

AMENDMENT NO. 1
TO
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

1.0 Page No. 16/58, Annex C, clause C1.5:

Renumber the existing clause C1.5 as C1.6

2.0 Page No. 16/58, Annex C :

Insert new clause C1.5 as follows:

“C1.5 Specific requirements for headlamps using filament lamps described in 17 of AIS 034, shall be as per the relevant paragraphs of ECE Regulation R112 or R113 as applicable.

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 of Lighting
and Light-Signalling Devices for 2 and 3
Wheeled Motor Vehicles,
their Trailers and Semi-trailers and
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December 2004

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

- 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.
- 0.1 This standard has been prepared for implementation of the mandatory requirements regarding performance of lighting and light signalling devices for use in two and three wheelers covered by the following standard:
- AIS 009/2001 Installation requirements of lighting and light signalling devices for 2 and 3 wheelers, their trailers and semitrailers
- 0.2 Safety Standard SS15.1 regarding the performance and other requirements for lighting and light signalling devices has been in force in the case of four wheelers. This standard fulfils the requirements of performance of such devices in the case of two and three wheelers.
- 0.3 While SS15.1 was being upgraded to align with the later versions of ECE regulations, the CMVR TSC had decided to incorporate some additional tests related to vibration and environmental performance. These have been included in this standard also.
- 0.4 This standard has been aligned with the related ECE regulations as last amended upto December 2002.
- 0.5 Annex J of this standard specifies the additional tests on headlamps with plastic lens, in line with ECE regulations. This Annex J will be implemented one year after the date of implementation of this standard.
- 0.6 For preparation of this standard, considerable assistance has taken from the following national/international standards:
- | | |
|----------------------------|--|
| ECE R 50 Rev.1-
Amend.4 | Uniform provisions concerning the approval of front position lamps, rear position lamps, stop lamps, direction indicators and rear-registration-plate illuminating devices for mopeds, motor cycles and vehicles treated as such |
| Supplement 5 | |

ECE R 56 Rev.1- Amend.2	Uniform provisions concerning the approval of headlamps for mopeds and vehicles treated as such
ECE R 57 Rev.1- Amend.2	Uniform provisions concerning the approval of headlamps for motor cycles and vehicles treated as such
ECE R 1 and 2 Rev.4 Amend.5	Uniform provisions concerning the approval of incandescent electric lamps for headlamps emitting asymmetrical passing beam or a driving beam or both
ECE R 72 Rev.1 Amend.3	Uniform provisions concerning the approval of motor cycle headlamps emitting an asymmetrical passing beam and a driving beam and equipped with halogen lamps (HS1 lamps)
ECE R 8 Rev.4 Corrigendum 1	Uniform provisions concerning the approval of motor vehicle headlamps emitting an asymmetrical passing beam or a driving beam or both and equipped with halogen filament lamps (H1, H2, H3, HB4, H7, H8, H9, HIR1, HIR2 and/or H11)
ECE R 20 Rev.2, Amend.4	Uniform provisions concerning the approval of motor vehicle headlamps emitting an asymmetrical passing beam or a driving beam or both and equipped with halogen filament lamps (H4 lamps)
ECE R 82 Rev.4 Amend.1	Uniform provisions concerning the approval of moped headlamps equipped with filament halogen lamps (HS2)
SS 15.01	Lighting, signalling and indicating systems on all motor vehicles other than three wheelers with engine capacity less than 500cc and motorcycles and tractors.

0.7 The Committee responsible for preparation of this standard is given in Annexure M.

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

1 SCOPE

This standard lays down the performance requirements of lighting and light signalling devices for two and three wheeled motor vehicles. This standard is also applicable to:

- two wheeled motor vehicles fitted with a side car,
- three wheeled motor vehicles designed to draw a trailer/semi-trailer,
- trailers and semi-trailers drawn by a three-wheeled vehicle.

2. REFERENCE

- | | | |
|------|----------------|---|
| (1) | IS 9435: 1980 | Terms and definitions relating to dimensions of road vehicles |
| (2) | IS 9211: 1979 | Denominations and definitions of weights of road vehicles |
| (3) | IS 11422: 1985 | Terms and definitions of weights of scooters and motor cycles |
| (4) | IS 11432: 1985 | Terms and definitions of dimensions of motorcycles |
| (5) | IS 11571: 1986 | Terms and definitions of dimensions of scooters |
| (6) | IS 14413: 1996 | Automotive vehicles: Tell tale symbols and controls on two wheeled and three wheeled vehicles |
| (7) | AIS 053 | Vehicles – Types – Terminology |
| (8) | AIS 007/1998 | Information on Technical Specifications to be submitted by the Manufacturer |
| (9) | 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 |
| (10) | AIS 009/2001 | Installation requirements of lighting and light signalling devices for 2 and 3 wheelers, their trailers and semi-trailers. |
| (11) | AIS 012 | Performance Requirements of Lighting and Light Signalling Devices for Motor Vehicle having more than Three Wheels, Trailer and Semi-Trailer. |

3.0 DEFINITIONS

3.1 The definitions given in AIS 008, AIS 009 and AIS 012 shall be applicable to this standard also. The additional terms are defined below.

3.2 “**Direction Indicator Lamp of Category 11**” means a direction indicator lamp intended to be fitted at the front of the vehicle. They are classified into 11, 11a, 11b or 11c depending upon on the intensities, as given in **Table A1**.

- 3.3** “**Direction Indicator Lamp of Category 12**” means a direction indicator lamp intended to be fitted at the rear of the vehicle.
- 3.4** “**Direction Indicator Lamp of Category 31**” means a direction indicator lamp intended to be fitted to the side of the vehicle.
- 3.5** “**Type of Device**” means devices which do not differ among themselves in such essential respects as the following:
- 3.5.1** make or trade name;
 - 3.5.2** the characteristics of the optical system;
 - 3.5.3** the addition or deletion of components likely to alter the optical results as a result of reflection, refraction or absorption and/or deformation during their operation;
 - 3.5.4** the materials constituting the lenses and coatings, if any.
 - 3.5.6.** The kind of beam produced(dipped beam, driving beam or both) in case of halogen filament headlamps.
 - 3.5.7.** The holder intended to accommodate the filament lamp(s) in case of halogen lamps.
- 4.0** Rear Position Light, Front Position Light, Stop Light, Reversing Light, Direction Indicator Light Front, Direction Indicator Light Rear and rear registration-mark illuminating device shall be so designed and constructed that in normal use, and despite the vibrations to which they may be subjected, their satisfactory operation continues to be assured and they retain the characteristics prescribed by this standard. This requirement is deemed to be satisfied, if the device passes the relevant tests as prescribed in this standard.
- Photometric Intensity of light emitted and colour of light emitted for Rear Position Light, Front Position Light, Stop Light, Reversing Lamp, Direction Indicator Light Front and Direction Indicator Light Rear shall be as given in **Annex A**.
- The fog lamps shall comply with the requirements specified in AIS 012.
- 5.0** Photometric measurements of the rear registration-mark illuminating device shall be as given in **Annex B**.
- 6.0** Photometric and other requirements for headlamps shall be as given in **Annex C**.
- 7.0** **REQUIREMENTS OF CONFORMITY OF PRODUCTION**
- 7.1.** Devices approved under this standard shall be so manufactured as to conform to the type approved by meeting the requirements set forth in the relevant annexes. The details of the minimum checks to be carried out by manufacturer and checks to be carried out at the surveillance audit by the test agency are detailed in **Annex K**.
- 7.2** The test agency may at any time verify the conformity control methods applied in each production facility as detailed in AIS 037.

7.3 Penalties for non-compliance of conformity of production shall be as detailed in AIS 037.

7.4 Provisions prescribed in Para 7.2 to 7.3 will come into force after AIS037 is notified for implementation.

8.0 FOR TYPE APPROVAL

8.1 Information

At the time of application, the manufacturer shall declare to the test agency the information given in **Table 1**.

Table 1 (See 8.1): 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.	The intended function(s) of the device.
8.	Drawings, in sufficient detail to permit identification of the type of device and showing in what geometrical position(s) the device may be mounted on the vehicle; the axis of observation to be taken as the axis of reference in the tests(horizontal angle $H = 0^\circ$, vertical angle $V = 0^\circ$) and the point to be taken as the centre of reference in the said tests; the drawings shall show the position intended for symbols.
9.	A brief technical description giving details, in particular, with the exception of lamps with non-replaceable light source/Light source module, of the intended category or categories of filament lamp prescribed.
10.	Samples as per 8.2
11.	In the case of a direction indicator: its category.
12.	Colour of light emitted (Red/White/Amber/Selective Yellow)
13.	Material of Lens: Glass/plastic
14.	In case the light source is replaceable, Category, rated voltage and quantity of filament lamp
15.	At the choice of the applicant, 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 rotate around its reference axis or, in the case of a rear registration plate lamp, that the device may be fitted in more than one or a field of positions in relation to the space to be occupied by the registration plate; these different conditions of installation (or different positions) shall be indicated in the communication form.
16.	In case of R2 and halogen filament headlamps, whether the headlamp is intended to provide dipped beam and driving beam or only one of those beams. If headlamp is equipped with an adjustable reflector, the mounting position(s) of the headlamp in relation to the ground and the longitudinal median plane of the vehicle.

8.2 Samples

8.2.1 Sufficient number of samples of each device to be type approved shall be submitted.

- 8.2.2** For type approval as per **Annex J**, of the plastic material of which the lenses of headlamps are made, the following samples shall also be submitted:
 - 8.2.2.1** Thirteen lenses.
 - 8.2.2.2** Six of these lenses may be replaced by six samples of material at least 60 mm × 80 mm in size, having a flat or convex outer surface and a substantially flat area (radius of curvature not less than 300 mm) in the middle measuring at least 15 mm × 15 mm.
 - 8.2.2.3** Every such sample of material shall be produced by the method to be used in series production.
 - 8.2.2.4** A reflector to which the lens can be fitted in accordance with the manufacturer's instructions.
 - 8.2.2.5** The materials making up the lenses and coatings, if any, shall be accompanied by the test report on the characteristics of these materials and coatings if they have already been tested and approved for type approval of another device.
 - 8.2.2.6** Mounting fixtures, where necessary.

9.0 CHANGES IN TECHNICAL SPECIFICATION

9.1 Every modification pertaining to the information, even if the changes are not technical in nature declared in accordance with Para **8.1** shall be intimated by the manufacturer to the certifying 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 certificate of compliance, may then consider, whether,

9.1.1 the model with the changed specifications still complies with provisions, or

9.1.2 Any further verification is required to establish compliance.

9.2 For considering whether testing is required or not, guidelines given in para **10** (Criteria for Extension of Approval) shall be used.

9.3 In case of **9.1.2**, tests for only those parameters which are affected by the modifications need be carried out

9.4 In case of fulfillment of criterion of para **9.1.1** or after results of further verification as per para of **9.1.1** are satisfactory, the approval of compliance shall be extended for the changes carried out.

10 CRITERIA FOR EXTENSION OF APPROVAL

The Criteria shall be as agreed between the test agency and manufacturer.

11 ALTERNATE STANDARDS

11.1 Subject to the provision of **11.2**, compliance to AIS 012 is considered to be compliance to this standard:

11.2 Headlamps using gas discharge light sources are not permitted. Headlamps with light sources other than those listed in Annexes **C, D, E, F** or **G** shall be permitted only with the permission of CMVR Standing Technical Committee.

Annex A (See 4.0)**Requirements for Rear Position Light, Front Position Light, Stop Light, Reversing Light and Direction Indicator Light Front Rear****A1.0 Photometric Requirements**

A1.1 Within the reference axis the intensity of the light emitted by each of the two devices shall be at least equal to the minimum values and shall not exceed the maximum values given in the Table **A1**, in conjunction with the details given in **A2** to **A8**.

A1.2 In no direction shall the maximum values stated be exceeded.

A1.3 Details on the methods of measurement to be used are given in **A9**.

A1.4 In case of devices designed for use with replaceable filament lamp, the filament lamp shall be of category listed in AIS 034 or corresponding standard applicable at the time of Type Approval of device or those permitted in the standard considered to be alternate as per rule 92(3) of CMVR. The lamp holders shall be compatible with the cap of such filament lamps.

A1.5 In case of devices with non-replaceable light source or light source module, the non-replaceable light source or light source module shall comply with the requirements given in Annex M of AIS 012.

Table A1: Intensity of light emitted by the devices: (See A1.1)

Sr. No.	Device	Minimum (cd)	Maximum (cd)	Remarks
A1.1	Rear Position Light	4	12	See A4 & A6
A1.2.1	Front Position Light	4	60	
A1.2.2	Front Position Light incorporated in the headlamp	4	100	
A1.3	Stop Light	40	185	See A6
A1.4	Direction Indicator Light Front			
A1.4.1	Category 11*	90	700	See A2.1
A1.4.2	Category 11a*	175	700	
A1.4.3	Category 11b*	250	800	
A1.4.4	Category 11c*	400	860	
A1.5	Direction Indicator Light			
A1.5.1	Category 31 to the front	90	700	See A2.1
A1.5.2	Category 31 to the rear	50	200	
A1.4	Direction Indicator Light Rear (12)	50	350	
A1.5	Reversing Light	80	300/600	See A2.2
* Refer to AIS 009 for the minimum mounting distances for these categories.				

A2 Requirement of Maximum Intensity of Light

A2.1 The requirement of maximum intensity of light (700/800/860 cd) for Direction Indicator Light Front (**A1.4.1**, **A1.4.2**, **A1.4.3** & **A1.4.4**) applies solely to the zone between the two vertical lines passing through $V=0^{\circ}/H=\pm 5^{\circ}$ and two horizontal planes passing through $V=\pm 10^{\circ}/H=0^{\circ}$. A maximum intensity of 400cd is applicable to all other directions

- A2.2** In the case of reversing light, the intensity of light emitted in all directions, in which the light can be observed, shall not exceed 300 cd in directions in or above horizontal plane or 600 cd in directions below the horizontal plane passing through H-V.
- A3** Outside the reference axis the intensity of the light emitted within the angular fields defined in the diagrams in Figure **A1** shall, in each direction corresponding to the points in the light distribution table set out in Figure **A2**, be at least equal to the product of the minima set out in Table **A1** and the percentage set out in that figure for the direction at issue.
- Alternatively, for Reversing lights, minimum intensities of the light emitted shall be as specified in Figure **A3**.
- A4** As an exception to **A1.1** a maximum luminous intensity of 60 cd is permitted for rear position lamps that are reciprocally incorporated with stop lamps below a plane forming an angle of 5° downwards from the horizontal plane.
- A5** Throughout the fields defined in **Figure A1** the intensity of the light emitted shall be at least 0.05 cd for position (side) lamps and at least 0.3 cd for stop lamps and direction-indicator lamps.
- A6** When a rear position lamp has been grouped or reciprocally incorporated with a stop lamp, the ratio of the actually measured light intensities from the two lamps when lit simultaneously to the intensity of the rear position (side) lamp when lit alone shall be at least 5:1 at the eleven measuring points defined in Figure **A2** and located within the field bounded by the vertical straight lines passing through 0° V/± 10° H and the horizontal straight lines passing through ± 5° V/0° H shown in the light distribution table.
- If the rear position lamp or the stop lamp or both contain more than one light source and considered as single lamps, as described in **A7** the values considered are those obtained with all light sources in operation.
- A7.0** In case of a single lamp containing more than one light source.
- A7.1** The lamp shall comply with the minimum intensity required when any one light source has failed.
- A7.2** When all light sources are illuminated, the maximum intensity for assembly of two lamps is given by multiplying by 1.4 the value prescribed for a single lamp in Table **A1**.
- A7.3** All light sources, which are connected in series, are considered to be one light source.
- A8** The requirements set out in **A9.6.3** concerning local variations in intensity shall be met.
- A9.0** **Methods of Photometric Measurements**
- A9.1** In general the intensities shall be measured with the light source(s) continuously alight.

In the case of lamps intended to work intermittently, precaution shall be taken to avoid overheating of the device. Depending on the construction of the device, for example, the use of light-emitting diodes (LED) or the need to take precautions to avoid overheating, it is allowed to measure the lamps in flashing mode.

This shall be achieved by switching with a frequency of $f = 1.5 \pm 0.5$ Hz with the pulse width greater than 0.3 s, measured at 95 per cent peak light intensity.

In the case of replaceable filament lamps, the filament lamps shall be operated at reference luminous flux during on time. In all other cases the voltage as required in paragraph **A9.4.1** shall be switched with a rise time and fall time shorter than 0.01 s; no overshoot is allowed.

In the case of measurements taken in flashing mode the reported luminous intensity shall be represented by the maximum intensity.

A9.2 Interference reflections during the photometric measurements shall be avoided by means of appropriate masking.

