AUTOMOTIVE INDUSTRY STANDARD

Automotive Vehicles – Approval of Devices for Indirect Vision Intended for use on A, M, N Category and L Category with Bodywork Vehicles – Specification

(Revision 2)

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ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

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

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INTRODUCTION

0.0 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 website.

0.1 AIS-001 covering mandatory requirements regarding performance of rear-view mirrors devices was published in 2001 and implemented thereafter in 2003.

0.2 With technological developments in automotive vehicles rear view mirrors, AIS-001 was taken up for revision and prepared in two parts.

This part covers the requirements for approval of devices for indirect vision for use on A, M, N, category and L category vehicles with bodywork vehicles specification.

0.3 This part is based on the following UN Regulation

UN R 46 Revision 6, Amendment 7, Supplement 9 to the 04 series of amendments Date of entry into force: 30 September 2021	Uniform Provisions Concerning the Approval of Devices for Indirect Vision and of Motor Vehicles with regard to the Installation of these Devices

0.4 While preparing this standard attempt has been made to align with the above UN regulation. However, certain changes were necessary in Indian context.

0.5 The following standards contain provisions, which through reference in this text constitute provisions of the standard

AIS-002 (Part 1) (Rev.2):2023	Automotive Vehicles – Devices for indirect Vision intended for use on L category with bodywork vehicles, M and N category - Installation requirements
AIS-037	Procedure for Type Approval and Establishing Conformity of Production for Safety Critical Components

IS 14272:2011	Automotive Vehicles – Types – Terminology
IS 13942:1994	Automotive vehicles - External projections - Performance requirements
ISO 15008:2003	Road vehicles - Ergonomic aspects of transport Information and control systems - Specifications and compliance procedures for in-vehicle visual presentation
CIE publication 50 (45)	International Electronical Vocabulary, Group 45, Lighting
EN 12368: 8.4	Traffic Control Equipment – Signal heads

0.6 The composition of AISC panel and AIS Committee responsible for preparation of this standard is given in Annex P and Annex R respectively.

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1. SCOPE

1.1 This standard applies to compulsory and optional devices for indirect vision set out in the table under clause 15.2.1.1.1. of AIS-002 (Part 1) (Rev. 2), for vehicles of category M and N and to compulsory and optional devices for indirect vision mentioned in clauses 15.2.1.1.3 and 15.2.1.1.4 of AIS-002 (Part 1) (Rev. 2) for vehicles of category L with bodywork at least partly enclosing the driver and interior and exterior rear-view mirrors used for agricultural tractors as mentioned in AIS-114.

Note: The permission to use rear view mirrors and indirect vision devices covered by this standard are governed by requirements specified by the standard for installation requirements for that category of vehicles.

1.2 This standard does not apply to devices other than those prescribed under clause 1.1 and their installation, for observing the vision area(s) immediately adjacent to the front and/or the passenger's side of vehicles of category M1, M2, M3, N1 and N2 ≤ 7.5 t.

2. DEFINITIONS

For the purposes of this standard:

2.1. "**Devices for indirect vision**" means devices intended to give a clear view of the rear, side or front of the vehicle within the fields of vision defined in clause 15.2.4. These may be conventional mirrors, camera-monitors or other devices able to present information about the indirect field of vision to the driver.

2.1.1 "**Mirror**" means any device, excluding devices such as periscopes, intended to give a clear view to the rear, side or front of the vehicle within the fields of vision defined in clause 15.2.4 of AIS-002 (Part 1) (Rev. 2), by means of a reflective surface.

2.1.1.1. "**Interior mirror**" means a device as defined in clause 2.1.1 above, which is intended to be fitted in the passenger compartment of a vehicle.

2.1.1.2. "**Exterior mirror**" means a device as defined in clause 2.1.1 above, which is intended to be mounted on the external surface of a vehicle.

2.1.1.3. "**Surveillance mirror**" means a mirror other than the ones defined in clause 2.1.1. which is intended to be fitted to the inside or outside of the vehicle in order to provide fields of vision other than those specified in clause 15.2.4 of AIS-002 (Part 1) (Rev. 2).

