in general cover series production from individual factories. However, a manufacturer may group together records concerning the same type from several factories, provided these operate under the same quality system and quality management.

2.4. Measured and Recorded Photometric Characteristics

The sampled rear marking plate shall be subjected to photometric measurements at the points and chromaticity coordinates provided for in the standard.

2.5. Criteria Governing Acceptability

The manufacturer is responsible for carrying out a statistical study of the test results and for defining, in agreement with the competent authority, criteria governing the acceptability of his products in order to meet the specifications laid down for verification of conformity of products in paragraph 10.1 of this standard.

The criteria governing the acceptability shall be such that, with a confidence level of 95%, the minimum probability of passing a spot check in accordance with Annex 12 (first sampling) would be 0.95.

ANNEX 12
(See 10.)

MINIMUM REQUIREMENTS FOR SAMPLING BY AN INSPECTOR

1. GENERAL

- 1.1. The conformity requirements shall be considered satisfied from a mechanical and a geometric standpoint, in accordance with the requirements of this standard, if any, if the differences do not exceed inevitable manufacturing deviations.
- 1.2. With respect to photometric performance, the conformity of mass-produced rear marking plates shall not be contested if, when testing photometric performances of any rear marking plate chosen at random:
 - 1.2.1. No measured value deviates unfavourably by more than 20% from the values prescribed in this standard.
 - 1.2.2. Rear marking plates with apparent defects are disregarded.
- 1.3. The chromaticity coordinates shall be complied with.

2. FIRST SAMPLING

In the first sampling four rear marking plates are selected at random. The first sample of two is marked A, the second sample of two is marked B.

2.1. The Conformity is not Contested

- 2.1.1. Following the sampling procedure shown in Figure 1 of this Annex the conformity of mass-produced rear marking plates shall not be contested if the deviation of the measured values of the rear marking plates in the unfavourable directions are:

2.1.1.1. Sample A

A1:	one rear marking plate	0%
	one rear marking plate not more than	20%
A2:	both rear marking plates more than	0%
	but not more than	20%
	go to Sample B	

2.1.1.2. Sample B

B1:	both rear marking plates	0%
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2.2. The Conformity is Contested

- 2.2.1. Following the sampling procedure shown in Figure 1 of this Annex the conformity of mass-produced rear marking plates shall be contested and the manufacturer requested to make his production meet the requirements (alignment) if the deviations of the measured values of the rear marking plates are:

2.2.1.1. Sample A

A3:	one rear marking plate not more than	20%
	one rear marking plate more than	20%
	but not more than	30%

2.2.1.2. Sample B

B2:	in the case of A2	
	one rear marking plate more than	0%
	but not more than	20%
	one rear marking plate not more than	20%
B3:	in the case of A2	
	one rear marking plate	0%
	one rear marking plate more than	20%
	but not more than	30%

2.3. **Approval Withdrawn**

Conformity shall be contested and paragraph 10 applied if, following the sampling procedure in Figure 1 of this Annex, the deviations of the measured values of the rear marking plates are:

2.3.1. Sample A

A4:	one rear marking plate not more than	20%
	one rear marking plate more than	30%
A5:	both rear marking plates more than	0%

2.3.2. Sample B

B4:	in the case of A2	
	one rear marking plate more than	0%
	but not more than	20%
	one rear marking plate more than	20%
B5:	in the case of A2	
	both rear marking plates more than	20%
B6:	in the case of A2	
	one rear marking plate	0%
	one rear marking plate more than	30%

3. **REPEATED SAMPLING**

In the cases of A3, B2, B3 a repeated sampling, third Sample C of two rear marking plates and fourth Sample D of two rear marking plates, selected from stock manufactured after alignment, is necessary within two months time after the notification.