A9.3 Should the results of the measurements be contested, they shall be carried out in such a way that:

A9.3.1 The measuring distance is such that the inverse square law of the distance applies.

A9.3.2 The measuring apparatus is such that the angular aperture of the receiver viewed from the centre of reference of the lamp lies between ten minutes of an angle and one degree.

A9.3.3 The intensity requirement for a given direction of observation is satisfactory provided that requirement is met in a direction not diverging by more than a quarter of a degree from the direction of observation.

A9.4 Light Sources for Measurement

A9.4.1 Replaceable Filament Lamps

All the measurements shall be carried out with a standard colourless lamp falling within the category intended for the device and adjusted in order to emit the reference light flux required for the lamp at issue.

In the case where the device may be installed on the vehicle in more than one or in a field of different positions the photometric measurements shall be repeated for each position or for the extreme positions in the field of the reference axis specified by the manufacturer.

When equipped with mass-production filament lamps at 6.75 V, 13.5 V or 28.0 V the luminous intensity (luminance) values produced shall be corrected. The correction factor is the ratio between the reference luminous flux and the mean value of the luminous flux found at the voltage applied (6.75 V, 13.5 V or 28.0 V).

The actual luminous fluxes of each filament lamp used shall not deviate more than ± 5 per cent from the mean value. Alternatively a standard filament lamp may be used in turn, in each of the individual positions, operated at its reference flux, the individual measurements in each position being added together

- Note: 1** When the use of a filament lamp not covered by AIS 034 but covered by an alternate standard approved under Rule 92(3) of CMVR, has been permitted, the reference lumens and other details shall be as per the relevant alternate standard.
- 2** In case the device is intended to be used with a coloured filament lamp and test is conducted with a standard colour less lamp, the lumen requirements should be corrected based on the lumen requirements specified for colourless and coloured bulbs prescribed in AIS 034. Alternatively, tests may be conducted with a coloured standard filament lamp, if such a lamp is available.

A9.4.2 Non-replaceable light source/Light source module

All measurements on lamps equipped with non-replaceable light source/Light source module shall be made at 6.75 V, or 13.5 V respectively for 6V or 12V system.

In the case of light sources supplied by a special power supply, the above test voltages shall be applied to the input terminals of that power supply. The test laboratory may require from the manufacturer the special power supply needed to supply the light sources.

For any signalling lamps, except those equipped with filament lamps, the luminous intensities measured after one minute and after thirty minutes of operation shall comply with the minimum and maximum requirement, direction indicator shall be operated in a flashing mode ($f=1.5\text{Hz}$, duty factor 50%). The luminous intensity distribution after one minute of operation can be calculated from the luminous intensity distribution after 30 minutes of operation by applying at each test point the ratio of luminous intensity measured at HV after one minute and after 30 minutes of operation.

- A9.5** The vertical and horizontal edges of the light-emitting surface of the device are determined and dimensioned in relation to its reference centre.

A9.6 Spatial Distribution of Light

- A9.6.1** **Figure A2** is the standardized table showing spatial distribution of light. **Figure A3** is the alternate spatial distribution of light for reversing lamps.

A9.6.2 Direction $H = 0^\circ$ and $V = 0^\circ$ corresponds to the axis of reference (intended to be on the vehicle it is horizontal and parallel to the median longitudinal plane of the vehicle and pointing towards the required field of view). It passes through the centre of reference. The values set out in the table give the minimum intensities for the various directions of measurement as a percentage of the minimum required for each lamp within the axis (in direction $H= 0^\circ$ & $V = 0^\circ$).

A9.6.3 Within the field of light distribution represented in diagrammatic form in **Fig. A2** by a grid, the distribution of the light shall be uniform in such a way that the light intensity in each direction of a part of the field formed by the lines of the grid reaches at least the lowest minimum value specified as a percentage (or the lowest available value) on the lines of the grid which surround the direction at issue. The intensity of light emitted at all points in the area defined in **Figure A1**, shall not exceed the maximum intensity defined in **A1.1**.

A10.5 Colour of Light Emitted

A10.5.1 The colour of light emitted shall be as given below:

Lamps	Colour
Direction Indicator Lamps	Amber
Rear Position Lamp (Tail Lamp)	Red
Stop Lamp	Red
Hazard Warning Lamp	Amber
Reversing Lamp	White
Front Position Lamp	White or Amber*
* The choice of the colour depends on requirements specified in AIS 009 for category of vehicle.	

A10.5.2 The colour of the light emitted inside the field of light distribution grid defined in **Figure A2**/**Figure A3** shall be within the limits of tri-chromatic coordinates prescribed in **Table A2**. Outside this field no sharp variation of colour shall be observed.

A10.5.3 For verifying the limits, a source of light at a colour temperature of 2856 K (illuminant A of the International Commission of Illumination (CIE) in combination with appropriate filters may be used.

A10.5.3.1 In the case of replaceable filament lamps, the colour of the light emitted, shall be measured by using a standard filament lamp of the category specified by the manufacturer operated at its test voltage as specified in AIS034.

A10.5.3.2 For lamps equipped with non-replaceable light source/Light source module, the colorimetric characteristics shall be verified with the light sources present in the lamps at the voltage of 6.75V or 13.5V as applicable.

Table A2: Colours of Lamps and Trichromatic coordinates (See A10.5.2)

Colour	Limit towards	
RED	Yellow	$y \leq 0.335$
	Purple	$z \leq 0.008$
AMBER	Yellow	$y \leq 0.429$
	Red	$y \geq 0.398$
	White	$z \leq 0.007$
WHITE	Blue	$x \geq 0.310$
	Yellow	$x \leq 0.500$
	Green	$y \leq 0.150 + 0.640x$
	Green	$y \leq 0.440$
	Purple	$y \geq 0.050 + 0.750x$
	Red	$y \geq 0.382$
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.		
Colour	Limit towards	
RED	Yellow	$y \leq 0.335$
	Purple	$y \geq 0.980 - x$
AMBER	Green	$y \leq x - 0.120$
	Red	$y \geq 0.390$
	White	$y \leq 0.790 - 0.670x$

A11.0 Markings

A11.1 The devices shall have, in a legible and indelible way, the following markings:

A11.2 Trade name or mark of the manufacturer

A11.3 Indication of filament lamp category or categories provided, if the devices are fitted with replaceable filament lamps.

Note: This is not applicable, if the devices are fitted with non-replaceable light source/Light source module.

A11.4 In case of devices with non-replaceable light source/Light source module the rated voltage and rated wattage of source.

A11.5 On the prototype for type approval, the markings may be provided by suitable temporary methods and need not necessary be obtained from the tools used for series production.

A12 Additional Tests

A12.1 In addition to the above requirements, following tests are applicable:
 Tests For procedure and requirements refer:

A12.1.1 Vibration Test **L2.0 of Annex L**

A12.1.2 Corrosion Test **L3.0 of Annex L**

A12.1.3 Dust test **L4.0 of Annex L**

A12.1.4 Moisture test **L5.0 of Annex L**

A12.2 In the case of devices with plastic lens, in addition to the above requirements, following tests are also applicable:

A12.2.1 Warpage **L7.0 of Annex L**

A12.2.2 Resistance to fuel test **L8.0 of Annex L**

A12.2.3 Resistance to oil test **L9.0 of Annex L**

A13 Requirements of Conformity of Production

While verifying the conformity of production as per para 7, in the case of devices picked up at random from production, the requirements as to the respectively minimum and maximum intensities of light emitted (measured with a standard filament lamp as referred to in this Annex shall be at least 80% of the minimum values specified and not exceed 120% of the maximum values allowed.

Figure A1 (See A3)
Minimum horizontal (H) and Minimum Vertical (V) angles of spatial light distribution

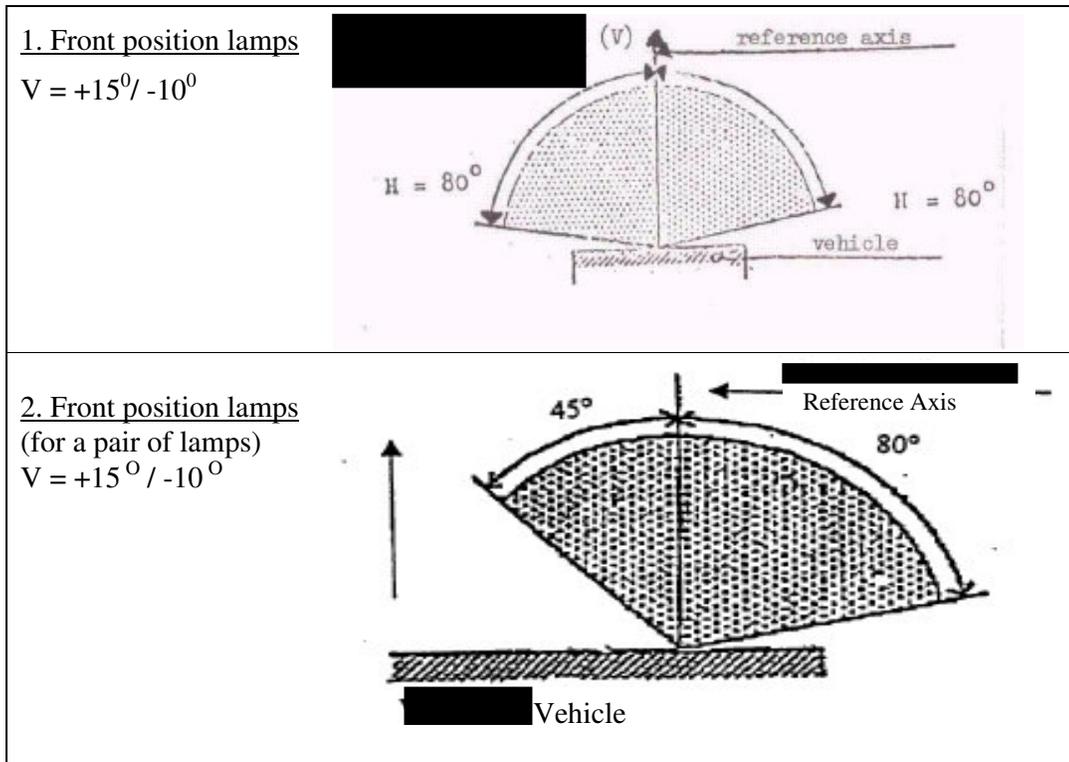


Figure A1 (See A3) Continued

Minimum horizontal (H) and Minimum Vertical (V) angles of spatial light distribution

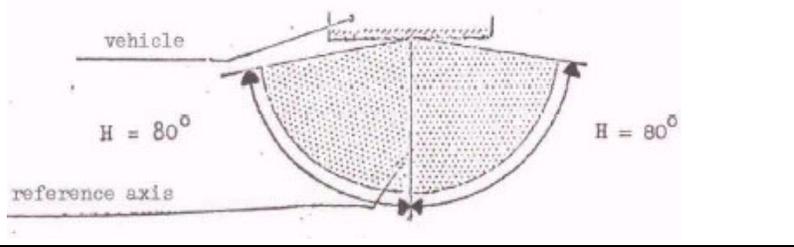
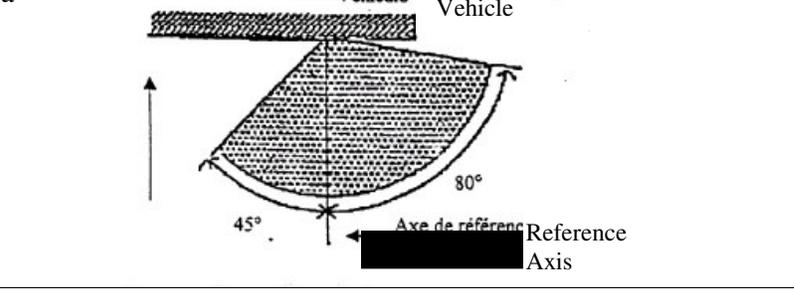
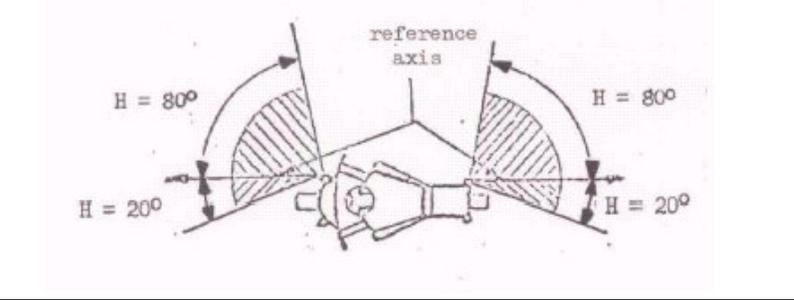
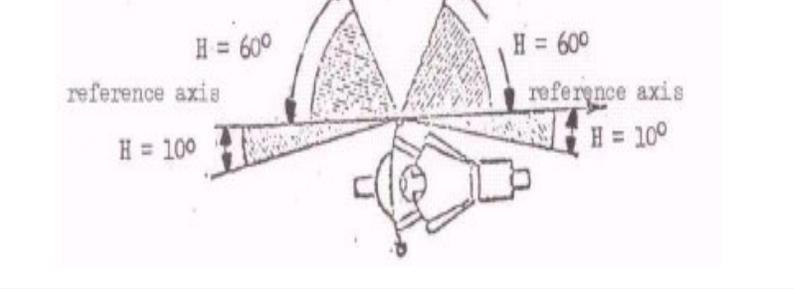
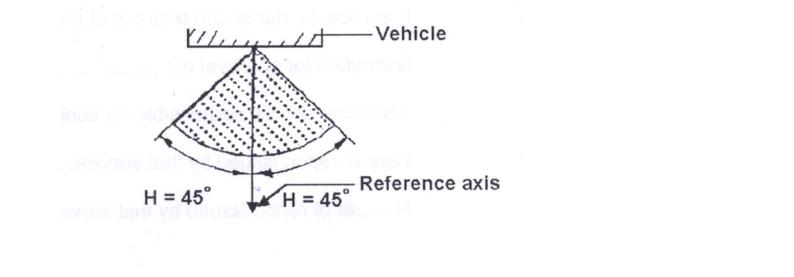
<p>3. <u>Rear position lamps</u> $V = +15^{\circ} / -10^{\circ}$</p>	
<p>4. <u>Rear position lamps (for a pair of lamps)</u> $V = +15^{\circ} / -10^{\circ}$</p>	
<p>5. <u>Direction Indicator lamps</u> (Categories 11 and 12) $V = \pm 15^{\circ}$</p>	
<p>6. <u>Direction Indicator lamps</u> (Category 31) $V = \pm 15^{\circ}$</p>	
<p>7. <u>Stop lamps</u> $V = +15^{\circ} / -10^{\circ}$</p>	

Figure A1 (See A3) Continued

Minimum horizontal (H) and Minimum Vertical (V) angles of spatial light distribution

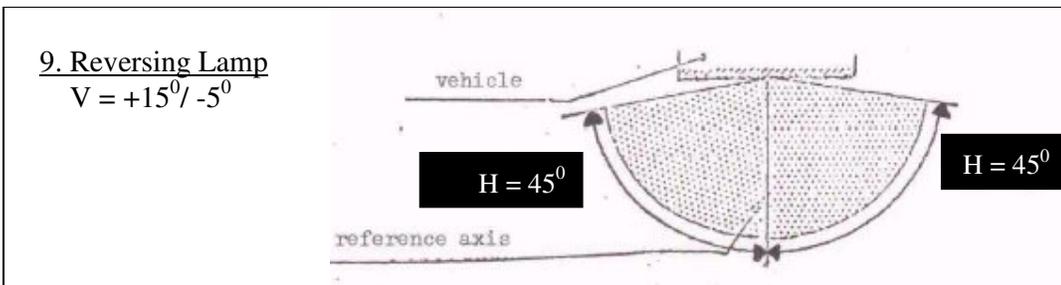
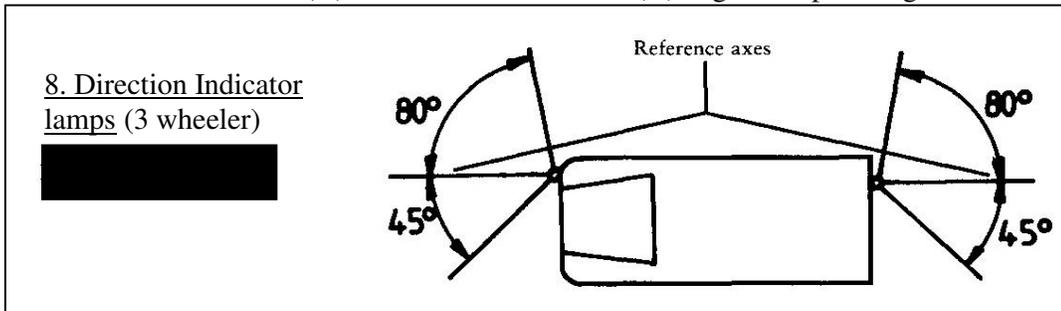