2.1.1.4 **"r"** means the average of the radii of curvature measured over the reflecting surface, in accordance with the method described in Annex G.

2.1.1.5 "**The principal radii of curvature at one point on the reflecting surface (r*i*)**" means the values obtained with the apparatus defined in Annex G measured on the arc of the reflecting surface passing through the centre of this surface parallel to the segment b, as defined in 6.1.2.1.2.1 of this standard and on the arc perpendicular to this segment.

2.1.1.6 "**The radius of curvature at one point on the reflecting surface (rp)**" means the arithmetical average of the principal radii of curvature r*i* and r′*i* i.e.:

$$r_p = \frac{r_i + r_i'}{2}$$

2.1.1.7 "**Spherical surface**" means a convex surface, which has, in both horizontal and vertical direction, measured radii of curvature compliant with the provisions given in paragraphs 6.1.2.2.2 and 6.1.2.2.4.

2.1.1.8 "**Aspherical surface**" means a convex surface, which may have variable radii of curvature both in the horizontal and vertical direction.

2.1.1.9 "**Aspherical mirror**" means a mirror composed of a spherical and an aspherical part, defined in clause 2.1.1.7 and 2.1.1.8 respectively, in which the transition of the reflecting surface from the spherical to the aspherical part has to be marked. As an example, the curvature of the main axis of the mirrors may be defined in the x/y coordinate system defined by the radius of the spherical primary calotte with:

$$y = R - \sqrt{R^2 - x^2} + k(x - a)^3$$

R: nominal radius in the spherical part
k: constant for the change of curvature
a: constant for the spherical size of the spherical primary calotte

2.1.1.10 "**Centre of the reflecting surface**" means the centre of the visible area of the reflecting surface.

2.1.1.11 "**The radius of curvature of the constituent parts of the mirror**" means the radius "c" of the arc of the circle which most closely approximates to the curved form of the part in question.

2.1.2 "**Camera-monitor system (CMS)**" means a device for indirect vision as defined in clause 2.1, where the field of vision is obtained by means of a camera-monitor combination as defined in clause 2.1.2.1 and 2.1.2.2. below.

2.1.2.1. "**Camera"** means a device that renders an image of the outside world and then converts this image into a signal (e.g. video signal).

2.1.2.2 **"Monitor"** means a device that converts a signal into images that are rendered into the visual spectrum.

2.1.3. "**Other devices for indirect vision**" means devices as defined in clause 2.1. above, where the field of vision is not obtained by means of a mirror or a camera-monitor device.

2.1.4. "**Vision support system**" means a system to enable the driver to detect and/or see objects in the area adjacent to the vehicle.

2.1.5. **"Luminance contrast"** means the brightness ratio between an object and its immediate background/surrounding that allows the object to be distinguished from its background/surroundings. The definition is in accordance with the definition given in ISO 9241-302:2008.

2.1.6. **"Resolution"** means the smallest detail that is discerned with a perceptual system, i.e. perceived as separate from the larger whole. The resolution of the human eye is indicated as "visual acuity".

2.1.7. **"Critical object"** means a cylindrical object with a height of 0.50 m and a diameter of 0.30 m. (See note below)

Note: A system for indirect vision is intended to detect relevant road users. The relevancy of a road user is defined by his or her position and (potential) speed. More or less in proportion with the speed of the pedestrian-cyclist- moped driver, the dimensions of these road users increase as well. For detection purposes a moped driver (D = 0.3 m) at 40 m distance would be equal to a pedestrian (D = 0.5 m) at a distance of 25 m. Considering the speeds, the moped driver would be selected as the criterion for the detection size; for that reason an object with a size of 0.3 m shall be used for determining the detection performance.

2.1.8. **"Critical perception"** means the level of perception that can just be obtained under critical conditions via the viewing system used. This corresponds to the situation in which the representative scale of the critical object is multiple times larger than the smallest detail that can be perceived via the viewing system.

2.1.9 **"Field of vision"** means the section of the tri-dimensional space which is monitored with the help of a device for indirect vision. Unless otherwise stated, this is based on the view on ground level offered by a device and/or devices other than mirrors. This may be limited by the relevant detection distance corresponding to the critical object.

