

AMENDMENT NO. 1
TO
AIS-057
Performance Requirements for Retro-Reflecting Devices for Power-Driven
Vehicles and their Trailers

1. Page No. 26/27, Annex F, cl. F1.3:

Substitute following text for the existing text of entire clause F 1.3:

F1.3 After undergoing the test, the retro- reflector shall have:

F1.3.1 The colour requirements as specified in 16.9.1

F1.3.2 A CIL which satisfy the condition specified in 7.3 and 7.4 as applicable when tested as per 7.9, which after the test, reaches at least 60% of the value previously obtained with the same sample.

2. Page No. 26/27, Annex F, cl. F 2.3:

Substitute following text for the existing text of entire clause F 2.3:

F2.3 After undergoing the test, the retro- reflector shall have:

F2.3.1 The colour requirements as specified in 16.9.1

F2.3.2 A CIL which satisfy the condition specified in 7.3 and 7.4 as applicable when tested as per 7.9, which after the test, reaches at least 60% of the value previously obtained with the same sample.

3. Page No. 26/27, Annex F, cl. F 3.3:

Substitute following text for the existing text of entire clause F 3.3:

F3.3 After undergoing the test, the retro- reflector shall have:

F3.3.1 The colour requirements as specified in 16.9.1

F3.3.2 A CIL which satisfy the condition specified in 7.3 and 7.4 as applicable when tested as per 7.9, which after the test, reaches at least 60% of the value previously obtained with the same sample.

PRINTED BY:
THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832. PUNE 411 004

ON BEHALF OF:
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

July 2005

AUTOMOTIVE INDUSTRY STANDARD

**Performance Requirements for
Retro-Reflecting Devices for
Power-Driven Vehicles
and their Trailers**

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March 2005

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

Sr. No.	Corri-genda.	Amend-ment	Revision	Date	Remark	Misc.

General Remarks :

INTRODUCTION

- 0.** 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 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.
- 1.0** This standard has been prepared for implementation of the mandatory requirements regarding performance requirements for retro-reflecting devices for power-driven vehicles and their trailers covered by the following standard:
- AIS-008/2001: Installation requirements of lighting and light-signalling devices for motor vehicle having more than three wheels, trailer and semi-trailer excluding agricultural tractor and special purpose vehicle
 - AIS-009/2001: Installation requirements of lighting and light signalling devices for 2 and 3 wheelers, their trailers and semi-trailers
 - AIS-030/2001: Installation requirements for lighting and light-signalling devices for agricultural tractor.
- 2.0** IS:8339-1993 regarding performance requirement of Reflex Reflectors (Retro-Reflecting Devices) has been in force under CMVR
- 3.0** This standard has been aligned with ECE regulation 3 as last amended upto December 2002. However, to take into account progressive changes in the colour coordinates in ECE regulations, alternative compliance to the coordinates for amber and red are permitted.
- 4.0** While formulating this standard in line with ECE-R-3, the CMVR-TSC had decided to incorporate some additional tests related to vibration and environmental performance. These have been included in this standard.

5.0 For preparation of this standard, considerable assistance has taken from the following national/international standards:

ECE-R-3 Uniform provisions concerning the approval of retro-
Rev.2-Amend.2 reflecting devices for power-driven vehicles and their trailers
(Supp.6 to 02
Series Amd.

IS:8339-1993 Automotive vehicles- reflex-reflectors- specification

6.0 The Automotive Industry Standards Committee responsible for preparation of this standard is given in Annex G.

Performance Requirements for Retro-Reflecting Devices for Power-Driven Vehicles and their Trailers

1.0 SCOPE

This standard lays down the performance requirements of retro-reflecting devices used on motor vehicles.

2.0 REFERENCES

- | | | |
|------|---|---|
| (1) | IS 9435: 1980 | Terms and definitions relating to dimensions of road vehicles |
| (2) | AIS-008/2001 | Installation requirements of lighting and light - signalling devices for motor vehicle having more than three wheels, trailer and semi-trailer excluding agricultural tractor and special purpose vehicle |
| (3) | AIS-009/2001 | Installation requirements of lighting and light-signalling devices for 2 and 3 wheelers, their trailers and semi-trailers. |
| (4) | AIS – 030/ 2001 | Installation Requirements of lighting and light-signalling devices for agricultural tractors |
| (5) | AIS-010 | Performance requirements of lighting and light-signalling devices for 2 and 3 wheeled motor vehicles, their trailers and semi-trailers and vehicles treated as such |
| (6) | AIS-012 | Performance requirements of lighting and light-sgnalling devices for motor vehicle having more than three wheels, trailer and semi-trailer |
| (7) | IS 269:1989 | Ordinary portland cement, 33 grade - specification. |
| (8) | ASTM C
150-84. | Standard specification for portland cement |
| (9) | IS 9000 (part 8):
1981 | Basic environmental testing procedures for electronic and electrical items: Vibration (sinusoidal) test. |
| (10) | IS 9000: (part 2
Sec. 1 to 4):
1977 | Basic environmental testing procedures for electronic and electrical items: Cold test |
| (11) | IS 10250: 1982 | Specification for severities for environmental tests for automotive electrical equipment |

3.0 DEFINITIONS

The definitions given in AIS 008 and AIS 009 shall be applicable to this standard also. The additional terms are defined below.

- 3.1 “Retro-Reflection”** means the reflection in which light is reflected in directions close to the direction from which it came. This property is maintained over wide variations of the illumination angle.

- 3.2 “**Retro-Reflecting Optical Unit**” means a combination of optical components producing retro-reflection.
- 3.3 “**Retro-Reflecting Device, also called Retro-Reflector**” means an assembly ready for use and comprising one or more retro-reflecting optical units.
- 3.4 “**Illuminating Surface of a Retro-Reflecting Device,**” also called “**light emitting surface**” means the total visible surface of the retro-reflecting optical units, which appears continuous at the normal observation distances.
- 3.5 “**Axis of Reference**” means the axis to be defined by the manufacturer of the retro-reflecting device, which serves as reference line for the illumination angles in photometric measurements and in practical use. The axis of reference usually corresponds to the axis of symmetry, if any, of the illuminating surface.
- 3.6 “**Centre of Reference**” means the intersection of the axis of reference with illuminating surface. It is specified by the manufacturer of the retro-reflecting devices.
- 3.7 “**Angle of Divergence**” means the angle between the straight lines connecting the centre of reference to the centre of the receiver and to the centre of the source of illumination.
- 3.8 “**Illumination Angle**” means the angle between the axis of reference and the straight line connecting the centre of reference to the centre of the source of illumination.
- 3.9 “**Angle of Rotation**” means the angle through which the retro-reflecting device is rotated about its axis of reference starting from one given position.
- 3.10 “**Angular Diameter of the Retro-Reflecting Device**” means the angle subtended by the greatest dimension of the visible area of the illuminating surface, either at the centre of the source of illumination or at the centre of the receiver.
- 3.11 “**Illumination of the Retro-Reflecting Device**” is the abbreviated expression used conventionally to designate the illumination measured in a plane perpendicular to the incident rays and passing through the centre of reference.
- 3.12 “**Coefficient of Luminous Intensity (CIL)**” means the quotient of the luminous intensity reflected in the direction considered, divided by the illumination of the retro-reflecting device for given angles of illumination, divergence and rotation.
- 3.13 The symbols and units used in this standard are given in **Annex A**.
- 3.14 A type of “**Retro-Reflecting Device**” is defined by the models and descriptive literature submitted with the application for approval. Retro-reflecting devices can be considered as belonging to the same type if they have one or more “retro-reflecting optical units” which are identical with those of the standard model, or if not identical are symmetrical and suitable for mounting one on the left and one on the right side of the vehicle, and if their other parts differ from those of the standard model only in ways not affecting the properties to which this standard applies.