Figure A2: Standardized table showing spatial distribution of light (See A3)

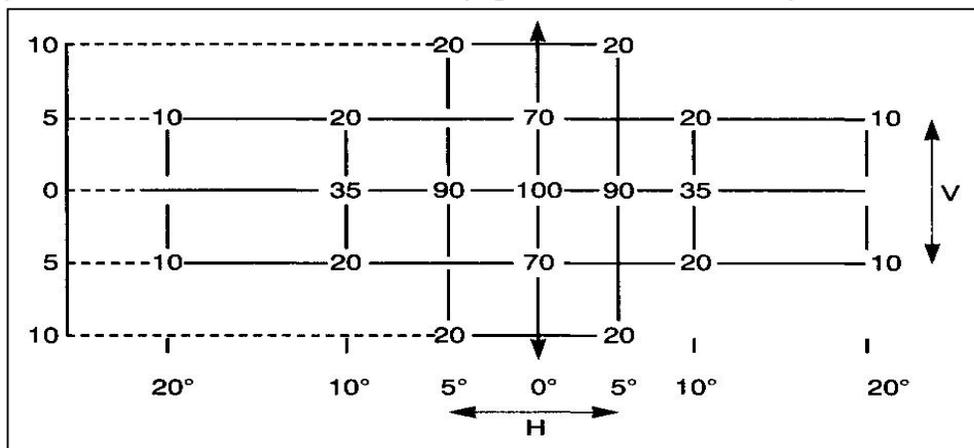
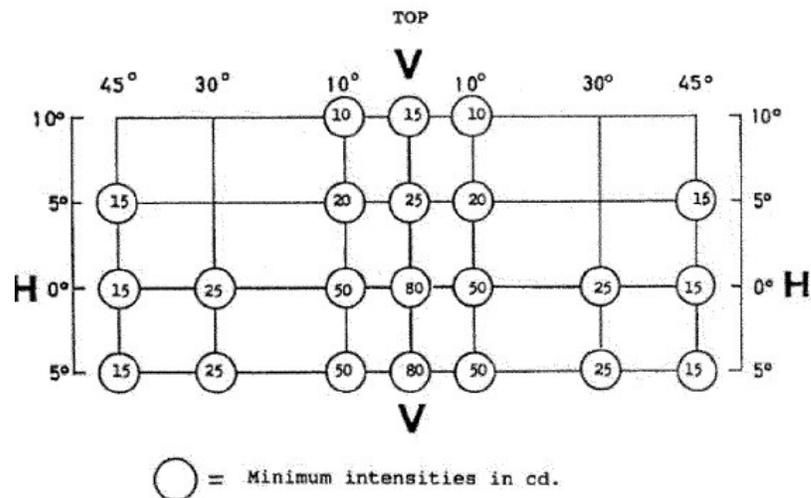


Figure A3: Standardized table (alternate) showing spatial distribution of Reversing light (See A3)



Annex B (See 5.0)

Photometric Measurements for the Rear Registration-plate Illuminating Device

B1 Position to be Illuminated

Devices shall be designed in such a way as to illuminate a position measuring at least 50 X 150.

B2 Colour of Light Emitted

The light of illuminating device shall be sufficiently colour less in order not to modify noticeably the colour of rear registration plate.

B3 Light Incidence

The manufacturer of the illuminating device shall specify one or more or a field of positions in which the device is to be fitted in relation to the space for registration plate.

When the lamp is placed in the position(s) specified by the manufacturer angle of incidence of the light on the surface of the plate does not exceed 82° at any point of the surface to be illuminated, that angle being measured in relation to the extremity of the light-emitting area of the device that is furthest from the surface of the plate. Where there is more than one optical component this requirement applies only to the part of the plate intended to be illuminated by the relevant component.

The device shall be designed in such a manner that no ray of light shines directly towards the rear with the exception of rays of red light where the device is combined or grouped with a rear lamp.

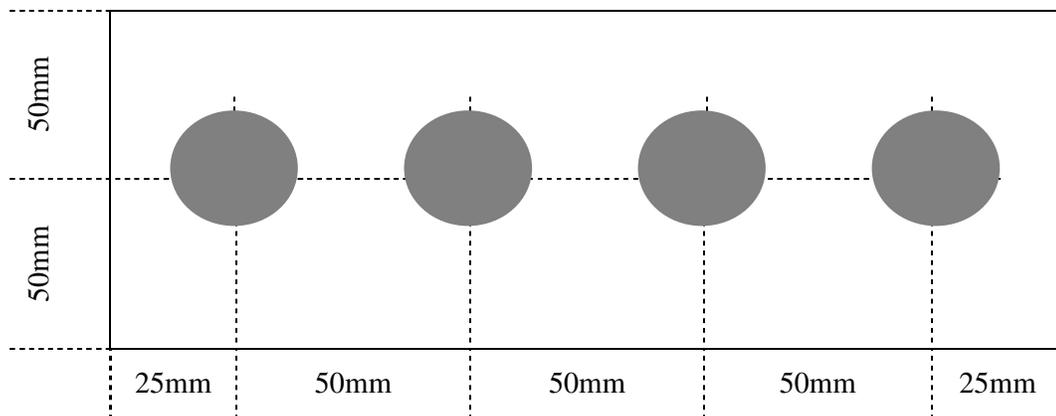
B4. Method of Measurement

The levels of luminance are measured on a sheet of clean white blotting paper having a minimum factor of diffuse reflection of 70 % and the same dimensions as the registration plate (200mm X 100 mm) and placed at the position it would normally occupy but 2 mm in front of its support.

The level of luminance is measured at right angles to the surface of the paper at the points shown in **figure B1**, each point representing a circular area 25 mm in diameter.

Light source for measurement shall be as prescribed in A9.4 of Annex A.

Figure B1 Points for measurement (See B4)



B5. Photometric Characteristics

Luminance (B) shall be at least 2 cd/m² at each of the measuring points defined below.

The luminance gradient between values B₁ and B₂, measured at any two points 1 and 2 selected from among the points referred to above shall not exceed 2 × B₀/cm, B₀ being the minimum luminance recorded at the various measuring points, or in other words

$$\frac{B_2 - B_1}{\text{Distance 1-2 in cm}} \leq 2 B_0/\text{cm}$$

B6.0 Markings

Markings shall be as per details given in **A11.0**

B7 Additional Tests

B7.1 In addition to the above requirements, tests as per **A12** of **Annex A** are applicable

B8.0 Requirements of Conformity of Production

Conditions specified in **A13** of **Annex A** shall be applicable.

Annex C (See 6.0)**Requirements for Headlamp General**

- C1.0** Specific Requirements of headlamps using different categories of filament lamps are detailed in the relevant Annexes as detailed below:
- C1.1** Specific requirements for headlamps using filament lamps category S3 or halogen lamps category HS2 are given in **Annex D**.
- C1.2** Specific requirements for headlamps, emitting a symmetrical dipped beam and driving beam using filament lamps category S1 or S2 are given in **Annex E**.
- C1.3** Specific requirements for headlamps, emitting an asymmetrical dipped beam and driving beam using filament lamps category R2 or halogen lamps category HS1 are given in **Annex F**.
- C1.4** Specific requirements for headlamps, emitting an asymmetrical dipped beam and driving beam using halogen lamps of categories H1, H3, HB3, HB4, H7 and H4 are given in **Annex G**.
- C1.5** In addition to the requirements given in the above-referred annexes, the headlamp shall comply with the following requirements as applicable.
- C2.0 General**
- C2.1** Headlamps shall be designed and manufactured in such a way that, under normal conditions of use and despite any vibrations to which they may be exposed, they continue to function properly and retain the required characteristics.
- C2.2** The components by which the filaments lamp(s) is/are fixed shall be made in such a way that, the filament lamp(s) can be fixed, even in darkness, in no other position but the correct one
- A headlamp is regarded as satisfying this requirements of this paragraph if the filament lamp can be easily be fitted into head lamp and positions lugs can be correctly fitted into their slots.
- C2.3** Headlamps shall be made in such a way that, with suitable filament lamp, they provide adequate illumination without dazzle in the case of the dipped beam and where applicable good illumination in the case of the driving beam.
- C2.4** The correct position of the lens in relation to the optical system shall be clearly marked and locked in position in order to avoid any rotation.
- C2.5** The general requirements specified above in **C2.1** to **C2.4** are considered to complied with if the specific requirements are satisfied
- C2.6** The colour emitted by headlamp shall be white. (Refer **Table A2** of **Annex A** for Trichromatic coordinates)
- C3.0 Adjustments**
- C3.1** The headlamps shall be fitted with a device enabling them to be adjusted on the vehicle in such a way as to meet the rules applying to them. This said device need not be attached to the parts within which the reflector and diffuser lens cannot be separated, provided that the use of those parts is restricted to vehicles on which the headlamps may be adjusted by other means.

Where a headlamp emitting a driving beam and a headlamp emitting a dipped beam, each being equipped with its own lamp, are grouped together to form a composite unit, the setting device shall enable each individual optical system to be set in an appropriate manner.

C3.2 The requirements of **C3.1** are not applicable to headlamp assemblies whose reflectors are indivisible.

C4.0 Driving Beam with more than One Light Source

C4.1 When more than one light source provides the driving beam those sources shall be combined in order to determine the maximum illumination value specified in the relevant annexes.

C5.0 Stability on Performance of Headlamps on Operation

C5.1 Additional tests meeting the requirements of **Annex H** shall be carried out in order to ensure that there are no excessive variations in photometric performance during use. This requirement is applicable only for headlamps covered by Annexes E, F and G.

C6.0 Additional Requirements for Headlamps with Plastic Lens

C6.1 If the lens of the headlamp is of plastic material, additional tests shall be carried out in accordance with the requirements of **Annex J**. This requirement is not applicable for headlamps covered by **Annex D**.

C6.2 In addition the following tests are applicable for all headlamps with plastic lens.

C6.2.1 Warpage **L7.0 of Annex L**

C6.2.2 Resistance to fuel test **L8.0 of Annex L**

C6.2.3 Resistance to oil test **L9.0 of Annex L**

Note: For headlamps complying with the J6.0 of Annex J, test prescribed in **C6.2.2** and **C6.2.3** need not be carried out.

C7.0 Additional Tests

C7.1 In addition to the above requirements, following tests are applicable:

Tests	For procedure and requirements refer:
C7.1.1 Vibration Test	L2.0 of Annex L
C7.1.2 Corrosion Test	L3.0 of Annex L
C7.1.3 Dust test	L4.0 of Annex L
C7.1.4 Moisture test	L5.0 of Annex L
C7.1.5 Thermal Shock test (applicable only for headlamps with glass lens)	L6.0 of Annex L
C7.1.6 High voltage (flash) test	L10.0 of Annex L

C8.0 Measurement of Photometry Requirements

C8.1 A measuring screen as described in the above Annexes and a standard lamp using a smooth colourless standard filament lamp of appropriate category shall be used in order to check the illumination provided by the headlamp.

C8.2 Reference Lamps for Measurement

C8.2.1 Reference lamp of category applicable to the head lamp shall be used.

C8.2.2 The voltage at the terminals of the reference lamps shall be adjusted to the relevant reference light flux in accordance with the values laid down for those lamps AIS 034. These figures are quoted for ready reference in **Table C1** and **Table C2** respectively for double filament and single filament lamps respectively.

These tables are only for reference. Absence of any category of filament lamps in these tables does not mean that use of headlamps with such filament lamps is prohibited. In such cases, the reference values given in AIS 034 shall be followed. Additional requirements for headlamps using such filament lamps specified in AIS034, if any, shall also be applicable.

C8.2.3 The dimensions determining the position of the filaments shall be as per AIS 034.

C8.2.4 The bulb for the filament standard lamp shall be of such a shape and optical quality that it causes a minimum of reflection or refraction which may have an adverse effect on the light distribution.

C8.5 The screen illumination values referred to in the relevant annexes shall be measured by means of a photoreceptor, the effective area of which shall be contained within a square of 65 mm side

Note: When the use of a filament lamp not covered by AIS 034 but covered by an alternate standard approved under Rule 92(3) of CMVR, has been permitted, the reference lumens and other details shall be as per the relevant alternate standard.

**Table C1: (See C8.2)
Details of double filament reference Lamps (Extract from AIS 034)**

Category	Filament				For headlamps referred in
	Main beam		Dipped beam		
	Rated Wattage	Lumen	Rated Wattage	Lumen	
S1	25	398 at ~ 6 V	25	284 lm at ~ 6 V	Annex E
S2	35	568 at ~ 12 V	35	426 lm at ~ 12 V	Annex E
HS1	35	700 at ~ 12 V	35	450 lm at ~ 6 V	Annex F
R2	45	700 at ~ 12 V	40	450 lm at ~ 12 V	Annex F
H4	60	1250 at ~ 12 V	55	750 at ~ 12 V	Annex G

Table C2: (See C8.2)
Details of single filament reference Lamps (Extract from AIS 034)

Category	Rated Wattage	Lumen	For headlamps referred in
S3	15	240 lm at ~ 6.75 V	Annex D
HS2	15	320 lm at ~ 6.75 V.	Annex D
H1	55	1150 at ~ 12 V	Annex G
H3	55	1100 lm at ~ 12 V	Annex G
HB3	60	1300 lm at ~ 12 V	Annex G
HB4	51	825 lm at ~ 12 V	Annex G
H7	55	1100 at ~ 12 V	Annex G

C9.0 Marking

C9.1 In addition to the type approval marking as per AIS037, the headlamps shall have the following markings, as applicable.

Note: Marking of type approval shall be become applicable only after AIS 037 is implemented.

C9.2 On headlamps incorporating a lens of plastic material, the letters “PL” shall be affixed near the symbols prescribed below.

C9.3 Headlamp Described in C1.2

C9.3.1 The headlamp shall bear in a clearly legible and indelible manner the letters “MB”.

C9.3.2 Headlamps designed in such a way as to preclude any simultaneous lighting-up of the dipped-beam filament and that of any other light source with which they may be integrated may be marked with an oblique stroke (/) following the symbol “MB” for the dipped beam in the component type-approval mark.

C9.3.3 On the back of headlamp the indication of the S1 and/or S2 category of the filament lamp fitted.

C9.3.4 Externally and/or on the lens the indication of the exterior markings of the headlamp, visible when the head lamp is installed on the vehicle.

C9.4 Headlamp Described in C1.3

C9.4.1 All headlamps designed in such a way as to preclude any simultaneous lighting-up of the dipped-beam filament and that of any other light source with which they may be associated shall be marked with an oblique stroke (/) after the dipped beam headlamp symbol.

C9.4.2 Where headlamps meet only the requirements of driving on the left, shall have a horizontal arrow pointing to the right of an observer looking at the headlamp head on, i.e. towards the side of the road driven upon.

C9.4.3 The letters “MBH” on headlamps with HS1 shall be marked.

C9.5 Headlamp Described in C1.4

- C9.5.1** Markings as per **C9.4**, except **C9.4.3** are applicable for this type of headlamps also. In addition the following markings shall be applicable.
- C9.5.2** On headlamps meeting left-hand traffic requirements only, a horizontal arrow pointing to the right of an observer facing the headlamp, i.e. To the side of the road on which traffic moves.
- C9.5.3** On headlamps in respect of the dipped beam only, the letters ‘HC’.
- C9.5.4** On headlamps in respect of the driving beam only, the letters ‘HR’.
- C9.5.5** On headlamps intended for both the dipped and the driving beam, the letters ‘HCR’;
- C9.5.6** On headlamps meeting the requirements of the driving beam, an indication of the maximum luminous intensity expressed by a reference mark, as defined in paragraph **G6.5** of **Annex G**.
- In the case of reciprocally incorporated headlamps, indication of the maximum luminous intensity of the driving beams as a whole shall be expressed as above.
- C9.5.7** Externally and/or on the lens the indication of the exterior markings of the headlamp, visible when the head lamp is installed on the vehicle.
- C10** Requirements given in **C3**, **C4**, **C5**, **C6**, and **C9** are not applicable to the type of headlamps referred to in **C1.1**
- C11** On the prototype for type approval, the markings may be provided by suitable temporary methods and need not necessary be obtained from the tools used for series production.

Annex D (See C1.1 of Annex C)
Head Lamps Using S3 or HS2 Category Lamp

D1 For the measurements the measuring screen is placed at a distance of 10 m for headlamps with S3 category lamps and 25m for headlamps with HS2 category lamps, in front of the headlamp and at right angles to the line joining the driving beam filament of the lamp and point HV (see figure D1/D2); line H-H shall be horizontal.