2.1.10 **"Detection distance"** means the distance measured from the centre of the lens of the camera to the point at which a critical object is just perceived (as defined by the critical perception.

2.1.11 **"Visual spectrum"** means light with a wavelength within the range of the perceptual limits of the human eyes: 380-780 nm.

2.1.12. **"Smear**" is a bright line displayed on the monitor while sun light or light from other bright light sources is directly hitting into the lens of the camera.

2.1.13. "**Mirror and CMS dual function system**" means a CMS of Class I in which a monitor complying with this standard is placed behind a semi-transparent mirror complying with this standard. The monitor is visible in the CMS mode.

2.2. **"Type of device for indirect vision"** means devices that do not differ on the following essential characteristics:

- design of the device inclusive, if pertinent**,** the attachment to the bodywork;
- in case of mirrors the class, the shape**,** the dimensions and radius of curvature of the mirror's reflecting surface;
- in case of camera-monitor systems, the class, the field of view, the magnification and resolution

2.3. **"Surveillance camera-monitor-recording device"** means a camera and either a monitor or recording equipment other than the camera monitor device defined in clause 2.1.2. which can be fitted to the inside or outside of the vehicle in order to provide fields of vision other than those specified in 15.2.4. of AIS-002 (Part 1) (Rev.2) or to provide a security system within or around the vehicle.

2.4. "**Class of device for indirect vision**" means all devices having one or more common characteristics or functions. They are classified as follows:

Class I	"**rear-view device**" intended to give the field of vision defined in clause 15.2.4.1 of AIS-002 (Part 1) (Rev.2)
Class II and III	**"Main rear-view device"** intended to give the fields of vision defined in clause 15.2.4.2 and 15.2.4.3 of AIS-002 (Part 1) (Rev.2)
Class IV	"**Wide-angle exterior device** ", intended to give the field of vision defined in clause 15.2.4.4 of AIS-002 (Part 1) (Rev.2)
Class V	"**Close-proximity view device** ", intended to give the field of vision defined in clause 15.2.4.5 of AIS-002 (Part 1) (Rev.2)
Class VI	"**Front- view device** ", intended to give the field of vision defined in clause 15.2.4.6 of AIS-002 (Part 1) (Rev.2)
Class VII	Main rear-view Mirrors intended for L category vehicles with bodywork intended to give the field of vision defined in clause 15.2.4.7 of AIS-002 (Part 1) (Rev.2)

2.5. "**Point light source detection factor (PLSDF)**" means the level of distinctness of a pair of point light sources, based on luminance intensities and horizontal and vertical dimension of the rendition on the monitor.

2.6. "**Point light source contrast factor (PLSCF)**" means the level of distinctness of a pair of point light sources, based on luminance differences between the maximum luminance of the luminance profile LH max and the minimum luminance of the luminance profile LH, min in the horizontal direction (see Figure 3 of Annex M).

3. APPLICATION FOR APPROVAL

3.1 Information to be submitted at the time of applying for type approval of the indirect vision devices shall be as given in Annex A.

3.2 Reserved.

3.3 For each type of device for indirect vision the application shall be accompanied by: three samples of the parts.

3.4 The CMS shall be provided by the applicant with the following documents:

(a) Technical specification of the CMS; and
(b) Operator's manual

4. MARKINGS

4.1. The samples of devices for indirect vision submitted for approval shall bear the trade name or mark of the manufacturer; this marking shall be clearly legible and be indelible.

4.2 Every device for indirect vision shall possess on at least one of the main components a space large enough to accommodate the approval mark, which shall be legible this space shall be shown on the sketches referred to in Annex A. The approval mark shall also be legible when the device has been mounted on the vehicle with exception of camera-monitor devices as defined in clause 2.1.2. Other components of the device shall bear a means of identification. In the case of limited space for the approval mark(s), other means of identification that link it to the approval mark shall be provided.

Note 1: The above condition is deemed to be complied with, if the space for approval marking is on the portion which does not get housed in the vehicle at the time of installation or on a portion which can be seen by repositioning the mirror.