3.15 Retro-reflecting devices are divided into three classes according to their photometric characteristics: Class I A or Class I B, Class III A and Class IV A. (See **Tables 1 and 2**)

3.16 “**Retro-reflecting devices of Class IB**” are devices combined with other signal lamps which are not watertight according to **9.1** and which are integrated into the body of a vehicle.

4.0 GENERAL SPECIFICATIONS

4.1. Retro-reflecting devices 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.

4.2. The components of retro-reflecting devices shall not be capable of being easily dismantled.

4.3. Retro-reflecting optical units may not be replaceable.

4.4. The outer surface of retro-reflecting devices shall be easy to clean. Hence it shall not be a rough surface; any protuberances it may exhibit shall not prevent easy cleaning.

4.5. For devices of Class IV A, their means of fixation shall be such that they allow a stable and durable connection between the device and the vehicle.

4.6 There shall be no access to the inner surface of the retro-reflectors when in normal use.

4.7 Requirements of **4.1, 4.4** and **4.6** are deemed to be satisfied, if the device passes the relevant tests as prescribed in this standard.

5.0 SPECIAL SPECIFICATIONS (TESTS)

5.1 The retro-reflecting devices shall satisfy the following requirements:

- 5.1.1 Shape and dimensions Refer **6**
- 5.1.2 Photometric requirements Refer **7**
- 5.1.3 Colourimetric requirements Refer **8**
- 5.1.4 Resistance to water and dirt penetration Refer **9**
- 5.1.5 Resistance to corrosion Refer **10**
- 5.1.6 Resistance to fuels Refer **11**
- 5.1.7 Resistance to lubricating oils Refer **12**
- 5.1.8 Resistance of the accessible rear face of mirror-backed retro-reflecting devices Refer **13**
- 5.1.9 Resistance to heat Refer **14**
- 5.1.10 Resistance to impact (applicable only for Class IVA) Refer **15**
- 5.1.11 Additional tests: Tests for vibration, cold and damp heat. Refer **Annex F**

- 5.2** Depending on the nature of the materials of which the retro-reflecting devices and, in particular, their optical units, are made, the test agency may omit certain unnecessary tests, subject to the express reservation that such omission shall be mentioned under "Remarks" on the test report. Such test reports shall be deemed to establish compliance to this standard.

6.0 SHAPE AND DIMENSIONS

6.1 Retro-reflectors of Class IA, IB and IVA

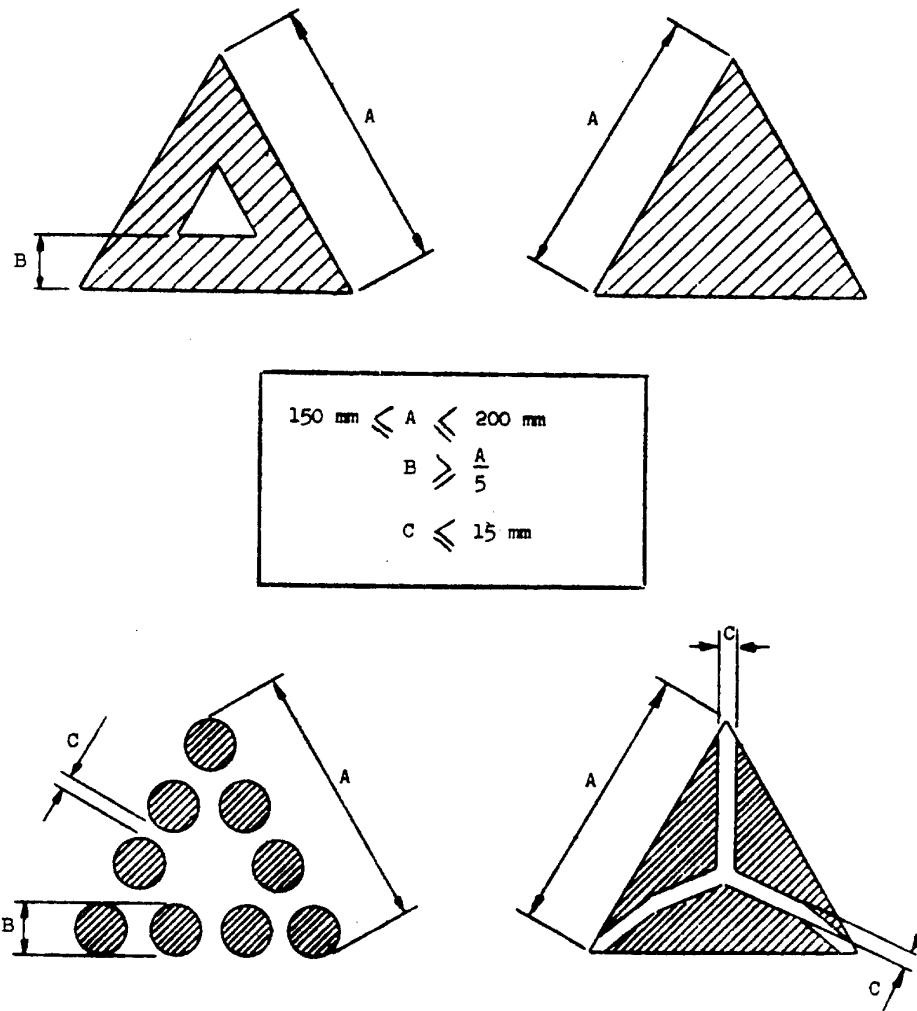
- 6.1.1 The shape of the illuminating surfaces shall be simple, and not easily confused at normal observation distances, with a letter, a digit or a triangle.
- 6.1.2 The preceding paragraph notwithstanding, a shape resembling the letters or digits of simple form O, I, U or 8 is permissible.
- 6.1.3 In the case of retro-reflectors of class IVA, the light emitting surface of the retro-reflecting device shall be at least 25 cm².

6.2 Retro-reflectors of Class IIIA

- 6.2.1 The illuminating surfaces of retro-reflecting devices in Class III A shall have the shape of an equilateral triangle. If the word "TOP" is inscribed in one corner, the apex of that corner shall be directed upwards.
- 6.2.2 The illuminating surface may or may not have at its centre a triangular, non-retro-reflecting area, with sides parallel to those of the outer triangle.
- 6.2.3 The illuminating surface may or may not be continuous. In any case, the shortest distance between two adjacent retro-reflecting optical units shall not exceed 15 mm.
- 6.2.4 The illuminating surface of a retro-reflecting device shall be considered to be continuous if the edges of the illuminating surfaces of adjacent separate optical units are parallel and if the said optical units are evenly distributed over the whole solid surface of the triangle.
- 6.2.5 If the illuminating surface is not continuous, the number of separate retro-reflecting optical units including the corner units shall not be less than four on each side of the triangle.
- 6.2.5.1 The separate retro-reflecting optical units shall not be replaceable unless they consist of approved retro-reflecting devices in Class I A.

6.2.6 The outside edges of the illuminating surfaces of triangular retro-reflecting devices in Class III A shall be as per **Figure 1**.