The reference lamps of category S3/HS2 shall be as detailed in **C8.2** in **Annex C**.

For lamps with transverse filament the filament shall be as horizontal as possible during the measurement.

D2 The dipped beam shall produce a cut-off of such sharpness that correct adjustment by means thereof is a practical possibility. The cut-off shall be perceptibly horizontal and as straight as possible over a horizontal length of:

- at least ± 900 mm, measured at a distance of 10 m in the case of headlamps with S3 category filament lamp,. (see **figure D1**).
- at least $\pm 2\ 250$ mm measured at a distance of 25 m in the case of headlamps with HS2 category filament lamp, (see **figure D2**).

D3 The light distribution shall not vary in lateral terms in a way that impairs good visibility

D4 Requirements for Headlamp Equipped with Category S3 Lamp.

D4.1 In lateral terms the headlamp shall be aligned in such a way that its beam is as symmetrical as possible in relation to line V-V.

D4.2 In vertical terms the headlamp shall be adjusted in such a manner that the illumination in point HV is 2 lux. Under those conditions, the cut-off is situated between line H-H and the line H-100 mm.

D4.3 When the headlamp has been adjusted in accordance with **D4.1** and **D4.2** the illumination values shall be as follows:

D4.3.1 On line H-H and above: 2 lux maximum.

D4.3.2 On a line situated 300 mm below line H-H and over a width of 900 mm either side of vertical line V-V: Not less than 8 lux.

D4.3.3 On a line 600 mm below line H-H and over a width 900 mm either side of the vertical line V-V: Not less than 4 lux.

D5.0 Photometric Tests on Headlamps Equipped with Category HS2 Halogen Lamp

D5.1 In lateral terms the headlamp shall be aligned in such a way that the distribution of the beam is symmetrical in relation to line V-V.

D5.2 In vertical terms the headlamp shall be adjusted in such a way that its cut-off is 250 mm below line H-H. It shall also be as horizontal as possible.

D5.3 When the headlamp has been adjusted in accordance with **D5.1** and **D5.2** the following conditions given in **Table D1** shall be met:

Table D1. (See D5.3) Illumination Requirements

Measuring point	Illumination E/Lux
Any point on and above the line H-H	< 0.7
Any point on the line 35L-35R except 35V	≥ 1
Point 35V	≥ 2
Any point on the line 25L-25R	≥ 2
Any point on the line 15L-15R	≥ 0.5

Figure D1. (See D1.0) Screen for headlamps with S3 filament lamp.
(Dimensions in mm over a distance of 10m)

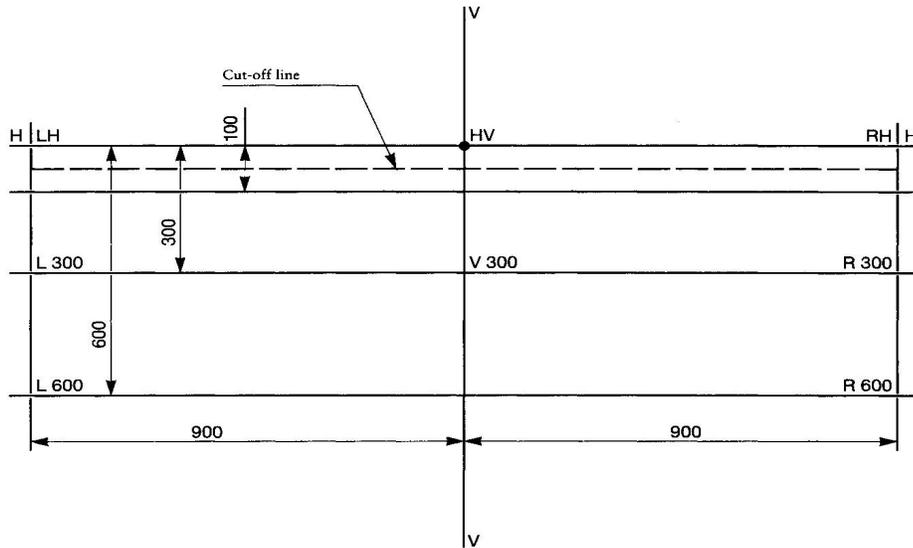
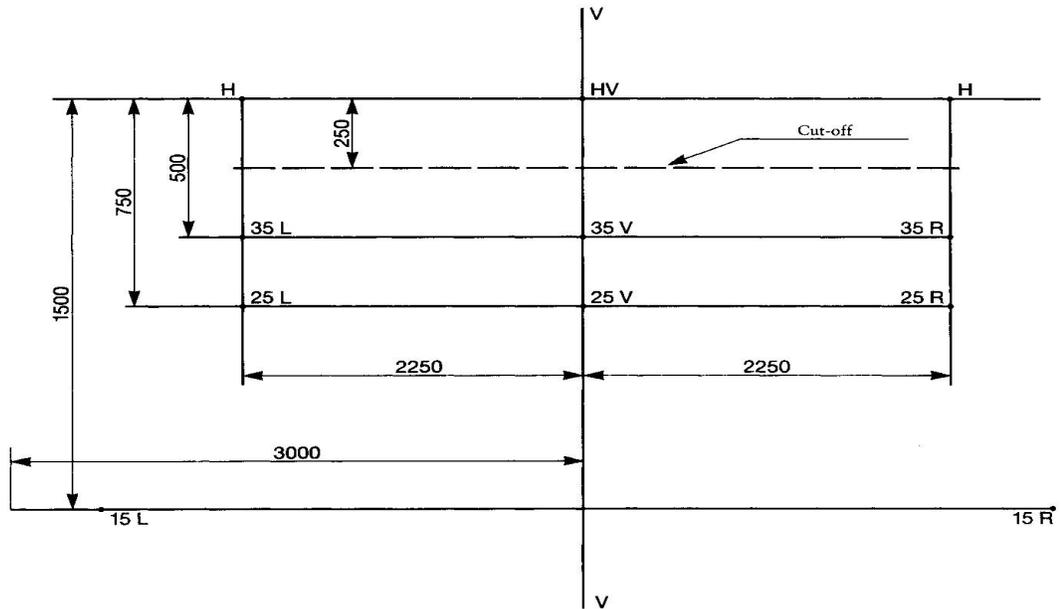


Figure D2. (See D1.0)
Screen for headlamps with HS2 filament lamp.
(Dimensions in mm over a distance of 25m)

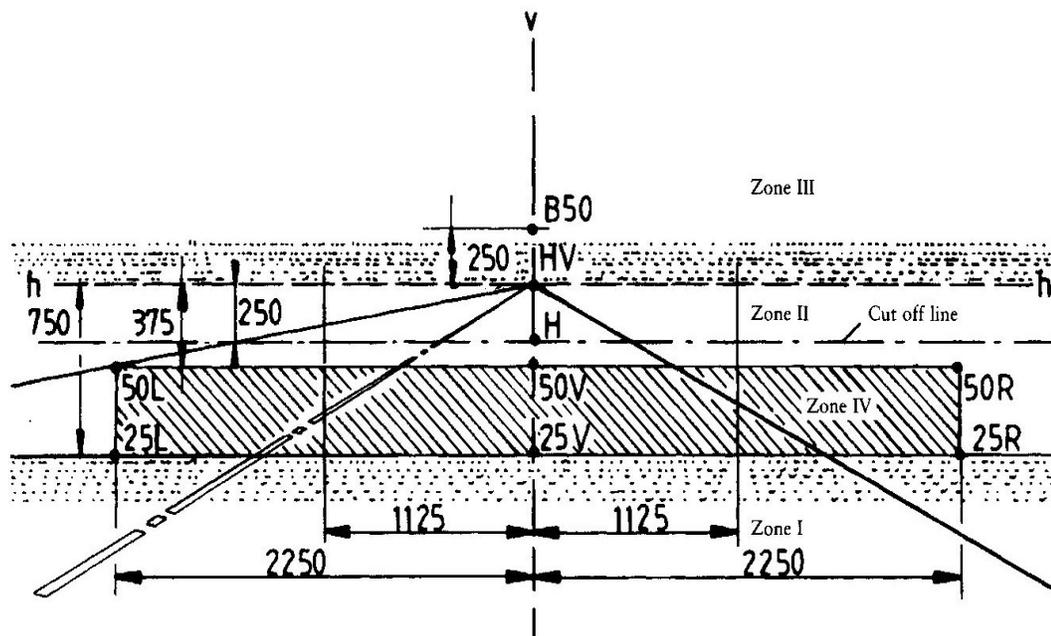


Annex E (See C1.2 of Annex C)

Head Lamps Emitting Driving Beam and Symmetrical Dipped Beam Using S1 or S2 Category Lamps

- E1** A measuring screen as described in **Figure E1** and a reference lamp of S1 or S2 category shall be used in order to check the illumination provided by the headlamp. (See **C8.2** of Annex C)
- E2** The dipped beam shall produce a cut-off of such sharpness that correct adjustment- by means thereof is a practical possibility. The cut-off shall be as straight and as- horizontal as possible over a horizontal length of at least $\pm 5^\circ$. When adjusted in accordance with **Figure E1** headlamps shall meet the conditions set out therein

Figure E1 : Measuring and Adjusting Screen (See E1,E2)
(Dimensions in mm over a distance of 25m)



- E3** The light distribution shall not vary in lateral terms in a way that impairs good-visibility.
- E4 Photometric Tests**
- E4.1** For adjustment purposes the relevant screen shall be placed at least 10 m in front of the headlamp, line h-h being horizontal. For the measurements the photocell shall be 25 m in front of the headlamp and at right angles to the line joining the incandescent filament lamp and point HV.
- E4.2** In lateral terms the headlamp shall be aligned in such a way that the distribution of the driving beam is symmetrical in relation to line v-v.
- E4.3** In vertical terms the headlamp shall be adjusted in such way that the dipped beam cut-off is 250 mm below line h-h (at a distance of 25 m).

- E4.4** When the headlamp has been adjusted in accordance with paragraphs **E4.1**, **E4.2** and **E4.3**, conditions for which are similar to those relating to driving beams, the following conditions shall be met:
- E4.4.1** The luminous centre of the driving beam shall not be more than 0.6° above or below line h-h;
- E4.4.2** The illumination provided by the driving beam shall reach its maximum value (E_{\max}) at the centre of the entire light distribution and diminish laterally;
- E4.4.3** The maximum illumination (E_{\max}) of the driving beam shall be at least 32 lux;
- E4.4.4** The illumination produced by the driving beam shall correspond to the following values:
- E4.4.4.1** The point of intersection between lines h-h and v-v, HV shall lie within the isolux for 90 % of maximum illumination.
- E4.4.4.2** Starting from HV horizontally to the right and left the illumination provided by the driving beam shall be at least 12 lux up to a distance of 1.125 m and not less than 3 lux up to a distance of 2.25 m.
- E4.4.5** The illumination provided by the dipped beam shall correspond to the values given in Table **E1**.

Table E1: Illumination provided by the dipped beam (See E4.4.5)

Measuring point	Illumination (Lux)
Any point on and above line h-h	≤ 0.7
Any point on the line 50L-50R with exception of 50V ⁽¹⁾	≥ 1.5
Point 50V	≥ 3.0
Any point on the line 25L-25R	≥ 3.0
All points within zone IV	≥ 1.5
⁽¹⁾ Ratio of intensity measured at 50R and 50V (50R/50V) shall be 0.25 minimum	

Annex F (See C1.3 of Annex C)
**Headlamps Emitting Driving Beam and an Asymmetrical Dipped Beam Using
 Filament Lamps of Category R2 or Halogen Lamps Category HS1**

- F1** A measuring screen placed vertically at distance of 25 m in front of the headlamp, as shown in Figure **F1**, and a reference lamp of R2 or HS1 category shall be used in order to check the illumination provided by the headlamp. (See **C7.2 of Annex C**)
- F2 Suitability for Traffic**
- F2.1** Headlamps shall be designed in such a way as to meet the requirement of driving on the left side of the road.
- F3.0 Alignment of Headlamp for Checking Illumination Requirements**
 The headlamp shall be aligned in such a way that:
- F3.1** The cut-off in the right-hand half of the screen shall be horizontal.
 The setting screen shall be sufficiently wide to permit examination of the cut-off over at least 5° on each side of line v-v.
- F3.2** On the screen this horizontal part of the cut-off shall be 25 cm below the horizontal plane dipped through the focal centre of the headlamp (see **Figure F1**).
- F3.3** The tip of the cut-off shall be on straight-line v-v. If the beam does not have a cut-off, a clear 'elbow' lateral setting shall be presented in such a way as best to meet the illumination requirements applying to points 75 R and 50 R for driving on the right and point 75 L and 50 L for driving on the left.
- F4.0 Illumination Requirements – General**
- F4.1** The headlamp shall be considered acceptable if it meets the requirements set out below with at least one standard filament lamp which may be presented together with the headlamp.
- F4.2** Headlamps shall be designed in such a way that, with adequate HS1 or R2 lamps, they provide adequate illumination without dazzle in the case of dipped beam and good illumination in the case of driving beam.
- F4.3** When aligned in this manner the headlamp shall meet the requirements referred to in **F5** and **F6**
- F4.4** Where a headlamp aligned as referred to above does not meet the requirements of **F5** and **F6**, it is permissible to alter the setting provided that the axis of the beam is not moved sideways by more than 1° (= 44 cm) to the right or left. The incorrect setting limit of 1° to the right or left is not compatible with a vertical incorrect setting upwards or downwards which is restricted only by the requirements laid down in **F6**
 However, the horizontal part of the cut-off shall not go beyond line h-h. In order to make settings easier by means of the cut-off it is permissible partly to mask the headlamp in order to make the cut-off more distinct.

F5 Requirement Relating to the Dipped Beam

- F5.1** The dipped beam shall produce a cut-off of such distinctness that it is possible to carry out adjustments correctly using the said cut-off. The cut-off shall be a straight horizontal line on the side opposite to the rule of the road for which the headlamp is intended (See **F3.1**). On the other side the cut-off shall not go beyond either broken line HV-H1 and H4 formed by a straight line formed by HV-H1 lying at an angle of 45° with the horizontal and a straight line H1-H4 offset by 1 % in relation to straight line h-h, or straight line HV-H3 inclined by 15° to the horizontal (see Figure **F1**). In no case is a cut-off going beyond both line HV-H2 and line H2-H4 and resulting from the combination of the two preceding possibilities acceptable.
- F5.2** The illumination produced on the screen by the dipped beam shall meet the requirements set out in **table F1**
- F5.3** In none of the zones I, II, III and IV shall there be lateral variations that impair good visibility.