3.1. The Conformity is not Contested

3.1.1. Following the sampling procedure shown in Figure 1 of this Annex the conformity of mass-produced rear marking plates shall not be contested if the deviations of the measured values of the rear marking plates are:

3.1.1.1. Sample C

C1:	one rear marking plate	0%
	one rear marking plate not more than	20%
C2:	both rear marking plates more than	0%
	but not more than	20%
	go to Sample D	

3.1.1.2. Sample D

D1:	in the case of C2	
	both rear marking plates	0%

3.2. The Conformity is Contested

3.2.1. Following the sampling procedure shown in Figure 1 of this Annex the conformity of mass-produced rear marking plates shall be contested and the manufacturer requested to make his production meet the requirements (alignment) if the deviations of the measured values of the rear marking plates are:

3.2.1.1. Sample D

D2:	in the case of C2	
	one rear marking plate more than	0%
	but not more than	20%
	one rear marking plate not more than	20%

3.3. Approval Withdrawn

Conformity shall be contested and paragraph 10 applied if, following the sampling procedure in Figure 1 of this Annex, the deviations of the measured values of the rear marking plates are:

3.3.1. Sample C

C3:	one rear marking plate not more than	20%
	one rear marking plate more than	20%
C4:	both rear marking plates more than	20%

3.3.2. Sample D

D3:	in the case of C2	
	one rear marking plate 0 or more than	0%
	one rear marking plate more than	20%

4. RESISTANCE TESTS

Specimens of one of the rear marking plates of Sample A, after sampling procedure in Figure 1 of this Annex, shall be tested according to the procedures described in Annexes 6 and 7 to this standard. The rear marking plate shall be considered acceptable if the tests were passed.

However, if the tests on specimens of Sample A did not pass the tests, the two rear marking plates of Sample B shall be subjected to the same procedure and both shall pass the test.