Figure 1 (See 6.2.6)
RETRO-REFLECTORS FOR TRAILERS - CLASS III A



Note : These sketches are for illustration purposes only

6.3 Compliance with the specifications of **6.1** and **6.2** shall be verified by visual inspection.

7.0 PHOTOMETRIC REQUIREMENT

7.1 When applying for approval, the applicant shall specify one or more or a range of axis of reference. This corresponds to the illumination angle $V = H = 0^\circ$ in the **Tables 1 and 2**.

In the case where more than one or a range of different axis of reference are specified by the manufacturer, the photometric measurements shall be repeated making reference each time to a different axis of reference or to the extreme axis of reference of the range specified by the manufacturer.

7.2. For photometric measurements, only the illuminating surface contained within a circle of 200 mm diameter for Class IA or IB shall be considered, and the illuminating surface itself shall be limited to 100 cm² though the surfaces of the retro-reflecting optical units need not necessarily have this area.

The manufacturer shall specify the perimeter of the area to be used. In the case of Class III A and Class IV A, the whole of the illuminating surfaces shall be considered without limitation as to size.

7.3 CIL Values for Retro-Reflectors of Categories Class IA, Class IB and Class IIIA

7.3.1 The CIL values for red retro-reflecting devices shall be at least equal to those in **Table 1**, expressed in millicandelas per lux, for the angles of divergence and illumination shown.

**Table 1: (See 3.15, 7.1 and 7.3.1)
CIL Values for Red Retro-Reflectors of
Categories Class IA, Class IB and Class IIIA**

Class	Angle of divergence α	Illumination angles β (in degrees)			
		Vertical V	0°	$\pm 10^\circ$	$\pm 5^\circ$
		Horizontal H	0°	0°	$\pm 20^\circ$
		millicandelas per lux			
I A, IB	20'		300	200	100
	1°30'		5	2.8	2.5
III A	20'		450	200	150
	1°30'		12	8	8

CIL values lower than those shown in the last two columns of the Table 1 are not permissible within the solid angle having the reference centre as its apex and bounded by the planes intersecting along the lines ($V = \pm 10^\circ, H = 0^\circ$) and ($V = \pm 5^\circ, H = \pm 20^\circ$).

7.3.2 CIL values for amber retro-reflecting devices in class IA or IB shall be at least equal to those in **Table 1** multiplied by the coefficient 2.5.

7.3.3 CIL values for white retro-reflecting devices in class IA or IB shall be at least equal to those in the **Table 1** multiplied by the coefficient 4.

7.4 CIL values for Retro-Reflectors of Category Class IV A

The CIL values shall be at least equal to those in the **Table 2**, expressed in millicandelas per lux, for the angles of divergence and illumination shown.

Table 2: (See 3.15 and 7.4)

CIL Values for Retro-Reflectors of Categories Class IVA

Colour	Angle of divergence α	Illumination angles β (in degrees)						
		Vertical V	0	± 10	0	0	0	0
		Horizontal H	0	0	± 20	± 30	± 40	± 50
millicandelas per lux								
White	20'		1800	1200	610	540	470	400
	1°30'		34	24	15	15	15	15
Amber	20'		1125	750	380	335	290	250
	1°30'		21	15	10	10	10	10
Red	20'		450	300	150	135	115	100
	1°30'		9	6	4	4	4	4

7.5 When the CIL of a retro-reflecting device is measured for an angle β of $V = H = 0^\circ$, it shall be ascertained whether any mirror effect is produced by slightly turning the device. If there is any such effect, a reading shall be taken with an angle β of $V = \pm 5^\circ, H = 0^\circ$. The position adopted shall be that corresponding to the minimum CIL for one of these positions.

7.6 With an illumination angle β of $V = H = 0^\circ$, or the angle specified in **7.5**, and an angle of divergence of 20', retro-reflecting devices which are not marked 'TOP' shall be rotated about their axes of reference to the position of minimum CIL, which shall conform to the value specified in **7.3** and **7.4**. When the CIL is measured for the other angles of illumination and divergence, the retro-reflecting device shall be placed in the position corresponding to this value of ϵ . If the specified values are not attained, the device may be rotated about its axis of reference $\pm 5^\circ$ from that position

7.7 With an illumination angle β of $V = H = 0^\circ$ or the angle specified in **7.5**, and an angle of divergence of 20', retro-reflecting devices marked 'TOP' shall be rotated about their axes $\pm 5^\circ$. The CIL shall not fall below the prescribed value in any position assumed by the device during this rotation.

7.8 If for the direction $V = H = 0^\circ$, and for $\epsilon = 0^\circ$ the CIL exceeds the specified value by 50 per cent or more, all measurements for all angles of illumination and divergence shall be made for $\epsilon = 0^\circ$.

7.9 The term 'Limited Photometry' used in this standard means the measurement of CIL for an angle of divergence of 20' and an illumination angle $V = H = 0^\circ$ or if necessary, in the position defined in **7.5** and **7.6**

COLOURIMETRIC REQUIREMENTS

- 8.1** These specifications shall apply only to white, red or amber retro-reflecting devices.
- 8.2** Retro-reflecting devices may consist of a combined retro-reflecting optical unit and filter, which shall be so designed that they cannot be separated under normal conditions of use.
- 8.3** The colouring of retro-reflecting optical units and filters by means of paint or varnish is not permitted.
- 8.4** When the retro-reflecting device is illuminated by ICI standard illuminant A, with an angle of divergence of $1/3^\circ$ and an illumination angle of $V = H = 0^\circ$, or, if this produces a white surface reflection, an angle $V = \pm 5^\circ$ $H = 0^\circ$, the trichromatic coordinates of the reflected luminous flux shall be within the following limits:

Table 3 (See 8.4): Trichromatic Coordinates

Red	limit towards yellow: $y \leq 0.335$
	limit towards purple: $z \leq 0.008$
Amber	limit towards yellow: $y \leq 0.429$
	limit towards red: $y \geq 0.398$
	limit towards white: $z \leq 0.007$
To take into account progressive changes in the colour coordinates in ECE regulations, alternatively compliance to the following coordinates for amber and red are permitted.	
Red	limit towards yellow: $y \leq 0.335$
	limit towards purple: $y \geq 0.980-x$
Amber	limit towards green: $y \leq x - 0.120$
	limit towards red: $y \geq 0.390$
	limit towards white: $y \leq 0.790 - 0.670x$

- 8.4.1** In the case of red and amber, compliance with the colorimetric specifications shall be verified by a visual comparison test.
- 8.4.2** If any doubt remains after the visual comparison, compliance with the colorimetric specifications shall be verified by determining the trichromatic coordinates of the most doubtful sample.
- 8.5** White retro-reflecting devices shall not produce a selective reflection, that is to say, the trichromatic coordinates “x” and “y” of the standard illuminant “A” used to illuminate the retro-reflecting device shall not undergo a change of more than 0.01 after reflection by the retro-reflecting device.

- 8.5.1 This shall be verified by the visual comparison test indicated above, the control field being illuminated by a light source of which the trichromatic coordinates differ by 0.01 from that of standard illuminant A.
- 8.5.2 In case of doubt, the trichromatic coordinates for the most selective sample shall be determined.