Table F1: Illumination provided by the dipped beam (See F5.2)

Measuring point- Headlamps for left hand traffic	Illumination (Lux)
Point B 50 R	≤ 0.3
Point 75 L	≥ 6
Point 50 L	≥ 6
Point 25 R	≥ 1.5
Point 25 L	≥ 1.5
Any point in Zone III	≤ 0.7
Any point in Zone IV	≥ 2
Any point in Zone I	≤ 20

F6 Requirements Concerning the Driving Beam

- F6.1** The illumination produced on the screen by the driving beam shall be measured using the same headlamp setting as for the measurements defined in **F4** and **F5**.
- F6.2** The illumination produced on the screen by the driving beam shall meet the following requirements:
- F6.3** Point of intersection HV of lines h-h and v-v shall be at the isolux representing 90 % of maximum illumination. Maximum value (E_{max}) shall be at least 32 lux. Its value shall not exceed 240 lux.
- F6.4** Starting from the HV point horizontally to the right and to the left, the illumination shall be at least 16 lux at a distance of 1.125 m and at least equal to 4 lux up to a distance of 2.25 m.
- F7.0 Reference (Standard) Head Lamp**
A headlamp is deemed to be a reference (standard) headlamp if it:
- F7.1** Meets the component type-approval requirements set out below;

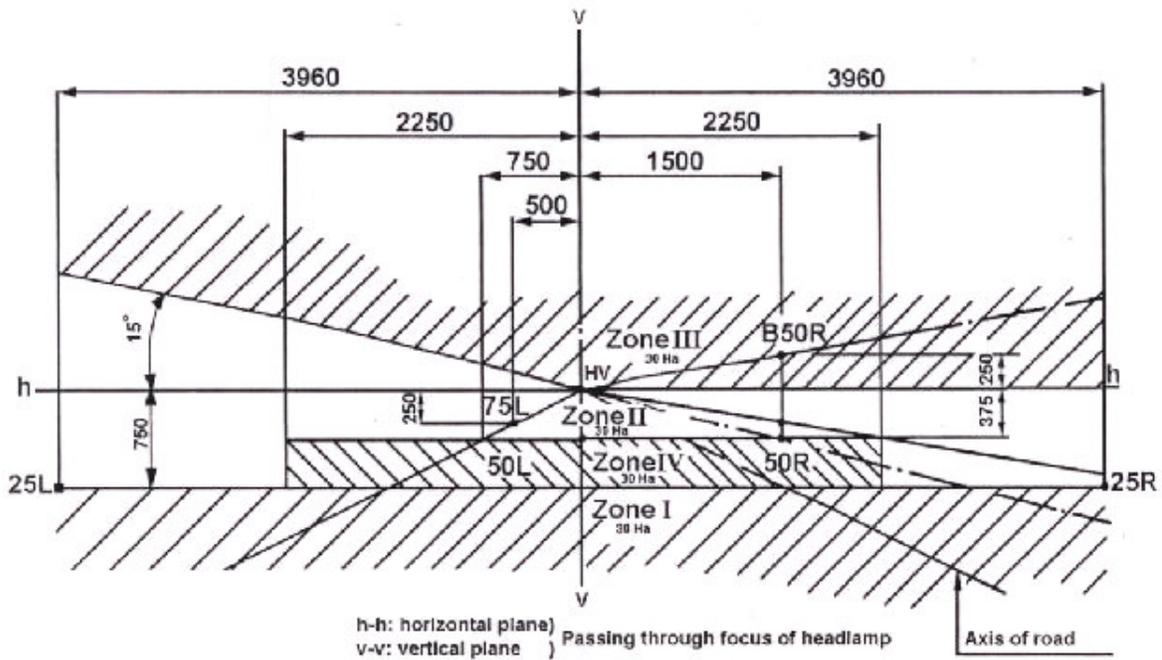
F7.2 Has an effective diameter of at least 160 mm;
 Provides illumination, with a reference lamp, at various points within the

F7.3 various areas provided for in **F5.2**;

F7.3.1 Which is at least 90 % of the maximum values, and

F7.3.2 At least 120 % of the minimum limits as required by **F5.2**,

Figure F1: Measuring Screen for Uniform European Beam for left hand traffic (With R2/HS1 category of filament lamp) (See F1)
 (Dimensions in mm with screen 25 m distance)



Annex G (See C1.4 of Annex C)

**Headlamps, Emitting an Asymmetrical Dipped Beam and Driving Beam Using
Halogen Lamps of Category H1, H3, HB3, HB4, H7 and/or H4**

G1 Headlamps shall be made in such a way that, with appropriate filament lamps, they provide adequate illumination without dazzle in the case of the dipped beam and good illumination in the case of the driving beam.

A measuring screen placed vertically at distance of 25 m in front of the headlamp, as shown in Figure **G1** and a reference lamp of appropriate category shall be used in order to check the illumination provided by the headlamp. (See **C7.2** of **Annex C**.)

The headlamp is deemed satisfactory if the photometry requirements are met with at least one reference filament lamp, which may be supplied with the headlamp.

G2 Suitability for Traffic

G2.1 Headlamps shall be designed in such a way as to meet the requirement of driving on the left side of the road.

G3.0 Head Lamps Equipped with Single-Filament Halogen Lamps (H1, H3, HB3, HB4 or H7)

On headlamps designed to provide alternately a driving beam and a dipped beam, any mechanical, electro-mechanical or other device incorporated in the headlamp for switching from one beam to the other shall be so constructed that:

G3.1 The device is strong enough to be worked 50 000 times without suffering damage despite the vibration to which it may be subjected in normal use;

G3.2 In the case of failure it is possible to obtain the dipped beam automatically;

G3.3 Either the dipped beam or the driving beam can always be obtained without any possibility of the mechanism stopping in between the two positions;

G3.4 The user cannot, with ordinary tools, change the shape or position of the moving parts.

G3.5 The requirement specified in **G3.1** to **G3.4** shall not be applicable to the control switch.

G4.0 Aiming of the Headlamp

G4.1 The cut-off in the right-hand half of the screen shall be horizontal.

The setting screen shall be sufficiently wide to permit examination of the cut-off over at least 5° on each side of line v-v.

G4.2 This horizontal part of the cut-off is situated 25 cm below the line h-h (see Fig **G1**).

- G4.3** The dipped beam shall produce a sufficiently sharp cut-off to permit satisfactory adjustment with its aid. The cut-off shall be horizontal straight line on the side opposite to the direction of traffic for which the headlamps is intended (See **G4.1**); on the other side it shall extend neither beyond the broken line H-V, H1-H4 formed by a straight line HV-H1 standing at an angle of 45° to the horizontal and a straight line H1-H4 lying 25 cm above the straight line hh, nor beyond the straight line HV-H3, inclined at an angle of 15° above the horizontal (see Figure **G1**). A cut-off extending beyond both line HV-H2 and H2-H4 and resulting from a combination of the above two possibilities shall in no circumstances be permitted.
- G4.4** The limit of re-alignment of 1° towards the right or left is not incompatible with upward or downward vertical re-alignment. The latter is limited only by the requirements laid down in **G6**. However, the horizontal part of the cut-off should not extend beyond the line h-h (the provisions of **G6** are not applicable for headlamps intended to meet the requirements for dipped beam only).
- G4.5** The elbow of the cut-off is on line v-v.
- G4.6** If, in the case of headlamp designed to satisfy the requirement with respect to dipped beam only, the focal axis diverges appreciably from the general direction of the beam, or if, whatever the type headlamp (dipped only or combined dipped and driving), the beam does not have a cut-off with a clear elbow, the lateral adjustment shall be affected in the manner which best satisfies the requirements for illumination at the points 75L and 50L for left hand traffic.
- G4.7** When so aimed the headlamp need, if its approval is sought solely for a dipped beam shall comply only with the requirements referred to in **G5**.
- When so aimed the headlamp need, if its approval is sought solely for a driving beam shall comply only with the requirements referred to in **G6**.
- When so aimed the headlamp need, if its approval is sought for a dipped beam and driving beam, it shall comply only with the requirements referred to in **G5 & G6**.
- A headlamp designed to emit a dipped beam may incorporate a driving beam not complying with this specification.
- G4.8** Where a headlamp so aimed does not meet the requirements **G5** and **G6**, its alignment may be changed provided that the axis of the beam is not laterally displaced by more than 1° (= 44 cm) to the right or left (See also **G4.4**).
- To facilitate adjustment by means of the cut-off, the headlamp may be partially occluded in order to sharpen the cut-off. (See also **G4.4**)
- G5.0 Provisions Regarding Dipped Beam**
- G5.1** The illumination produced on the screen by the dipped beam shall meet the requirements spiced in Table **G1** and the following requirements:
- G5.2** There shall be no lateral variations detrimental to good visibility in any of the zones I, II, III and IV.
- G5.3** The illumination values in zones “A”&“B” as shown in figure **G2** shall be checked by the measurement of the photometric values of points 1 to 8 on this figure. These values shall lie within the following limits

$1 + 2 + 3 \geq 0.3$ lux, and
 $4 + 5 + 6 \geq 0.6$ lux, and
 $0.7 \text{ lux} \geq 7 \geq 0.1$ lux and
 $0.7 \text{ lux} \geq 8 \geq 0.2$ lux

Table G1: Illumination provided by the dipped beam

Measuring point Headlamps for left hand traffic	Illumination (Lux)
Point B 50 R	≤ 0.4
Point 75 L	≥ 12
Point 75 R	≤ 12
Point 50 R	≤ 15
Point 50 L	≥ 12
Point 50 V	≥ 6
Point 25 R	≥ 2
Point 25 L	≥ 2
Any point in Zone III	≤ 0.7
Any point in Zone IV	≥ 3
Any point in Zone I	$\leq 2 \times (E_{50R} \text{ or } E_{50L})^{(1)}$
⁽¹⁾ E_{50R} and E_{50L} are the illuminations actually measured at points “B 50 R” and “B 50 L” respectively.	

G6.0 Provisions Regarding Driving Beams

G6.1 The illumination produced on the screen by the driving beam shall meet the following requirements:

G6.2 In the case of a headlamp designed to provide a driving beam and a dipped beam, measurements of the illumination produced on the screen by the driving beam shall be taken with the same headlamp alignment as for measurements under **G4**. In the case of a headlamp providing a driving beam only, it shall be adjusted that the area of maximum illumination is centered on the point of intersection of the lines h-h and v-v.

G6.3 The point of intersection (HV) of lines h-h and v-v shall be situated within the isolux representing 90 % of maximum illumination. This maximum value (E_{max}) shall be not less than 48 lux. The maximum value shall in no case exceed 240 lux. Moreover, in the case of a combined dipped and driving headlamp, this maximum value shall not be more than 16 times the illumination measured for the dipped beam at point 75 R (or 75 L).

G6.4 the maximum luminous intensity (I_{max}) of the driving beam expressed in thousands of candelas shall be calculated by means of the formula:

$$I_{max} = 0.625 E_{max}$$

Figure G1: Measuring Screen for Uniform European Beam for Left hand traffic (See G1)

(Dimensions in millimeter with screen at 25m distance)

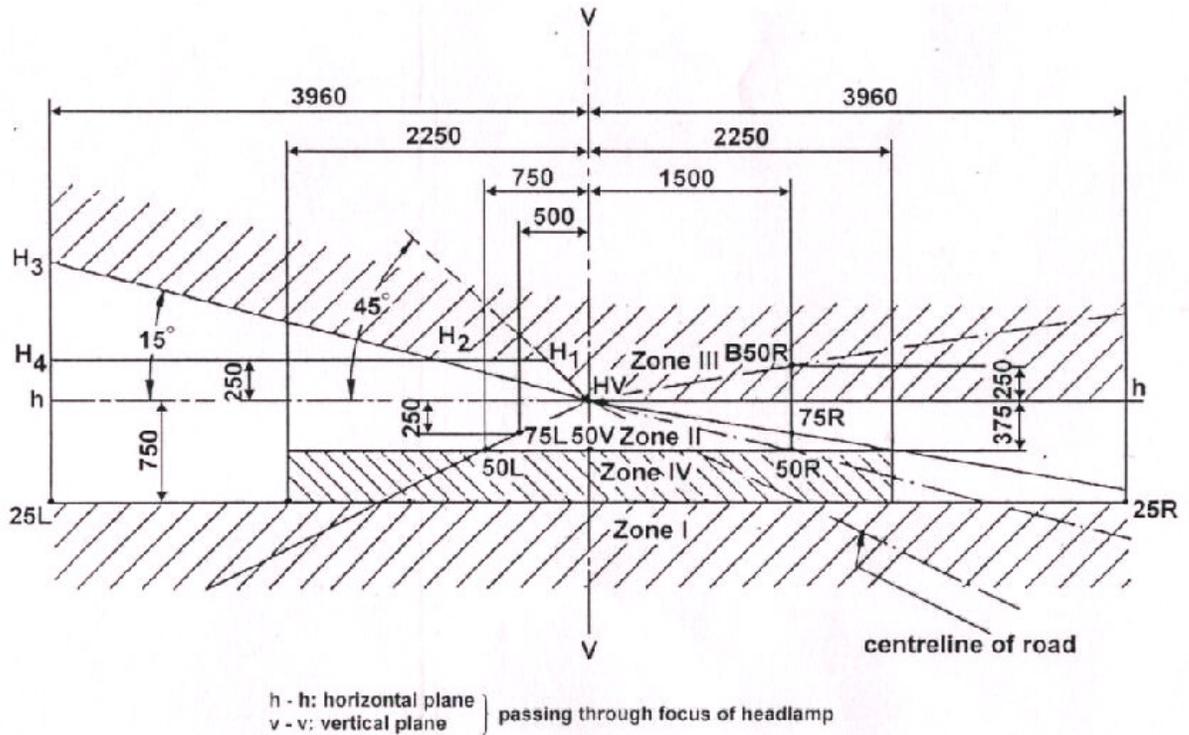
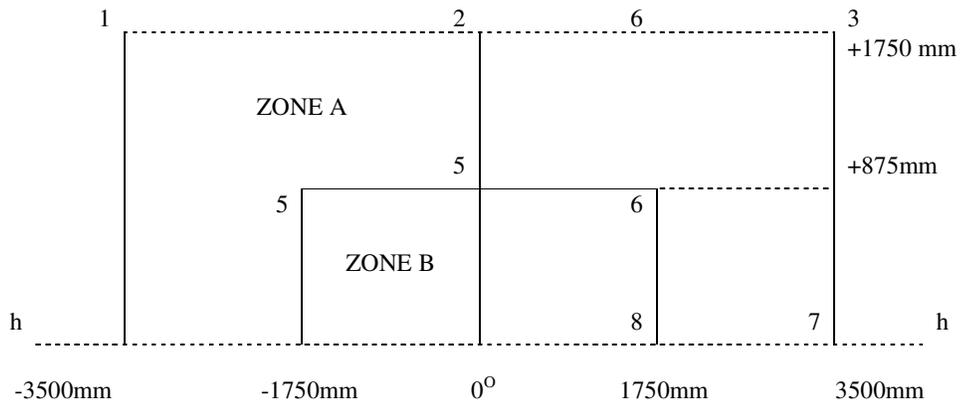


Figure G2. Measuring points for Illumination Values (See G5.3)



G6.5 the reference mark (I'_{max}) indicating this maximum intensity and referred to in **C9.5.3** of **Annex C** shall be obtained by means of the formula:

$$I'_{max} = \frac{I_{max}}{3} = 0.208 E_{max}$$

This value being rounded to whichever is the nearest of the following: 7.5, 10, 12.5, 17.5, 20, 25, 27.5, 30, 37.5, 40, 45, 50.

G6.6 Starting from the HV point horizontally to the right and left, the illumination shall not be less than 24 lux up to a distance of 1.125 m and not less than 6 lux up to a distance of 2.25 m.

G7.0 Standard Headlamp

A headlamp is deemed to be a standard (reference) headlamp if it:

G7.1 satisfies the above mentioned requirements for approval;

G7.2 has an effective diameter of not less than 160 mm;

G7.3 provides with a standard filament lamp, at the various points and in the various zones referred to in **G5.1**, illumination equal to:

G7.3.1. not more than 90 % of the maximum limits and

G7.3.2. not less than 120 % of the minimum limits prescribed.

Annex H (See C5.0 of Annex C)
Tests on the Stability of the Photometric Performance of
Headlamps in Operation

- H1** Once the photometric values have been measured according to the requirements of the relevant annexes, in points Emax for driving beam and HV, 50 R, B 50 L for dipped beam (or HV,50 L, B 50 R for headlamps designed for left-hand traffic) a complete headlamp sample is tested for stability of photometric performance in operation.
“Complete headlamp” is understood to mean the complete lamp itself including those surrounding body parts and lamps which could influence its thermal dissipation.
- H2** The tests are carried out in a dry and still atmosphere at an ambient temperature of $27\text{ °C} \pm 5\text{ °C}$, the complete headlamp being mounted on a base representing the correct installation on the vehicle.
- H3** **Test procedure for Clean Headlamp**
- H3.1. Operating the Headlamp**
The headlamp is operated for a specified time, which is 12 hours for tests with clean headlamps, so that:
- H3.1.1** In case where only one lighting function (driving or dipped beam) is to be approved, the corresponding filament is for operated for a period of the specified time (See also **H3.1.4**)
- H3.1.2** In the case of a reciprocally incorporated dipped beam lamp and driving lamp (dual-filament lamp or two filament lamps):
- H3.1.2.1** If the applicant declares that the headlamp is to be used with a single filament lit (See also **H3.1.5**), the test is carried out in accordance with this condition activating (See also **H3.1.4**) each specified function successively for half the specified time.
- H3.1.2.2** In all other cases (See also **H3.1.4** and **H3.1.5**), the headlamp is subjected to the following cycle until the specified time is reached:
- 15 minutes, dipped beam filament lit
 - 5 minutes, all filaments lit,
- H3.1.3** In the case of grouped lighting functions all the individual functions shall be lit simultaneously for the time specified for individual lighting functions (**H3.1.1**) also taking into account the use of reciprocally incorporated lighting functions (**H3.1.2**), according to the manufacturer' s specifications.
- H3.1.4** When tested headlamp is grouped and/or reciprocally incorporated with signalling lamps, the latter shall be it for the duration of the test. In case of a direction indicator lamp, it shall lit in flashing operation mode with an on/off time ratio of approximately one to one.
- H3.1.5** If two or more lamp filaments are simultaneously lit when the headlamp flashing is used, this is not considered as being normal use of the filament simultaneously

H3.2 Test Voltage

The voltage shall be adjusted so as to supply 90 % of the maximum wattage specified for the category of filament lamp in AIS 034. The applied wattage shall in all cases comply with the corresponding value of a filament lamp of 12 V rated voltage, except if the manufacturer specifies that the headlamp may be used at a different voltage. In the latter case, the test is carried out with the filament lamp whose wattage is the highest that can be used.