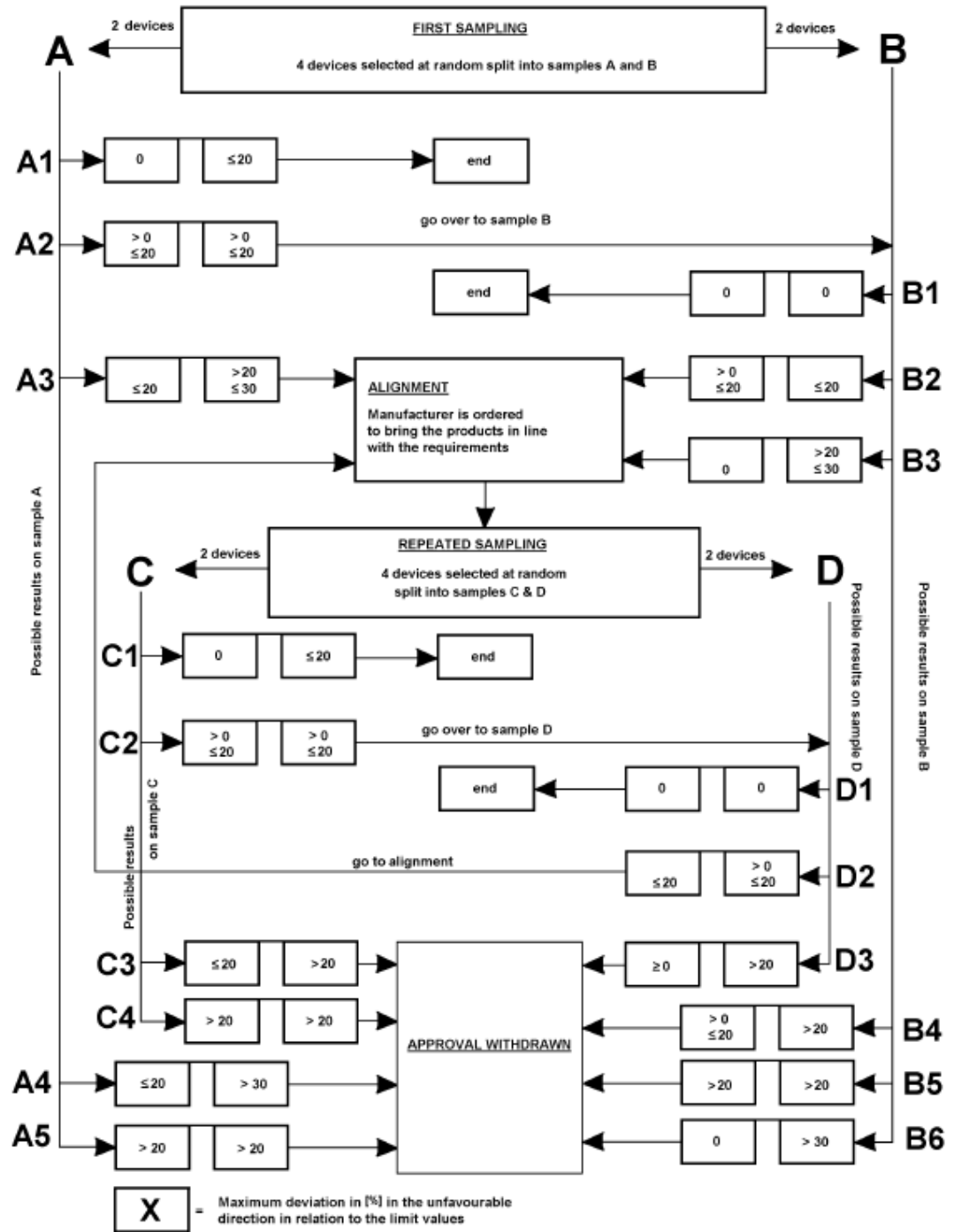


Figure 1

ANNEX 13
(See 8.2)

**GUIDELINES FOR INSTALLATION OF REAR MARKING PLATES
ON HEAVY AND LONG VEHICLES**

1. It is recommended to apply on vehicles specified in paragraph 2 of this Annex "Rear marking plates for heavy and long vehicles" conforming to this standard and the specific requirements relating to its scope in accordance with the guidelines given in this Annex.

2. **SCOPE**

The main purpose of these guidelines is to establish requirements for installation, arrangement, position and geometric visibility of rear marking plates on heavy and long vehicles. It increases the visibility and permits an easy identification of these vehicles.

2.1. **Heavy Motor Vehicles**

The installation of rear marking plates for heavy motor vehicles according to the provisions of this Annex is required for vehicles of Category N2, with a maximum mass exceeding 7.5 tonnes and N3, with the exception of tractors for semi-trailers and for articulated buses

2.2. **Long Vehicles**

The installation of rear marking plates for long vehicles, according to the provisions of this Annex, is required for the following vehicles:

Categories T1, T2, T3 – trailers/semi-trailers exceeding 8 m in length (including the drawbar)

All vehicles of Category T4

3. **NUMBER**

One, two, or four.

4. **ARRANGEMENT –**

Every rear marking shall be fitted such that the lower edge is horizontal. Every part of a rear marking shall lie within 5° of a transverse vertical plane at right angles to the longitudinal axis of the vehicle and shall face to the rear. The set of marking plates shall be arranged symmetrically with respect to the median longitudinal plane of the vehicle.

The rear marking plates shall be type approved and meet the requirements of this standard with the following classification:

(a) For heavy vehicles:

Class 1	: alternate, oblique stripes of red fluorescent and yellow retro-reflective materials;
Class 3	: alternate, oblique stripes of red retro-reflective and yellow retro-reflective materials.

(b) For long vehicles:

Class 2	: yellow retro-reflective centre with a red fluorescent border;
Class 4	: yellow retro-reflective centre with a red retro-reflective border.

5. POSITION

In width: No individual specifications

In height: Above the ground, not less than 250 mm (lower edge),
nor more than 2,100 mm (upper edge).

6. GEOMETRIC VISIBILITY

Horizontal angle: 30° inwards and outwards

Vertical angle : 15° above and below the horizontal

Orientation : rearwards.

ANNEX 14
(See Introduction)
COMMITTEE COMPOSITION *
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* At the time of approval of this Automotive Industry Standard (AIS)