9.0 RESISTANCE TO WATER AND DIRT PENETRATION

9.1 Water Submersion Test

- 9.1.1 Retro-reflecting devices whether part of a lamp or not, shall be stripped of all removable parts and immersed for 10 minutes in water at a temperature of $50^{\circ} \pm 5^{\circ} \text{C}$, the highest point of the upper part of the illuminating surface being 20 mm below the surface of the water.

This test shall be repeated after turning the retro-reflecting device through 180° , so that the illuminating surface is at the bottom and the rear face is covered by about 20 mm of water.

These optical units shall then be immediately immersed in the same conditions in water at a temperature of $25^{\circ} \pm 5^{\circ} \text{C}$.

- 9.1.2 No water shall penetrate to the reflecting surface of the retro-reflecting optical unit. If visual inspection clearly reveals the presence of water, the device shall not be considered to have passed the test.
- 9.1.3 If visual inspection does not reveal the presence of water or in case of doubt, the CIL shall be measured by the method described in **7.9** the retro-reflecting device being first lightly shaken to remove excess water from the outside.

9.2 Alternative test procedure for Class IB devices

As an alternative, at the request of the manufacturer, the tests described in **Annex B** (moisture and dust test) shall be applied instead of the submersion-test specified in **9.1**.

10.0 RESISTANCE TO CORROSION

- 10.1 Retro-reflecting devices shall be so designed that they retain the prescribed photometric and colorimetric characteristics despite the humidity and corrosive influences to which they are normally exposed. The resistance of the front surface to tarnishing and of the protection of the rear face to deterioration shall be checked particularly when an essential metal component seems liable to be attacked.
- 10.2 The retro-reflecting device, or the lamp if the device is combined with a light, shall be stripped of all removable parts and subjected to the action of a saline mist for a period of 50 hours, comprising two periods of exposure of 24 hours each, separated by an interval of two hours during which the sample is allowed to dry.

- 10.3 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.
- 10.4 Immediately after completion of the test, the sample shall not show signs of excessive corrosion liable to impair the efficiency of the device.

11.0 RESISTANCE TO FUELS

- 11.1 The outer surface of the retro-reflecting device and, in particular, of the illuminating surface, shall be lightly wiped with a cotton cloth soaked in a mixture of 70% by volume of n-heptane and 30% by volume of toluol.
- 11.2 After about five minutes, the surface shall be inspected visually. It shall not show any apparent surface changes, except that slight surface cracks shall not be objected to.

12.0 RESISTANCE TO LUBRICATING OILS

- 12.1 The outer surface of the retro-reflecting device and, in particular, the illuminating surface, shall be lightly wiped with a cotton cloth soaked in a detergent lubricating oil. After about 5 minutes, the surface shall be cleaned.
- 12.2 The CIL shall then be measured as per **7.9**.

13.0 RESISTANCE OF THE ACCESSIBLE REAR FACE OF MIRROR-BACKED RETRO-REFLECTING DEVICES

- 13.1 After having brushed the rear face of the retro-reflecting device with a hard nylon brush, a cotton cloth soaked in the mixture, defined in **11.1** shall be applied to the said rear face for one minute. The cotton cloth is then removed and the retro-reflecting device left to dry.
- 13.2 As soon as evaporation is completed, an abrasion test shall be made by brushing the rear face with the same nylon brush as before.
- 13.3 The CIL shall then be measured (see **7.9**) after the whole surface of the mirror-backed rear face has been covered with Indian ink (black).

14.0 RESISTANCE TO HEAT

- 14.1 The retro-reflecting device shall be kept for 48 consecutive hours in a dry atmosphere at a temperature of $65 \pm 2^{\circ}\text{C}$.
- 14.2 After this test, no cracking or appreciable distortion of the retro-reflecting device and, in particular, of its optical component shall be visible.

15.0 RESISTANCE TO IMPACT – CLASS IV A

- 15.1 The retro-reflecting device shall be mounted in a manner similar to the way in which it is mounted on the vehicle, but with the lens faced horizontal and directed upwards.
- 15.2 Drop a 13 mm diameter polished solid steel ball, once, vertically onto the central part of the lens from a height of 0.76 m. The ball may be guided but not restricted in free fall.
- 15.3 When a retro-reflecting device is tested at room temperature with this method, the lens shall not crack.

16.0 SEQUENCE OF CARRYING OUT VARIOUS TESTS

- 16.1 The applicant shall submit for approval ten samples, which shall be tested in the chronological order indicated in **Annex C**. Actual sequence of testing is applicable only for the tests carried out on the same sample.

16.2 Tests on all the samples

- 16.2.1 All the ten samples shall be subjected to verification of general specifications (See **4.0**) of shape and dimensions (See **6.0**) and visual inspection of colorimetry (See **8.0**).

In case of a doubt on compliance to colorimetry, the most doubtful sample shall be subjected to measurement of trichromatic coordinates.

- 16.2.2 Then the ten samples shall be subjected to the heat resistance test (see **14.0**). At least one hour after this test, the samples shall be visually examined for cracks and deformation and colorimetric characteristics (See **8.4.1**).

- 16.2.3 Limited photometry shall be carried out on all the ten samples (see **7.9**).

- 16.3 The two retro-reflecting devices, which have the minimum and maximum values of test results as per **16.2.3**, shall then be fully tested as shown in **7.0**

These two samples shall be kept by the test agencies for any further checks, which may be found necessary.

- 16.4 The other eight samples shall be divided into four groups of two samples each, the tests for each group shall be carried out as described below:

16.5 First group

- 16.5.1 The two samples shall be subjected successively to the water penetration test (see **9.1**) and then, if this test is satisfactory, to the tests for resistance to fuels (see **11.0**)and lubricating oils (see **12.0**).

- 16.5.2 In the case of retro reflecting devices of Class IB, the alternate test as per **Annex B** may be carried out.

16.6 Second group

16.6.1 The two samples shall, if necessary, be subjected to the corrosion test (see **10.0**) and then to the abrasive-strength test of the rear face of the retro-reflecting device (see **13.0**).

16.6.2 In case of retro – reflecting devices of class IVA, these two samples shall also be subjected to impact test (see **15.0**)

16.7 Third group

The two samples shall be subjected to vibration test (**F1** of Annex **F**).

16.8 Fourth group

The two samples shall be subjected to exposure to damp heat (Cycling) test (**F3** of Annex **F**) and cold temperature test (**F2** of Annex **F**).

16.9 After undergoing the tests referred to in the above paragraph, the retro-reflecting devices in each group shall have:

16.9.1 A colour, which satisfies the conditions, laid down in **8**. This shall be verified by a qualitative method and, in case of doubt, confirmed by a quantitative method.

16.9.2 A CIL, which satisfies the conditions, laid down in **7.9**.

17.0 TYPE APPROVAL

17.1 At the time of application, the manufacturer shall declare to the test agency the information given in **Table 4** and applicable number of samples of the retro-reflecting device if necessary, the means of fixation.

**Table 4 (See 17.1)
Information to be declared for Type Approval**

1.	Manufacturer' s name & address:
2.	Telephone No:
3.	FAX. No.:
4.	E mail address:
5.	Contact person:
6.	Plant/(s)of manufacture:
7	Trade name or mark
8	Axis/Axes/range of Axis of reference corresponding to the illumination angle $V = H = 0^\circ$
9	Brief description of material of retro-reflecting optical unit:
10	Drawings, in triplicate, in sufficient detail to permit identification of the type, showing geometrically the orientation in which the retro-reflecting device is to be fitted to the vehicle. The drawings shall show the position intended for the approval number and class indicator in relation to the approval mark;
11	Colour:
12	Class of Retro-Reflector
13	Effective area of retro-reflector for photometric measurement

- 17.2 If the samples submitted meet the requirements of this standard, approval shall be granted.