H4.0 Test Results for Clean Headlamp

After testing as per **H3**, the headlamp shall meet the following requirements:

H4.1 Visual Inspection

Once the headlamp has been stabilized to the ambient temperature, the headlamp lens and the external lens, if any, shall be cleaned with a clean, damp cloth. It shall then be inspected visually; no distortion, deformation, cracking or change in colour of either the headlamps or the external lens, if any, shall be noticeable.

H4.2 Photometric Test**H4.2.1** The photometric values shall be measured at the following points:**H4.2.1.1** Dipped beam:

- 50 L - B 50 R - HV for headlamps designed for left-hand traffic.

H4.2.1.2 Driving beam:

- Point of Emax.

H4.2.2 Adjustment may be carried out to allow for any deformation of the headlamp base due to heat (the change of the position of the cut-off line is covered in **H6**).**H4.2.3** A 10 % discrepancy between the photometric characteristics and the values measured prior to the test is permissible, including the tolerances of the photometric procedure.**H5 Tests for Dirty Headlamp****H5.1** After being tested as specified in **H3** and **H4**, the headlamp shall be operated for a specified time of one hour after being prepared as per **H5.2**. The cycle of operations shall be same as those specified in **H3**, except that the specified time is one hour instead of 12 hours.**H5.2 Application of Test Mixture on the Headlamp**

The test mixture described in **H5.3** shall be uniformly applied to the entire light-emitting surface of the headlamp and then left to dry. This procedure is repeated until the illuminating value has dropped to 15 - 20 % of the values measured for each following point under the conditions described in paragraph **H2**:

- a) Emax in driving beam for a driving/dipped lamp.
- b) Emax in driving beam for a driving lamp only.
- c) 50 L and 50 V for a dipped lamp only, designed for left-hand traffic. (50 V is situated 375 mm below HV on the vertical line v-v on the screen at 25 distance)

H5.3 Test Mixture

The mixture of water and polluting agent to be applied to the headlamp shall be composed of nine parts (by mass) of silica sand with a grain size distributed between 0 and 100 µm, one part (by mass) of vegetal carbon dust of a grain size distributed between 0 and 100 µm, 0.2 (by mass) of NaCMC and an appropriate quantity of distilled water, the conductivity of which is lower than 1 mS/m for the purpose of this test.

NaCMC represents sodium salt carboxymethylcellulose, customarily referred to as CMV. The NaCMC used in the dirt mixture shall have a degree of substitution (DS) of 0.6-0.7 and a viscosity of 200-300 cP for a 2% solution at 20°C.

The mixture shall not be more than 14 days old.

H5.4 After operation as per **H5.1**, the conditions given in **H4.2** shall be complied.

H5.5 The measuring equipment shall be equivalent to that used during headlamp approval tests. A standard (reference) filament lamp is used for the photometric verification.

H6.0 Test for Change in Vertical Position of the Cut-off Line Under the Influence of Heat

H6.1 This test consists of verifying that the vertical drift of the cut-off line under the influence of heat does not exceed a specified value for an operating dipped lamp.

The headlamp tested in accordance with requirements given in **H3** shall be subjected to the test described in **H6.2** without being removed from or readjusted in relation to its test fixture.

H6.2 Test

The test shall be carried out in a dry and still atmosphere at an ambient temperature of 27 °C ± 5 °C.

Using a production filament lamp, which has been aged for at least one hour the headlamp is operated on dipped beam without being removed from or readjusted in relation to its test fixture. (For the purpose of this test, the voltage shall be adjusted as specified in **H3.2**.)

The position of the cut-off line in its horizontal part (between VV and the vertical line passing through point B 50 R for left-hand traffic shall be verified 3 minutes (r3) and 60 minutes (r60) after operation.

The measurement of the variation in the cut-off line position as described above is carried out by any method giving acceptable accuracy and reproducible results.

H6.3 Test Results

H6.3.1 The result expressed in milliradians (mrad) is considered as acceptable when the absolute value $\Delta r_1 = |r_3 - r_{60}|$ recorded on the headlamp is not more than 1.0 mrad ($\Delta r_1 \leq 1.0$ mrad).

H6.3.2 However, if this value is more than 1.0 mrad but not more than 1.5 mrad ($1.0 \text{ mrad} < \Delta r_1 \leq 1.5 \text{ mrad}$) a second head lamp shall be tested as described in **H6.2** after being subjected three consecutive times to the cycle as described below, in order to stabilize the position of mechanical parts of the headlamp on a base representative of the correct installation on the vehicle:

- Operation of the dipped beam lamp for one hour (the voltage shall be adjusted as specified in **H3.2**)
- Period of rest for one hour

H6.3.3 The headlamp type is considered as acceptable if the mean value of the absolute values of Δr_1 measured on the first sample and Δr_{11} measured on the second sample is not more than 1.0mrad.

$$\text{i.e.} \quad \frac{\Delta r_1 + \Delta r_{11}}{2} \leq 1.0\text{mrad}$$

**Annex J (See C6.1)
Requirements for Lamps Incorporating Lenses of Plastic Material and Testing of
Lens or Material Samples and of Complete Lamps**

J1. General Specifications

- J1.1.** The samples of lens of plastic material or the material as applicable shall comply with the requirements of **J2.1.1** to **J2.1.6**
- J1.2.** The two samples of complete lamps shall comply with the requirements of **J2.1.7** and **J2.1.8**
- J1.3** Samples of lenses of plastic material or samples of material shall be subjected with the reflector to which they are intended to be fitted (where applicable) to approval tests in the chronological order indicated in table **J1**.
- J1.4.** However, if the lamp manufacturer can prove that the product has already passed the tests prescribed in **J2.1.1** to **J2.1.6** below, or the equivalent tests pursuant to AIS 012, those tests need not be repeated; only the tests prescribed in **J2.1.7** and **J2.1.8** are mandatory.

J2. Tests

J2.1 The following are the tests to be conducted:

	Tests	On	Refer
J2.1.1	Resistance to temperature changes	Lens	J3
J2.1.2	Resistance to atmospheric agents	Lens or material	J4
J2.1.3	Resistance to chemical agents	Lens or material	J5
J2.1.4	Resistance to detergents and hydrocarbons	Lens or material	J6
J2.1.5	Resistance to mechanical deterioration	Lens	J7
J2.1.6	Test of adherence of coatings, if any	Lens	J8
J2.1.7	Resistance to mechanical deterioration	Complete headlamp	J9.1
J2.1.8	Test of adherence of coatings, if any	Complete headlamp	J9.2

J2.2 The test plan for the above tests is given in Table **J1** and **J2**.

J3 Resistance to Temperature Changes

J3.1 Conditioning

J3.1.1 Three new samples (lenses) are subjected to five live cycles of temperature and humidity (RH = relative humidity) change in accordance with the following cycle:

Duration (hour)	At Temperature (°C)	And Relative Humidity (%RH)
3	40 ± 2	85 to 95
1	23 ± 5	60 to 75
15	-30 ± 2	
1 ⁽¹⁾	23 ± 5	60 to 75
3	80 ± 2	
1	23 ± 5	60 to 75

⁽¹⁾ The periods of one hour at 23 °C ± 5 °C shall include the periods of transition from one temperature to another which are needed in order to avoid thermal shock effect.

J3.1.2 Before this test, the samples shall be kept at $27\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and 60 %-75 % RH for at least four hours.

J3.2 Photometric Measurements

J3.2.1 Photometric measurements shall be carried out on the samples before and after the test.

J3.2.2 These measurements shall be made using a standard lamp, at the following points:

B 50 L and 50 R for the dipped beam of a dipped beam lamp or a dipped/driving lamp (B 50 R and 50 L in the case of headlamps intended for left-hand traffic) or B 50 and 50 R/L in the case of symmetrical dipped beam;

E_{max} route for the driving beam of a driving lamp or a dipped/driving lamp

J3.3 Results

The variation between the photometric values measured on each sample before and after the test shall not exceed 10 % including the tolerances of the photometric procedure.

J4 Resistance to Atmospheric Agents

J4.1 Initial Measurements

The diffusion (T_4) and transmission (T_2) of light shall be measured on three new samples (lenses or samples of material) as per the procedure prescribed in **J11**.

J4.2 Treatment

J4.2.1 These samples shall be exposed to radiation from a source having a spectral energy distribution similar to that of a black body at a temperature between 5500 K and 6 000 K.

Appropriate filters shall be placed between the source and the samples so as to reduce as far as possible radiations with wave lengths smaller than 295 nm and greater than 2 500 nm.

The samples shall be exposed to an energetic illumination of $1\ 200\ \text{W}/\text{m}^2 \pm 200\ \text{W}/\text{m}^2$ for a period such that the luminous energy that they receive is equal to $4\ 500\ \text{MJ}/\text{m}^2 \pm 200\ \text{MJ}/\text{m}^2$.

Within the enclosure, the temperature measured on the black panel placed on a level with the samples shall be $50\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. In order to ensure a regular exposure, the samples shall revolve around the source of radiation at a speed of between 1 and 5 r/min.

J4.2.2 The samples are sprayed with distilled water of conductivity lower than 1 mS/m at a temperature of $27\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, in accordance with the following cycle:

- spraying: 5 minutes
- drying: 25 minutes

J4.3 Requirements

J4.3.1 After the test for resistance to atmospheric agents, the outer face of the samples shall be free from cracks, scratches, chipping and deformation.

J4.3.2 The transmission (T_3) of light shall be measured on these samples as per the procedure prescribed in **J11**

The mean variation in transmission Δ_{tM} shall not exceed 0.020. ($\Delta_{tM} \leq 0.020$)

Where Δ_{tM} is the arithmetic average of Δ_t for each of the three samples tested. Δ_t is calculated as shown below for each sample

$$\Delta_t = \frac{T_2 - T_3}{T_2}$$

J5.0 Resistance to Chemical Agents

J5.1 After the tests and measurements described in **J4** have been carried out, the outer face of the said three samples is treated as described in **J5.3** with the mixture defined in **J5.2**.

J5.2 Test Mixture

The test mixture is composed of 61.5 % n-heptane. 12.5 % toluene. 7.5 % ethyl tetrachloride. 12.5 % trichlorethylene and 6 % xylene (% volume).

J5.3 Application of the Test Mixture

J5.3.1 A piece of cotton cloth is soaked (as per ISO 105) until the mixture is saturated as defined in **J5.2** and within 10 seconds, applied for 10 minutes to the outer face of the sample at a pressure of 50 N/cm², corresponding to an effort of 100 N applied on a test surface of 14 × 14 mm.

J5.3.2 During this 10 minute period, the cloth pad shall be soaked again with the mixture so that the composition of the liquid applied is continuously identical with that of the test mixture prescribed.

J5.3.3 During the period of application, it is permissible to compensate the pressure applied to the sample in order to prevent it from causing cracks.

J5.4 Cleaning

J5.4.1 At the end of the application of the test mixture, the samples shall be dried in the open air and then washed with the solution described in **J6.3** (Resistance to detergents) at 27 °C ± 5 °C.

J5.4.2 Afterwards the samples shall be carefully rinsed with distilled water containing not more than 0.2 % impurities at 27 °C ± 5 °C and then wiped off with a soft cloth.

J5.5 Requirements

J5.5.1 After the test of resistance to chemical agents, the samples shall not bear any traces of chemical staining likely to cause a variation of flux diffusion more than those prescribed below.

J5.5.2 The diffusion (T_5) of light shall be measured on these samples as per the procedure prescribed in **J11**.

J5.5.3 The mean variation in diffusion Δ_{dM} shall not exceed 0.020. ($\Delta_{dM} \leq 0.020$).

Where Δ_{dM} is the arithmetic average of Δ_d for each of the three samples tested. Δ_d is calculated as shown below for each sample

$$\Delta_d = \frac{T_5 - T_4}{T_2}$$

J6 Resistance to Detergents and Hydrocarbons
Initial Measurements

J6.1 The transmission (T_2) of light shall be measured on three new samples (lenses or samples of material) as per the procedure prescribed in **J11**

J6.2 Treatment for Resistance to Detergents

The outer face of three samples (lenses or samples of material) is heated to $50\text{ }^\circ\text{C} \pm 5\text{ }^\circ\text{C}$ and then immersed for five minutes in a mixture maintained at $27\text{ }^\circ\text{C} \pm 5\text{ }^\circ\text{C}$ and composed of 99 parts distilled water containing not more than 0.02 % impurities and one part alkylaryl sulphonate.

After this, the samples are dried at $50\text{ }^\circ\text{C} \pm 5\text{ }^\circ\text{C}$. the surface of the samples is cleaned with a moist cloth.

J6.3 Treatment for Resistance to Hydrocarbons

The outer face of these three samples is then lightly rubbed for one minute with a cotton cloth soaked in a mixture composed of 70 % n-heptane and 30 % toluene (% volume), and then dried in the open air.

J6.4 Results

J6.4.1 After the above two tests have been performed successively, the transmission (T_3) of light shall be measured on these samples as per the procedure prescribed in **J11**

J6.4.2 The mean variation in transmission Δ_{tM} shall not exceed 0.010.
(i.e. $\Delta_{tM} \leq 0.010$)

Where Δ_{tM} is the arithmetic average of Δ_t for each of the three samples tested. Δ_t is calculated as shown below for each sample

$$\Delta_t = \frac{T_2 - T_3}{T_2}$$

J7 Resistance to Mechanical Deterioration

J7.1 Initial Measurements

The diffusion (T_4) and transmission (T_2) of light shall be measured on three new samples (lenses or samples of material) as per the procedure prescribed in **J11**

J7.2 The outer face of these samples (lenses) is subjected to the uniform mechanical deterioration test by the Spray testing method as described below:

J7.3 Spray Testing Method

J7.3.1 Spray Gun

The spray gun used shall be equipped with a nozzle 1.3 mm in diameter allowing a liquid flow-rate of 0.24 ± 0.02 litre/minute at an operating pressure of $6.0 - 0 / + 0.5$ bar. Under these operating conditions the fan pattern obtained shall be $170 \text{ mm} \pm 50 \text{ mm}$ in diameter on the surface exposed to deterioration, at a distance of $380 \text{ mm} \pm 10 \text{ mm}$ from the nozzle.

J7.3.2 Test Mixture

The test mixture is composed of:

Silica sand of hardness 7 on the Mohrs scale, with a grain size between 0 and 0.2 mm and an almost normal distribution, with an angular factor of 1.8 to 2.

Water of hardness not exceeding 205 g/m^3 for a mixture comprising 25 g of sand per litre of water

J7.3.3 Application of Spray

The outer surface of the lamp lenses is subjected once to the action of the sand jet produced as described above. the jet shall be sprayed almost perpendicular to the surface to be tested.

The deterioration is checked by means of one or more samples of glass placed as a reference near the lenses to be tested. The mixture shall be sprayed until the variation in the diffusion of light on the sample or samples measured by the method described in **Annex H** is such that:

$$\Delta_d = \frac{T_5 - T_4}{T_2} = 0.0250 \pm 0.0025$$

Several reference samples may be used to check that the whole surface to be tested has deteriorated homogeneously.

J7.4.0 Requirements

J7.4.1 The transmission (T_3) and diffusion (T_5) of light shall be measured on these samples as per the procedure prescribed in **J11**

J7.4.2 The mean variation in transmission Δ_{tM} shall not exceed 0.100. ($\Delta_{tM} \leq 0.100$)

Where Δ_{tM} is the arithmetic average of Δ_t for each of the three samples tested. Δ_t is calculated as shown below for each sample.

$$\Delta_t = \frac{T_2 - T_3}{T_2}$$

- J7.4.3** The mean variation in diffusion Δ_{dM} shall not exceed 0.050.
(i.e. $\Delta_{dM} \leq 0.050$)

Where Δ_{dM} is the arithmetic average of Δ_d for each of the three samples tested. Δ_d is calculated as shown below for each sample.

$$\Delta_d = \frac{T_5 - T_4}{T_2}$$

J8 Test of Adherence of Coatings, if any

- J8.1** This test is applicable only the lens that has any adherent coating.

J8.2 Preparation of the Sample

A surface of 20 mm × 20 mm in area of the coating of a lens is cut with a razor blade or a needle into a grid of squares approximately 2 mm × 2 mm. The pressure on this blade or needle shall be sufficient to cut at least the coating.

J8.3 Description of the Test

- J8.3.1** An adhesive tape is used with a force of adhesion of 2 N/(cm of width) ± 20 % measured under the standardized conditions specified in **J8.5** to this Annex. This adhesive tape, which shall be at least 25 mm wide, is pressed for at least five minutes to the surface prepared as prescribed in **J8.2**.