When two or more lamps are part of the same unit of grouped, combined or reciprocally incorporated lamps (including a retro-reflector), approval is granted only if each of these lamps satisfies the requirements of the corresponding standards. Lamps not satisfying any one of those standards shall not be part of such a unit of grouped, combined or reciprocally incorporated lamps.

- 17.3 At the choice of the manufacturer, it will specify that the device may be installed on the vehicle with different inclinations of the reference axis in respect to the vehicle reference planes and to the ground or, in case of Class IA, IB and IVA retro-reflectors, rotate around its reference axis; these different conditions of installation shall be indicated in the information.

18.0 CHANGES IN TECHNICAL SPECIFICATION

- 18.1 Every modification pertaining to the information, even if the changes are not technical in nature declared in accordance with **17.1** shall be intimated by the manufacturer to the test agency.

If the changes are in parameters not related to the provisions, no further action need be taken.

If the changes are in parameters related to the provisions, the Testing Agency, which has issued the test report of compliance, may then consider, whether,

- 18.1.1 the retro-reflecting device with the changed specifications still complies with provisions; or,

- 18.1.2 any further verification is required to establish compliance.

- 18.2 For considering whether testing is required or not, guidelines given in **19.0** (Criteria for Extension of Approval) shall be used.

- 18.3 In case of **18.1.2**, tests for only those parameters which are affected by the modifications need be carried out

- 18.4 In case of fulfillment of criterion as per **18.1.1** or after results of further verification as per **18.1.2** are satisfactory, the approval of compliance shall be extended for the changes carried out.

19.0 CRITERIA FOR EXTENSION OF APPROVAL

- 19.1 If the approval granted in respect of a retro-reflecting device is extended to other such devices differing only in colour, the two samples in any other colour submitted shall be required to meet only the colorimetric and photometric specifications, the other tests no longer being required.

This condition is not applicable to devices of Class IV A.

- 19.2 Till the details are finalized, the Criteria shall be as agreed between the test agency and manufacturer.

20.0 REQUIREMENTS OF CONFORMITY OF PRODUCTION

- 20.1. Devices approved under this standard shall be so manufactured as to conform to the type approved by meeting the requirements set forth in these standard and relevant annexes.
- 20.2 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.
- 20.3 With respect to photometric performances, the conformity of mass-produced retro-reflectors shall not be contested if, when testing photometric performances of any retro-reflector chosen at random no measured value deviates unfavourably by more than 20 per cent from the minimum values prescribed in this Standard.
- 20.4 The chromaticity coordinates shall be complied with.
- 20.5 The details of the minimum checks to be carried out by manufacturer are detailed in **Annex D**.
- 20.6 The test agency may at any time verify the conformity control methods applied in each production facility.
 - 20.6.1 The normal frequency of these verifications shall be as decided by CMVR-TSC.
 - 20.6.2 Retro-reflectors with apparent defects are ignored.
 - 20.6.3 The statistical criterion for verifying compliance to the photometric requirements is given in **Annex E**.

Note: The provision of **20.0** will come into force after AIS-037 is notified for implementation.

21.0 MARKINGS

- 21.1 Every retro-reflecting device shall bear the following markings
 - 21.1.1 the word “TOP” inscribed horizontally on the highest part of the illuminating surface, if such an indication is necessary to determine without ambiguity the angle or angles of rotation prescribed by the manufacturer
 - 21.1.2 A space of sufficient size to accommodate the approval mark shall be provided on every device. (As per AIS 037)
 - 21.1.3 Symbols IA, IB, IIIA or IVA showing the class of the retro-reflecting device.
 - 21.1.3 the trade name or mark of the applicant;
- 21.2 The marking of the word “TOP”, the approval mark (as and when AIS -037 becomes mandatory for retro-reflecting devices) and group symbol markings shall be clearly legible and be indelible. They shall be applied on the illuminating surface, or on one of the illuminating surfaces, of the retro-reflecting device and shall be visible from the outside when the retro-reflecting device is fitted on the vehicle.

- 21.3 Where grouped, combined or reciprocally incorporated lamps comply with the requirements covered by different standards, a single approval mark may be applied, an approval number and, if necessary, the required arrow. This approval mark may be placed anywhere on the grouped, combined or reciprocally incorporated lamps provided that:
 - 21.3.1 It is visible after their installation;
 - 21.3.2 No part of the grouped, combined or reciprocally incorporated lamps that transmits light can be removed without at the same time removing the approval mark.
- 21.4 On the prototype for type approval the marking may be provided by suitable temporary methods and need not necessary be obtained from the tools used for series production.

Annex A (See 3.13 & 7.0)
RETRO- REFLECTING DEVICE SYMBOLS AND UNITS

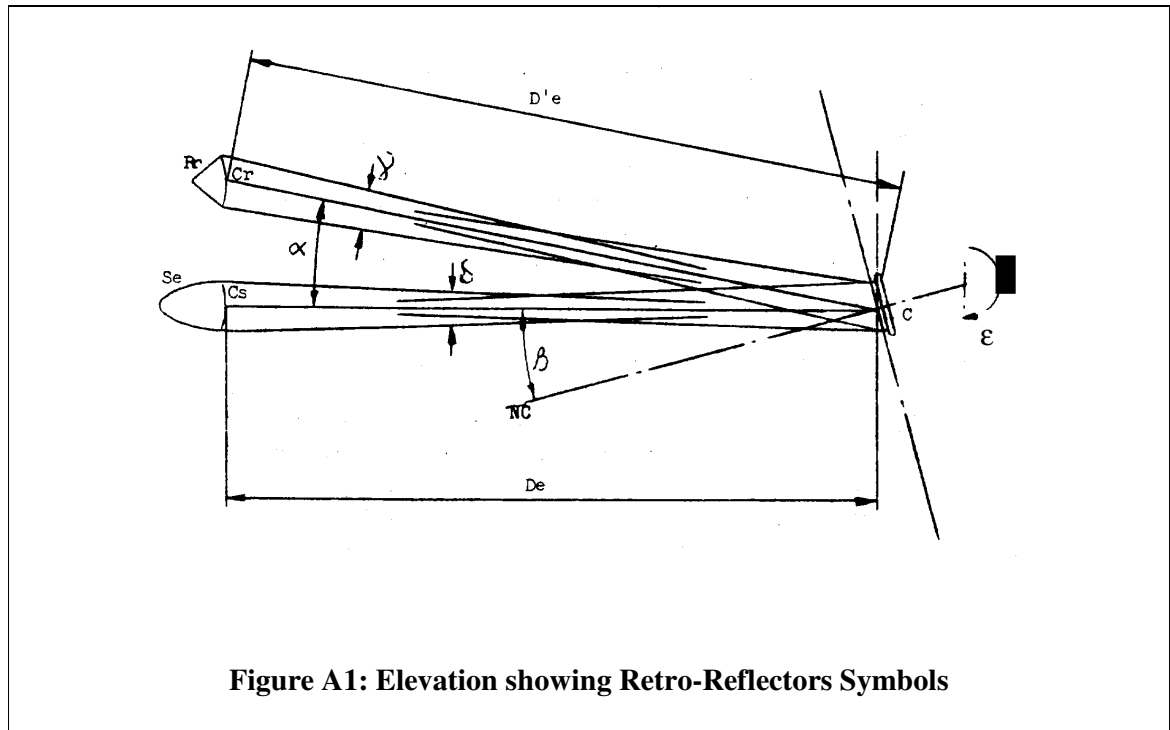


Figure A1: Elevation showing Retro-Reflectors Symbols

- A = Area of the illuminating surface of the retro-reflecting device (cm²)
- C = Centre of reference
- CIL = Coefficient of luminous intensity (millicandelas/lux)
- Cr = Centre of receiver
- Cs = Centre of source of illumination
- D = Observation distance from and from beyond which the illuminating surface appears to be continuous
- De = Distance from centre Cs to centre C (m)
- D' e = Distance from centre Cr to centre C (m)
- Note: In general, De and D' e are very nearly the same and under normal conditions of observation it may be assumed that De = D' e.
- E = Illumination of the retro-reflecting device (lux)
- NC = Axis of reference
- Rr = Receiver, observer or measuring device
- Se = Source of illumination

α = Angle of divergence

β = Illumination angle.

With respect to the line Cs-C which is always considered to be horizontal, this angle is prefixed by the signs “-” (left), “+” (right), “+” (up) or “-” (down), according to the position of the source Se in relation to the axis NC, as seen when looking towards the retro-reflecting device.

For any direction defined by two angles, vertical and horizontal, the vertical angle is always given first.

γ = Angular diameter of the measuring device Rr as seen from point C

δ = Angular diameter of the source Se as seen from point C

ϵ = Angle of rotation. This angle is positive when the rotation is clockwise as seen when looking towards the illuminating surface. If the retro-reflecting device is marked "TOP", the position thus indicated is taken as the origin.

\emptyset_r = Diameter of receiver Rr if circular (cm)

\emptyset_s = Diameter of source of illumination (cm)

Angles are expressed in degrees and minutes.

Annex B (See 9.2 & 16.5.2)

**ALTERNATE METHOD APPLICABLE FOR RETRO-REFLECTING
DEVICES OF CLASS IB****B1 Scope**

As an alternative, at the request of the manufacturer, the following test (moisture and dust test) shall be applied instead of the submersion-test specified in 9.1

B2 Moisture test

The test evaluates the ability of the sample device to resist moisture penetration from a water spray and determines the drainage capability of those devices with drain holes or other exposed openings in the device.

B2.1 Water spray test equipment

A water spray cabinet with the following characteristics shall be used:

B2.1.1 Cabinet

The cabinet shall be equipped with a nozzle(s), which provides a solid cone water spray of sufficient angle to completely cover the sample device. The centreline of the nozzle(s) shall be directed downward at an angle of $45^{\circ} \pm 5^{\circ}$ to the vertical axis of a rotating test platform.

B2.1.2 Rotating test platform

The rotating test platform shall have a minimum diameter of 140 mm and rotate about a vertical axis in the centre of the cabinet.

B2.1.3 Precipitation rate

The precipitation rate of the water spray at the device shall be 2.5 (+ 1.6/-0) mm/min as measured with a vertical cylindrical collector centred on the vertical axis of the rotating test platform. The height of the collector shall be 100 mm and the inside diameter shall be a minimum of 140 mm.

B2.2 Water spray test procedure

A sample device mounted on a test fixture, with initial CIL measured and recorded shall be subjected to a water spray as follows:

B2.2.1 Device openings

All drain holes and other openings shall remain open. Drain wicks, when used, shall be tested in the device.

B2.2.2 Rotational speed

The device shall be rotated about its vertical axis at a rate of $4.0 \pm 0.5 \text{ min}^{-1}$.

B2.2.3 If the retro-reflector is reciprocally incorporated or grouped with signalling or lighting functions, these functions shall be operated at design voltage according to a cycle of 5 min ON (in flashing mode, where appropriate), 55 min OFF.

B2.2.4 Test duration

The water spray test shall last 12hours (12 cycles of 5/55 min).

B2.2.5 Drain period

The rotation and the water spray shall be turned OFF and the device allowed to drain for 1 hour with the cabinet door closed.

B2.3 Sample evaluation

Upon completion of the drain period. The interior of the device shall be observed for moisture accumulation. No standing pool of water shall be allowed to be formed, or which can be formed by tapping or tilting the device. The CIL shall be measured according to the method specified in 7.9 after having dried the exterior of the device with a dry cotton cloth.

B3.0 Dust exposure test

This test evaluates the ability of the sample device to resist dust penetration, which could significantly affect the photometric output of the retro-reflector.

B3.1 Dust exposure test equipment

The following equipment shall be used to test for dust exposure:

B3.1.2 Dust exposure test chamber

The interior of the test chamber shall be cubical in shape in size 0.9 to 1.5 m per side. The bottom may be "hopper shaped" to aid in collecting the dust. The internal chamber volume, not including a "hopper shaped" bottom shall be 2 m³ maximum and shall be charged with 3 to 5 kg of the test dust. The chamber shall have the capability of agitating the test dust by means of compressed air or blower fans in such a way that the dust is diffused throughout the chamber.

B3.1.3 The dust

The test dust used shall be fine powdered cement in accordance with standard ASTM C 150-84.

Alternatively, medium heat Portland cement according IS 269:1989 may be used.

B3.2 Dust exposure test procedure

A sample device, mounted on a test fixture, with the initial CIL measured and recorded, shall be exposed to dust as follows:

B3.2.1 Device openings

All drain holes and other openings shall remain open. Drain wicks, when used, shall be tested in the device.

B3.2.2 Dust exposure

The mounted device shall be placed in the dust chamber no closer than 150 mm from a wall. Devices with a length exceeding 600 mm shall be horizontally centred in the test chamber. During the test duration of 5 hours, the test dust shall be agitated as completely as possible by compressed air or blower(s) at intervals of 15 min for a period of 2 to 15 s. The dust shall be allowed to settle between the agitation periods

B3.5 Measured sample evaluation

Upon completion of the dust exposure test, the exterior of the device shall be cleaned and dried with a dry cotton cloth and the CIL measured according to the method specified in 7.9.

Annex C: (See 16.1)