- J8.3.2** The end of the adhesive tape is then loaded in such a way that the force of adhesion to the surface considered is balanced by a force perpendicular to that surface. At this stage, the tape is torn off at a constant speed of 1.5 m/s ± 0.2 m/s.

J8.4 Results

There shall be no appreciable impairment of the gridded area. Impairments at the intersections between squares or at the edges of the cuts are permitted, provided that the impaired area does not exceed 15 % of the gridded surface.

J8.5 Adhesive Tape Adherence Test

- J8.5.1** This method determines, the linear force of adhesion of an adhesive tape to a glass plate under standard conditions by measuring the force necessary to unstick an adhesive tape from a glass plate at an angle of 90°.

- J8.5.2** The ambient conditions while carrying out the tests shall be at 27 °C ± 5 °C and 65 % ± 15 % relative humidity (RH).

- J8.5.3** Before the test, the sample roll of adhesive tape shall be conditioned for 24 hours in the specified atmosphere (see section **J8.5.2** above).

- J8.5.4** Five test-pieces each 400 mm long are tested from each roll. These test-pieces are taken from the roll after the first three turns have been discarded.

The five test pieces are taken while the tape is radially unrolled at a speed of approximately 300 mm/s, and the test-pieces are then applied within 15 seconds in the following manner:

- J8.5.5** The tape is applied to the glass plate progressively with a slight lengthwise rubbing movement of the finger, without excessive pressure, in such a manner as to leave no air bubble between the tape and the glass plate.

- J8.5.6** The assembly is left in the specified atmospheric conditions for 10 minutes.
- J8.5.7** About 25 mm of the test-piece is unstuck from the plate in a plane perpendicular to the axis of the test-piece.
- J8.5.8** The plate is fixed and the free end of the tape folded back at 90°. Force is applied in such a manner that the separation line between the tape and the plate is perpendicular to this force and perpendicular to the plate.
- J8.5.9** The tape is then pulled to unstick at a speed of 300±30 mm/s and the force required is recorded.
- J8.5.10** The five values obtained are arranged in order and the median value taken as the results of the measurement. This value is expressed in Newton per centimetre of width of the tape.
- J9** **Tests of the Complete Headlamp Incorporating a Lens of Plastic Material**
- J9.1** **Resistance to Mechanical Deterioration of the Lens Surface**
- J9.1.1** **Tests**
The lens of one headlamp is subjected to the test described in **J7.2** to **J7.3.3**
- J9.1.2** **Results**
After the test, the results of photometric measurements carried out on the headlamp in accordance with this standard shall not exceed by more than 30 % the maximum values prescribed at point B 50 L and HV and not by more than 10 % below the minimum values prescribed at point 75 R (in the case of headlamps intended for left-hand traffic, the points to be considered are B 50 R, HV and 75 L). In the case of the symmetrical dipped beam the points to be considered are B 50 and H.
- J9.2** **Test of Adherence of Coatings, if any**
The lens of a headlamp is subjected to the test described in **J8**.
- J10** **Verification for Establishing Conformity of Production**
- J10.1** With regard to the materials used for the manufacture of lenses, the lamps of a series are recognized as complying with the requirements of this Annex, if:
- J10.1.1** After the test for resistance to chemical agents (see **J5.3** and **J5.4**), and the test for resistance to detergents and hydrocarbons, (see **J6.2** and **J6.3**) the outer face of the samples exhibits no cracks, chipping or deformation visible to the naked eye.
- J10.1.2** After the test described in **J9.1.1**, the photometric values at the points of measurement considered in **J9.1.2** are within the limits prescribed for conformity of production by this standard.
- J10.2** If the test results fail to satisfy the requirements, the tests shall be repeated on another sample of headlamps selected at random.

J11.0 Method of Measurement of the Diffusion and Transmission of Light

J11.1 Equipment (see figure)

The equipment is illustrated in **Figure J1**. The beam of a collimator K with a half divergence is limited by a diaphragm D_T with an opening of 6 mm against which the sample stand is placed.

$$\frac{\beta}{2} = 17.4 \times 10^{-4} \text{ rd}$$

A convergent achromatic lens L₂ corrected for spherical aberrations, links the diaphragm DT with the receiver R; the diameter of the lens L₂ shall be such that it does not diaphragm the light diffused by the sample in a cone with a half top angle

$$\frac{\beta}{2} = 14^\circ$$

An annular diaphragm D_D with angles $\frac{\alpha_0}{2} = 1^\circ$ and $\frac{\alpha_{\max}}{2} = 12^\circ$ is placed in an image focal plane of the lens L₂.

The non-transparent central art of the diaphragm is necessary in order to eliminate the light arriving directly from the light source. It shall be possible to remove the central part of the diaphragm from the light beam in such a manner that it returns exactly to its original position.

The distance L₂ D_T and the focal length F₂ of the lens L₂ shall be so chosen that the image of D₂ completely covers the receiver R.

For L₂ the use of a focal distance of about 80mm is recommended.

When the initial incident flux is referred to 1000 units, the absolute precision of each reading shall be better than 1 unit.

J11.2 Measurement

The measurements given in table J3 are taken:

Table J3: Measurements to be taken. (See J11.2)

Reading	With sample	With central part of D _D	Quantity represented
T ₁	No	No	Incident flux initial reading
T ₂	Yes (Before test)	No	Flux transmitted by the new material in a field of 24°C.
T ₃	Yes (After test)	No	Flux transmitted by the tested material in a field of 24°C.
T ₄	Yes (Before test)	Yes	Flux diffused by the new material
T ₅	Yes (After test)	Yes	Flux diffused by the tested material

Figure J1 (See J11.1) Test Equipment

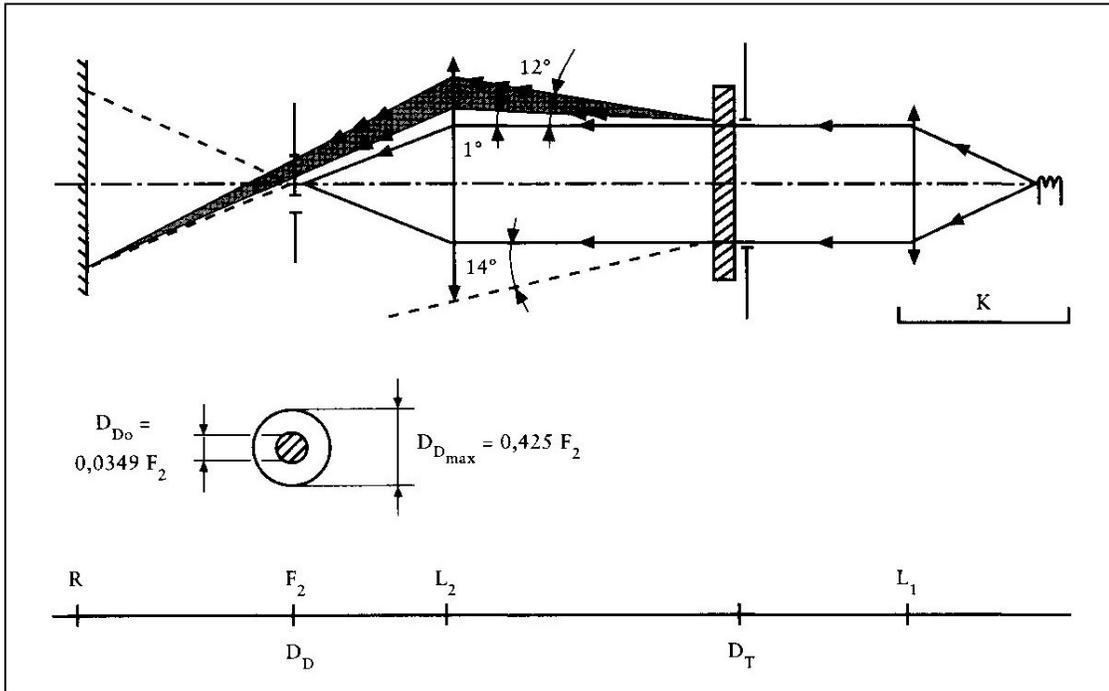


Table J1: Test plan for plastic materials (lenses or samples of material) for establishing conformity for Type Approval (See J2.2)

Tests ↓	Lens or sample material						Lens						
	1	2	3	4	5	6	7	8	9	10	11	12	13
Sample Number ◇													
1. Temperature changes													
– Limited photometry (J3.2.1)	-	-	-	-	-	-	-	-	-	Y	Y	Y	-
– Temperature change (J3.1)	-	-	-	-	-	-	-	-	-	Y	Y	Y	-
– Limited photometry (J3.2.1)	-	-	-	-	-	-	-	-	-	Y	Y	Y	-
2. Atmospheric and chemical agents													
– Transmission measurement (J4.1)	Y	Y	Y	-	-	-	-	-	-	-	-	-	-
– Diffusion measurement (J4.1)	Y	Y	Y	-	-	-	-	-	-	-	-	-	-
– Atmospheric agents (J4.2)	Y	Y	Y	-	-	-	-	-	-	-	-	-	-
– Transmission measurement (J4.3.2)	Y	Y	Y	-	-	-	-	-	-	-	-	-	-
– Chemical Agents (J5.3, J5.4)	Y	Y	Y	-	-	-	-	-	-	-	-	-	-
– Diffusion measurement (J5.5.2)	Y	Y	Y	-	-	-	-	-	-	-	-	-	-
3. Detergents and HC													
– Transmission measurement (J6.1)	-	-	-	Y	Y	Y	-	-	-	-	-	-	-
– Detergents (J6.2)	-	-	-	Y	Y	Y	-	-	-	-	-	-	-
– Hydrocarbons (J6.3)	-	-	-	Y	Y	Y	-	-	-	-	-	-	-
– Transmission measurement (J6.4.1)	-	-	-	Y	Y	Y	-	-	-	-	-	-	-
4. Mechanical deterioration													
– Transmission measurement (J7.1)	-	-	-	-	-	-	Y	Y	Y	-	-	-	-
– Diffusion measurement (J7.1)	-	-	-	-	-	-	Y	Y	Y	-	-	-	-
– Spray testing method (J7.3)	-	-	-	-	-	-	Y	Y	Y	-	-	-	-
– Transmission measurement (J7.4.1)	-	-	-	-	-	-	Y	Y	Y	-	-	-	-
– Diffusion measurement (J7.4.1)	-	-	-	-	-	-	Y	Y	Y	-	-	-	-
5. Adherence (J8)	-	-	-	-	-	-	-	-	-	-	-	-	Y
“-” No tests. “Y” To be tested													

Table J2: Test plan for complete headlamps with plastic lens for establishing conformity for Type Approval (See J2.2)

Tests ↓	Complete headlamp	
	1	2
Sample Number ◇		
1. Mechanical deterioration		
– deterioration (J9.1.1, J7.2)	Y	--
– Limited photometry (J9.1.2)	Y	--
2. Adherence (J9.2, J8)	--	Y
“-” No tests. “Y” To be tested		

K2.3.3 If the results of the tests described above do not meet the requirements, tests shall be repeated using another standard filament lamp.

K2.4 For Headlamps Covered by Annex F and Annex G

With respect to photometric performances, the conformity of mass-produced headlamps are established, when testing photometric performances of any headlamp chosen at random and equipped with a standard filament lamp and complies with **K2.4.1** or **K2.3.2**

In the case of headlamps covered by Annex F and Annex G For values B 50R and Zone III the maximum permitted deviation are given in **K2.4.1**, and **K2.4.2**.

K2.4.1	– B50 R	0.2 lux equivalent 20 % 0.3 lux equivalent 30 %.
	– Zone III	0.3 lux equivalent 20 % 0.45 lux equivalent 30 %.

K2.4.2 For the dipped beam, the prescribed values in Annex are met at HV (with a tolerance of 0.2 lux) and related to that aiming at least one point of each area delimited on the measuring screen (at 25 m) by a circle 15 cm in radius around point B 50 R (with a tolerance of 0.1 lux), 75 R (or L), 50 R (or L), 25 R, 25 L and in the entire area of zone IV which is not more than 22.5 cm above line 25 R and 25 L.

K2.4.3 For the driving beam, HV being situated within the isolux 0.75 E_{max} , a tolerance of + 20 % for maximum values and – 20 % for minimum values is observed for the photometric values at any measuring point specified in **Annex F** or **Annex G**, as applicable.

K2.4.4 If the results of the tests described above do not meet the requirements, the alignment of the headlamp may be changed, provided that the axis of the beam is not displaced laterally by more than 1° to the right or left.

See also **K1.4** and **K1.5**.

K2.5. Photometric Tests

Tests of conformity in this standard shall cover the photometric at the points provided for in the relevant Annexes, the reading being limited to the following points:

K2.5.1 For Headlamps Covered by Annex D
HV, LH, RH, L600 and R600. (See Figure D1)

K2.5.2 For Headlamps covered by Annex E
 E_{max} , HV in the case of the driving beam, and to the points HV, 50R, 50L, in the case of the dipped beam.

K2.5.3 For Headlamps Covered by Annex F and Annex G

K2.5.3.1 E_{max} , HV (see **K2.5.3.2**) HL, HR (see **K2.5.3.3**) in the case of a driving beam, and to points B 50 R, HV, 50 V, 75 L and 25 R in the case of the dipped beam

- K2.5.3.2** When the driving beam is reciprocally incorporated with the dipped beam, HV in the case of the driving beam shall be the same measuring point as in the case of the dipped beam.
- K2.5.3.3** HL and HR: points “hh” located at 1.125 m to the left and to the right of point HV respectively
- K3.0** **Change in Cut Off Line Under Influence of Heat**
Tests of conformity in this standard shall cover the verification of the change in vertical position of the cut-off line under the influence of heat for headlamps covered in Annex E, Annex F and Annex G. The following procedure shall be followed.
- K3.1** One of the sampled headlamps shall be tested according to the procedure described in paragraph **H6.2** of **Annex H** after being subjected three consecutive times to the cycle described in paragraph **H6.3.2.** of **Annex H.**
- K3.2** The headlamp shall be considered as acceptable if Δr does not exceed 1.5 mrad.
- K3.3** If this value exceeds 1.5 mrad but is not more than 2.0 mrad, a second sample shall be subjected to the test after which the mean of the absolute values recorded on both samples shall not exceed 1.5 mrad.
- K4.0** **Test Procedures**
- K4.1** Tests shall generally be carried out in accordance with the methods set out in this standard.
- K4.2** 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.
- K4.3** The application of paragraphs **K4.1** and **K4.2** requires regular calibration of test apparatus and its correlation with measurement made by a competent authority.
- K4.4** In all cases the reference methods shall be those of this standard, particular for the purpose of verification by test agencies.
- K5.0** **Nature of Sampling**
- K5.1** Samples of devices shall be selected at random from the production of a uniform batch. A uniform batch means a set of devices of the same type, defined according to the production methods of the manufacturer.
- K5.2** 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.

K6.0 Criteria Governing Acceptability

K6.2 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 acceptability of his products in order to meet the specification laid down for verification of conformity of devices.

K6.3 The criteria governing acceptability shall be such that, with a confidence level of 95 per cent, the minimum probability of passing a spot check in accordance with **K7** (first sampling) would be 0.95.

K7.0 Verification by the Test Agency

When the tests are being carried out for surveillance audit as per AIS037, the tests for photometric characteristics shall be carried out.

Conditions given in **K1.0**, **K2.0**, **K4.0** and **K5.0** shall also be applicable.

The following are sampling plan and the criteria for deciding conformity.

K7.1 First Sampling

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.

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

K7.2 Conformity Established

The conformity of mass-produced devices is established, if conditions given any one of the clauses **K7.2.1**, **K7.2.2** or **K7.2.3** are satisfied.

K7.2.1 A1: If the deviations of the measured values of sample A, for one device is 0 % and the other device not more than 20 %

K7.2.2 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

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

K7.2.3 Sample A satisfies the conditions of **K2.3.2** and **K2.4.2** as applicable.

K7.3 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) if any one of conditions given clauses **K7.3.1**, **K7.3.2** or **K7.3.3** occurs

K7.3.1 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 %.

- K7.3.2** B2 In the case of A2, if the deviations of the measured values of one device is more than 0%, but not more than 20% and the other device is not more than 20%.
- B3 In the case of A2, if the deviation of the measured values of one device of sample B, is 0 percent and the other device is more than 20 % but not more than 30 %.

K7.3.3 Sample A does not satisfy the conditions of **K2.3.2** and **K2.4.2** as applicable.

K7.4 Withdrawal of Type Approval

The type approval shall be withdrawn) if any one of conditions given clauses **K7.4.1**, **K7.4.2**, **K7.4.3**, **K7.4.4** or **K7.4.5** occurs

- K7.4.1** 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 %.
- A5 If the deviations of the measured values of sample A, for both devices is more than 20 %.
- K7.4.2** 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% an on the other device is more than 20 %.
- K7.4.3** B5 In the case of A2, if the deviations of the measured values of both the devices of sample B, are more than 20 %.
- K7.4.4** 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%.
- K7.4.5** Sample A and Sample B do not satisfy the conditions of **K2.3.2** and **K2.4.2** as applicable.

K7.5 Repeated Sampling

In the case of **K7.3** 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.

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

K7.6 Conformity is Re-established

The conformity of mass-produced devices is established, if conditions given any one of the clauses **K7.6.1**, **K7.6.2** or **K7.6.3** are satisfied.

- K7.6.1** C1 If the deviations of the measured values of sample C, for one device is 0 % and the other device not more than 20 %.

K7.6.2 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 %.

K7.6.3 Sample C satisfies the conditions of **K2.3.2** and **K2.4.2** as applicable.

K7.7 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) if any one of conditions given clauses **K7.7.1** or **K7.7.2** occurs.

K7.7.1 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 %.

K7.7.2 Sample C does not satisfy the conditions of **K2.3.2** and **K2.4.2** as applicable.

K7.8 Withdrawal of Type Approval

The type approval shall be withdrawn) if any one of conditions given clauses **K7.8.1**, **K7.8.2**, **K7.8.3**, **K7.8.4** or **K7.8.5** occurs

K7.8.1 C3 If the deviations of the measured values of sample C, for one device is not more than 20 % and the other device is more than 20 %.

C4 If the deviations of the measured values of sample C, for both devices is not more than 20 %.

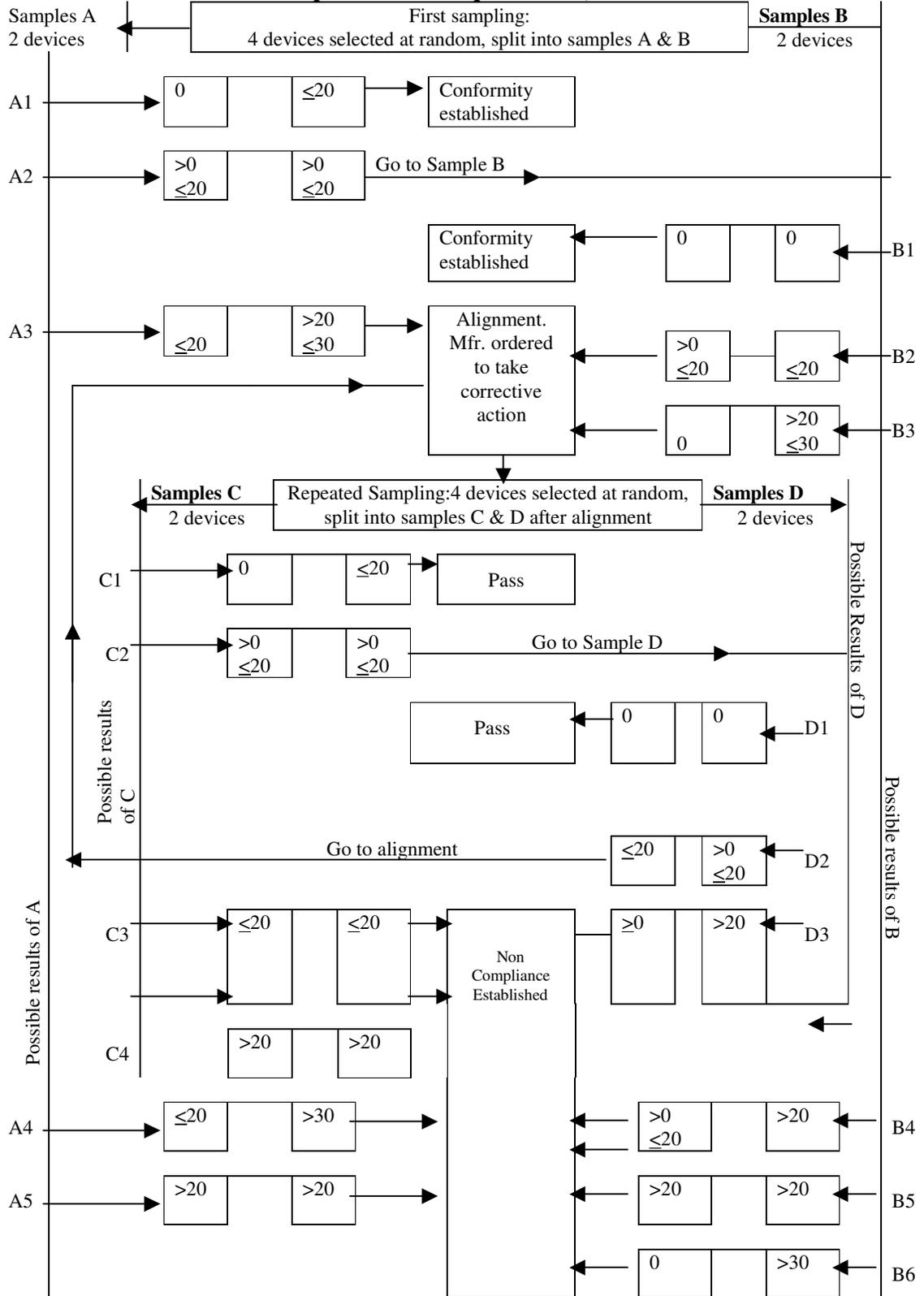
K7.8.2 D3 In the case of C2, if the deviations of the measured values of one device of sample D, is 0% or more than 0% and on the other device is more than 20 %.

K7.8.3 Sample C and Sample D do not satisfy the conditions of **K2.3.2** and **K2.4.2** as applicable.

K7.9 The statistical plan is illustrated in Figure **K1**.

Note: In the case of headlamps, the conditions of **K2.3.2** and **K2.4.2** as applicable are not indicated. However these conditions prevail as referred to in the relevant paragraphs above.

Figure K1 (See K7.9): Schematic diagram of Statistical Procedure for compliance to photometric requirements,.



X = Maximum deviation in percent in the unfavourable direction in relation to the limit values.

Annex L (See 7.1)
Additional Tests

- L1** The following are the procedures and requirements for additional tests. The applicability of the tests and requirements are as given in the individual annexes.
- L2.0** **Vibration Test**
- L2.1** The test specimen mounted on a suitable support shall be rigidly fixed on a suitable vibrating machine constructed to produce simple harmonic function (a total amplitude of 1.5 mm) and shall be subjected to vibration through a frequency range of 10-55-10 Hz in a period of 1 minute with continuously varying frequencies. The vibration shall be applied for not less than 1 hour in the directions of each of the 3 major axes of the light.
- L2.3** At the end of the vibration test, the test specimen shall not show evidence of material defects, lens or reflector rotation, displacement or rupture of parts except filaments lamp failures.
- L3.0** **Corrosion Resistance Test**
- L3.1** **Apparatus : Salt Spray Chamber**
- L3.1.1** The chamber for this test shall be so constructed that the salt spray is produced in the lower part of the chamber, in the upper part of which the parts to be exposed are suspended.
- L3.1.2** The construction of the ceiling walls and other parts of the chamber shall be such that no condensate can drip on the test specimen. The spray shall be produced by an atomizer employing compressed air free from all impurities.
- L3.1.3** In general, a salt spray chamber shown in Figure **L1**, with a spraying arrangement as shown in Figure **L2** and complying with the following requirements would be suitable.
- L3.1.4** The cabinet shall approximately be of the dimensions shown, and the cabinet and its internal fittings shall be made of monel metal or other suitable material. A shelf capable of being fitted in the upper or lower part of the cabinet shall be provided.
- L3.1.5** The air used for atomizing the salt solution shall be clean. It shall be possible to adjust the pressure by a relief valve or by the pressure outlet of the blower.
- L3.1.6** It shall be possible to control the amount of spray by adjusting the position of the lower nozzle C by unscrewing the bottom lock-nut B. The diameter of nozzle shall be 1.5 mm. A tap and second branch in the air-line shall be available for agitating the salt solution as required.
- L3.1.7** The spraying apparatus shall be capable of atomizing not less than 1450 ml salt solution per hour. The quantity of solution sprayed per cubic meter capacity of the chamber shall be approximately 175 ml per minute.
- L3.1.8** A container filled with cotton wool shall be provided as shown in fig. L1. It acts as breather and provides an outlet for the air which is constantly being pumped into the chamber, the cotton wool acting as a filter and preventing salt mist from being discharged into the atmosphere.

Figure L1. Salt Spray Chamber (See L3.1.3)

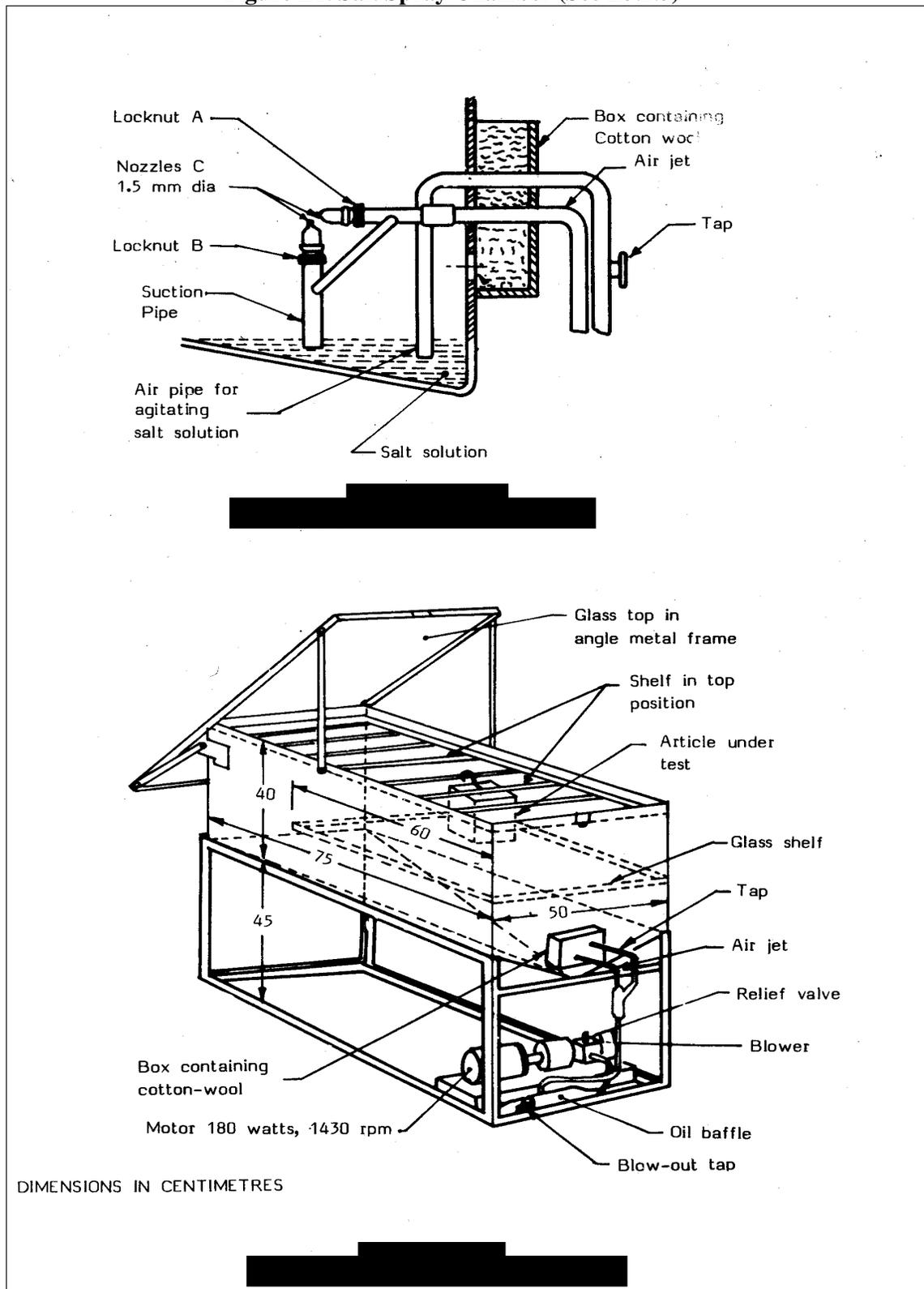


Figure L2. Details of spraying equipment (See L3.1.3)

L3.2 Procedure

The nozzle for atomizing the salt solution shall be adjusted for maximum amount of spray. The pressure of the solution shall be maintained between 29 and 33 kPa. The test piece shall be sprayed in the chamber with 5% solution of sodium chloride in water at the standard temperature of $27 \pm 2^\circ \text{C}$ for 50 hours consisting of two periods, each period being of 24 hours of spraying and one hour of draining. The pH of the salt solution shall be such that the collected solution will be in the pH range of 6.5 to 7.2.

L3.3 The unit under test shall not show a corrosion which shows a change of more than 10% variation in the unfavourable direction, in the photometry requirements as specified in the relevant Annexes.

L4.0 Dust Test for Seals & Gaskets

L4.1 A sample unit with any drain hole closed shall be mounted in its normal operating position 150 mm from the wall in a box measuring 900 mm in all directions, containing 5 kg of fine powdered cement.

At intervals of 15 minutes this dust shall be agitated by compressed air or fan blower by projecting blasts of air for a two second period in downward direction into the dust in such a way that the dust shall be completely and uniformly diffused throughout the entire cube. The dust is then allowed to settle.

In the meantime, the lamp is operated at the rated voltage continuously with an operating cycle of 30 minutes (15 min. ON and 15 min. OFF).

This test shall be continued for 5 hrs.

L4.2 After this test, the exterior surface of the unit shall be cleaned and the photometric test repeated and if the maximum intensity is within 10% of the maximum value found in the photometric test, it shall be considered adequately dust tight.

L5.0 Moisture Test for Adequate Drainage

L5.1 A sample unit shall be mounted in its normal operating position with all drain holes open and subjected to a precipitation of 2.5 mm of water per minute delivered at an angle of 45 degrees from a nozzle with a solid cone spray. The rate of water spray shall be measured by the rise of water in small straight sided pan placed horizontally and completely within the area covered by the water spray. During the moisture test, the unit shall revolve about its vertical axis at a rate of 4 rev/min. This test shall be continued for 12 hours. The water be then be turned off and the unit permitted to drain for 1 hour.

L5.2 After the test, unit under test shall not accumulate moisture in excess of 2 ml.

L6.0 Thermal Shock Resistance Test

L6.1 A sample unit shall be connected for not less than 15 minutes with the filament at 7, 14 and 28 V for rated voltages of 6, 12 and 24 V respectively in its normal operating position in an ambient temperature of approximately 27°C. It shall then be disconnected and immediately plunged into water at 5°C below the ambient such that the lens comes in contact with water.

L6.2 After the test, no cracking or fracture of the lens shall occur.

L7.0 Warpage Test for Devices with Plastic Lenses

L7.1 The sample unit shall be mounted in its normal position and operated as indicated in **Table L1** at design working voltage in an oven controlled at 50 ±1°C for a duration of 1 hour.

Table L1 (See 5.1 and L7.1) Operation of lamps

Lamp	Operation
Direction Indicator:	Steady Flash
Stop Lamp, Reversing Lamp:	5 Minutes ON and 5 Minutes OFF
Other lamps:	Steady burn

L7.2 There shall be no evidence of excessive warpage of lenses, which would affect the proper functioning of the unit.

L8.0 Resistance to Oil - Test with Plastic Lenses

L8.1 The outer surface of the lens of the sample unit shall be gently wiped with a cotton cloth soaked in detergent lubricating oil. After 5 minutes the surface shall be cleaned by washing in detergent solution. The surface shall be inspected. The application of various oils shall be done on the same sample one after another.

L8.2 The unit under test shall not show any deterioration of the unit.

L9.0 Test for Resistance to Fuel - Test with Plastic Lenses

L9.1 The outer surface of the lens of the sample unit shall be gently wiped with a cotton cloth soaked in a mixture of petrol and Benzol (90 : 10).

L9.2 After 5 minutes, the surface shall not show any visible change.

Note: Tests prescribed in **L8.0** and **L9.0** shall be conducted on the same sample, not necessarily in the same sequence.

L10.0 High Voltage (flash) Test

L10.1 The test piece shall be isolated from the condensers, if any, and internally ground, and shall be subjected to flash test, with an alternating current of 500 V rms. at any convenient frequency between 40 and 60 Hz between the end of the terminals and the ground. During this test the lamps shall be removed.

L10.2 The test specimen shall satisfactorily withstand this test without arcing or puncture

Annexure : M
(See Introduction)
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