CHRONOLOGICAL ORDER OF TESTS

Operation No.	Test	⁽¹⁾		Group: 1		Group: 2		Group: 3		Group: 4	
		1	2	3	4	5	6	7	8	9	10
1 ⁽²⁾	General specifications	y	y	y	y	y	y	y	y	y	y
2 ⁽²⁾	Shapes and dimensions (See 6.0)	y	y	y	y	y	y	y	y	y	y
3 ⁽³⁾	Colorimetry (See8.4.1/8.5.1)	y	y	y	y	y	y	y	y	y	y
4	Heat Test (See14.1)	y	y	y	y	y	y	y	y	y	y
5 ⁽⁴⁾	Check for distortion(See14.2)	y	y	y	y	y	y	y	y	y	y
6 ⁽⁴⁾	Limited Photometry(See7.9)	y	y	y	y	y	y	y	y	y	y
7 ⁽⁴⁾	Photometry complete(See7.0)	y	y								
8	Preserve samples (See 16.3)	y	y								
9 ⁽⁷⁾	Water Submersion (See9.1.1)			y	y						
10	Visual inspection (See 9.1.2)			y	y						
11 ⁽⁵⁾	Colorimetry (See8.4.1/8.5.1)			y	y						
12	Limited Photometry (See7.9)			y	y						
13	Application of fuel mixture (See 11.1)			y	y						
14	Visual inspection(See11.2)			y	y						
15	Application of lubricating oil(See12.1)			y	y						
16	Visual inspection(See12.2)			y	y						
17 ⁽⁵⁾	Colorimetry (See8.4.1/8.5.1)			y	y						
18	Limited Photometry (See7.9)			y	y						
19 ⁽⁷⁾	Corrosion test (See10.1 to 10.3)					y	y				
20	Visual inspection(See10.4)					y	y				
21 ⁽⁸⁾	Rear face (See13.1)					y	y				
22 ⁽⁵⁾	Colorimetry (See8.4.1/8.5.1)					y	y				
23	Limited Photometry(See7.9)					y	y				
24 ⁽⁶⁾	Impact test (See15.1,15.2)					y	y				
25 ⁽⁶⁾	Visual Inspection (See15.3)					y	y				
26	Vibration Test(See F1.0)							y	y		
27 ⁽⁵⁾	Colorimetry (See8.4.1/8.5.1)							y	y		
28	Limited Photometry (See7.9)							y	y		
29	Damp heat test (See F3.0)									y	y
30 ⁽⁵⁾	Colorimetry (See8.4.1/8.5.1)									y	y
31	Limited Photometry(See7.9)									y	y
32	Cold test(See F2.0)									y	y
33 ⁽⁵⁾	Colorimetry (See8.4.1/8.5.1)									y	y
34	Limited Photometry(See7.9)									y	y

Notes:

- (1) These two are the samples, which gave the minimum and maximum readings as per Operation No. 8
- (2) To be checked by visual inspection.
- (3) If in doubt after visual inspection, check Trichromatic coordinates on the most doubtful sample as per para 8.0
- (4) To be carried out at least one hour after Operation. No. 5
- (5) If in doubt after visual inspection, check Trichromatic coordinates on both sample as per para 8.
- (6) Applicable only to Class IVA retro-reflecting devices
- (7) Alternatively, Tests as per Annex B for Class IB devices.
- (8) Applicable only to mirror-backed retro-reflecting devices.

Annex D (See 20.5)**MINIMUM CHECKS TO BE CARRIED OUT BY THE MANUFACTURER**

- D1.0** This Annex specifies the minimum checks to be carried out by the manufacturer, for establishing compliance (See 20.5).
- D2.0 General**
- D2.1** For each type of retro-reflector the holder of the approval mark shall carry out at least the tests for photometric, colorimetric characteristics and the resistance to penetration of water, at appropriate intervals in accordance with the provisions of this standard.
- D2.2** If any sampling shows non-conformity with regard to the type of test concerned, (See also 20.3) further samples shall be taken and tested. The manufacturer shall take steps to ensure the conformity of the production concerned.
- D3.0 Methods used in Tests**
- D3.1** Tests shall generally be carried out in accordance with the methods set out in this Standard.
- D3.2** In any test of conformity carried out by the manufacturer, equivalent methods may be used with the consent of the test agency responsible for approval tests. The manufacturer is responsible for proving that the applied methods are equivalent to those laid down in this Standard.
- D3.3** The application of paragraphs **D3.1** and **D3.2** requires regular calibration of test apparatus and its correlation with measurements made by a test agency.
- D3.4** In all cases the reference methods shall be those of this standard, particularly for the purpose of administrative verification and sampling.
- D4.0 Nature of Sampling**
- D4.1** Samples of retro-reflectors shall be selected at random from the production of a uniform batch. A uniform batch means a set of retro-reflectors of the same type, defined according to the production methods of the manufacturer.
- D4.2** 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.
- D5.0 Measured and Recorded Photometric Characteristics**
- D5.1** The sampled retro-reflector shall be subjected to photometric measurements at the points and chromaticity co-ordinates provided for in the standard
- D6.0 Criteria Governing Acceptability**
- D6.1** 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 in this standard.
- D6.2** The criteria governing the acceptability shall be such that, with a confidence level of 95 per cent, the minimum probability of passing a spot check in accordance with Annex E (first sampling) would be 0.95.

Annex E (See 20.6.3)

STATISTICAL PROCEDURE FOR VERIFYING THE COMPLIANCE TO PHOTOMETRIC REQUIREMENTS DURING SURVEILLANCE AUDIT

E1.0 While tests are being carried out for surveillance audit as per AIS-037, the following is the statistical procedure for verifying compliance of the photometric characteristics. The scheme is illustrated in Figure **E1**.

Note: The percentages indicated for deviation of the measured value in the following clauses refer to the deviation in the unfavourable directions.

E2.0 First Sampling

E2.1 In the first sampling four devices are selected at random. The first two samples are marked A, and the second two samples are marked B. Based on the tests and test results as described below the decision of compliance, need for corrective action or non compliance is established.

E2.2 Conformity established

The conformity of mass-produced devices is established, in the event of **E2.2.1** or **E2.2.2**.

E2.2.1 A1 If the deviations of the measured values of sample A, for one device is 0 % and the other device not more than 20 %

E2.2.2 A2 If the deviations of the measured values of both the devices of sample A, are more than 0 % but not more than 20 % and the test results of sample B are as per B1.

B1 If the deviations of the measured values of both the devices of sample B are not more than 0 %.

E2.3 Corrective Action (Alignment) required

The conformity of mass-produced devices shall be contested and the manufacturer requested to make his production meet the requirements (alignment) in the event of **E2.3.1**, **E2.3.2** or **E2.3.3**.

E2.3.1 A3 If the deviations of the measured values of sample A, for one device is not more than 20 % and the other device is more than 20 % but not more than 30%.

E2.3.2 B2 In the case of A2, if the deviations of the measured values is more than 0% but not more than 20%, and the other is not more than 20 %.

E2.3.3 B3 In the case of A2, if the deviation of the measured values of one device of sample B, is 0% and the other device is more than 20 % but not more than 30%.

E2.4 Non Compliance established

The conformity of mass-produced devices is deemed to be not established in the event of **E2.4.1**, **E2.4.2**, **E2.4.3** or **E2.4.4**.

E2.4 A4 If the deviations of the measured values of sample A, for one device is not more than 20 % and the other device is more than 30 %.

E2.4.1 A5 If the deviations of the measured values of sample A, for both devices is more than 20 %.

- E2.4.2** B4 In the case of A2, if the deviations of the measured values of one device of sample B, is more than 0% but not more than 20% and on the other device is more than 20 %.
- E2.4.3** B5 In the case of A2, if the deviations of the measured values of both the devices of sample B, is more than 20 %.
- E2.4.4** B6 In the case of A2, if the deviations of the measured values of one device of sample B, is 0% and on the other device is more than 30%.

E3.0 Repeated Sampling:

In the case of **E2.3** a repeated sampling, from stock manufactured after alignment, is necessary within two months' time after the notification

Four devices are selected at random. The first two (third sample) are marked C, and the other two (fourth sample) are marked D. Based on the tests and test results as described below the decision of compliance, need for corrective action or non compliance is established.

E3.1 Conformity is re-established

The conformity of mass-produced devices is established, in the event **E3.1.1** or **E3.1.2**.

- E3.1.1** C1 If the deviations of the measured values of sample C, for one device is 0 % and the other device not more than 20 %
- E3.1.2** C2 If the deviations of the measured values of both the devices of sample C, are more than 0 % but not more than 20 % and the test results of sample D are
 - D1 If the deviations of the measured values of both the devices of sample D are not more than 0 %.

E3.2 Corrective action (Alignment) is still required

The conformity of mass-produced devices shall be contested and the manufacturer requested to make his production meet the requirements (alignment) in the event of **E3.2.1**.

- E3.2.1** D2 In the case of C2, if the deviation of the measured values of one device of sample D is more than 0 % but not more than 20% and the other device is not more than 20 %.

E3.3 Non compliance established

The conformity of mass-produced devices is deemed to be not established in the event of **E3.3.1**, **E3.3.2** or **E3.3.3**

- E3.3.1** C3 If the deviations of the measured values of sample C, for one device are not more than 20 % and the other device is more than 20 %.
- E3.3.2** C4 If the deviations of the measured values of sample C, for both devices is not more than 20 %.
- E3.3.3** D3 In the case of C2, if the deviations of the measured values of one device of sample D is 0% or more than 0% and on the other device is more than 20 %.

E4.0 Resistance to penetration of water

With respect to the verification of the resistance to penetration of water, the following procedure shall be applied.

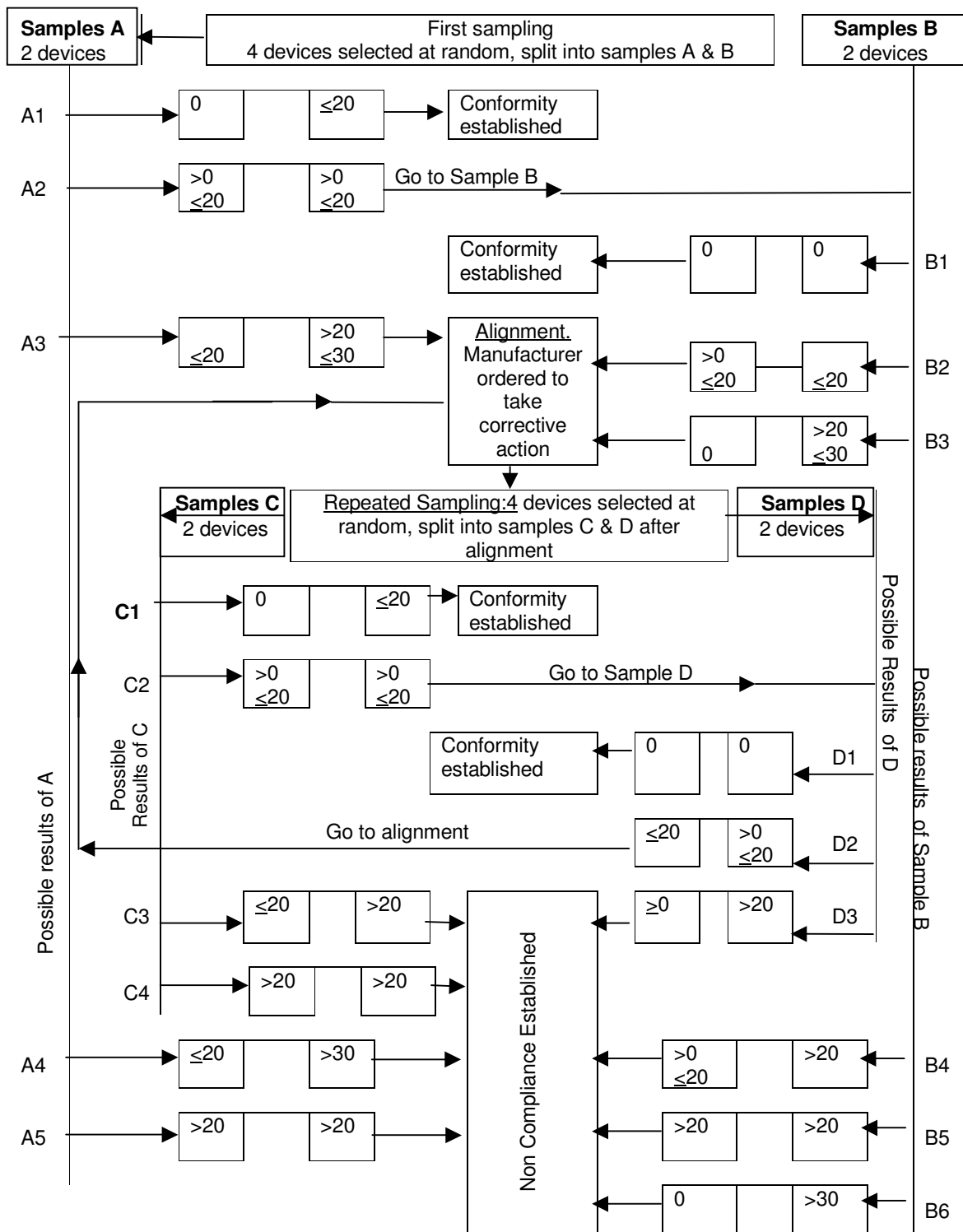
One of the retro-reflectors of Sample A, after sampling procedure in Figure E1 shall be tested according to the procedure described in **9.0** of this standard

The retro-reflectors shall be considered as acceptable if the test has been passed.

However, if the test on Sample A is not complied with, the two retro-reflectors of Sample B shall be subjected to the same procedure and both shall pass the test.

E5.0 Penalties in the case of conformity not being established shall be as per AIS-037.

Figure E1 (See E1)
SCHEMATIC DIAGRAM OF STATISTICAL PROCEDURE FOR COMPLIANCE TO PHOTOMETRIC REQUIREMENTS.



The figures in the box represent the maximum permissible deviation in the unfavourable direction in relation to the limit values.

Annex F (See 5.1.11)

ADDITIONAL TESTS FOR RETRO-REFLECTING DEVICES**F1. Vibration Test:**

F1.1 This test is intended to determine the ability of retro-reflecting devices to withstand specified severity of vibration when mounted on a vehicle.

F1.2 The test shall be carried out as specified in IS 9000 (part 8): 1983 with the following severity:

Frequency range 10 to 55 Hz

Displacement amplitude 0.75mm

Total duration Three hours

F1.3 The retro-reflecting device shall comply with the requirements given in **16.9**

F2.0 Cold Test

F2.1 This test is intended to determine the suitability of the retro-reflecting device at the specified low temperature likely to be encountered when mounted on a vehicle.

F2.2 The test shall be conducted as specified in IS 9000 (Part 2/Sec1): 1977 to IS 9000 (Part2/Sec 4): 1977. The retro-reflecting device shall be tested for low temperature use at the following conditions:

Temperature 10 °C

Duration exposure 2 hrs

F2.3 After the test the retro-reflecting device shall be allowed to return to ambient temperature. The retro-reflecting device shall comply with the requirements given in 16.9

F3.0 Damp Heat (Cycling) Test

F3.1 This test is intended to check the satisfactory performance level that can be maintained before and after exposure to varying conditions of humidity and temperature.

F3.2 The test shall be carried out according to group 2 of IS 10250: 1982

The number of conditioning cycles and recovery period shall be as follows:

Number of cycles 7

Recovery period 24 hours

F3.3 The retro-reflecting device shall comply with the requirements given in **16.9**

Annex G
(See Introduction)
COMMITTEE COMPOSITION
Automotive Industry Standards Committee

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