Note 2: 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.

5. APPROVAL

5.1 If the samples submitted for approval meet the requirements of clause 6 of this standard, approval of the pertinent type of device for indirect vision shall be granted.

5.2. The Approval number shall be as per AIS-037.

5.3. Reserved

5.4 Reserved

5.4.1 Reserved

5.4.2. Reserved

5.4.3 In addition to the approval mark (5.2), an additional symbol I or II or III or IV or V or VI, or VII specifying the class to which the type of device for indirect vision belongs. The additional symbol shall be placed in any convenient position.

5.5 The approval mark and the additional symbol shall be clearly legible and be indelible.

5.6 Reserved

6. REQUIREMENTS

6.1 **Mirrors**

6.1.1 **General specifications**

6.1.1.1. All mirrors shall be adjustable

6.1.1.2. (a) Rear-view mirrors (Classes II to VII)

The edge of the reflecting surface shall be enclosed in a protective housing (holder, etc.) which, on its perimeter, shall have a value 'c' greater than or equal to 2.5 mm at all points and in all directions.

If the reflecting surface projects beyond the protective housing, the radius of curvature 'c' on the edge of the projecting part shall be not less than 2.5 mm and the reflecting surface shall return into the protective housing under a force of 50 N applied to the point of greatest projection, relative to the protective housing, in a horizontal direction, approximately parallel to the longitudinal median plane of the vehicle.

(b) Rear-view mirrors (Class I)

In cases, where the edge of the reflecting surface is enclosed in a protective housing (holder, etc.), the radius of curvature "c" on its perimeter shall be not less than 2.5 mm at all points and in all directions. In cases, where the edge of the reflecting

surface projects beyond the protective housing, this requirement shall apply to the edge of the projecting part.

6.1.1.3. When the mirror is mounted on a plane surface, all parts, irrespective of the adjustment position of the device, including those parts remaining attached to the support after the test provided for in clause 6.3.2 below, which are in potential static contact with a sphere either 165 mm in diameter in the case of an Class I mirror or 100 mm in diameter in the case of an Class II to VII mirror, shall have a radius of curvature 'c' of not less than 2.5 mm.

6.1.1.4. The requirements in clause 6.1.1.2. and 6.1.1.3. above shall not apply to parts of the external surface which protrude less than 5 mm, but the outward facing angles of such parts shall be blunted, save where such parts protrude less than 1.5 mm. For determining the dimension of the projection, the following method shall apply:

6.1.1.4.1. The dimension of the projection of a component which is mounted on a convex surface may be determined either directly or by reference to a drawing of an appropriate section of this component in its installed condition.

6.1.1.4.2. If the dimension of the projection of a component which is mounted on a surface other than convex cannot be determined by simple measurement, it shall be determined by the maximum variation of the distance of the center of a 100 mm diameter sphere from the nominal line of the panel when the sphere is moved over and is in constant contact with that component. Figure 1 shows an example of the use of this procedure.

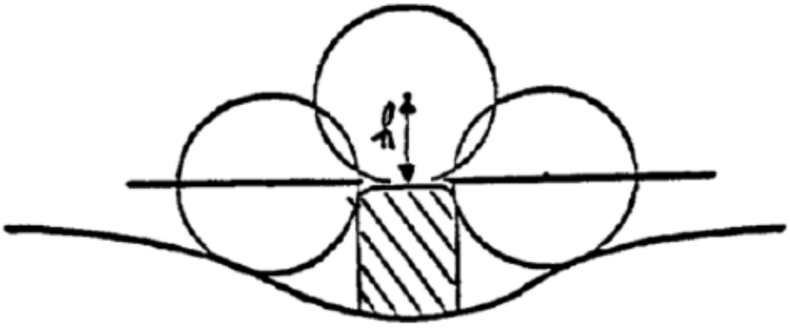


Figure 1
Example for the measurement by maximum variation

6.1.1.5 Edges of fixing holes or recesses of which the diameter or longest diagonal is less than 12 mm are exempt from the radius requirements of clause 6.1.1.3. above provided that they are blunted.

6.1.1.6 The device for the attachment of mirrors to the vehicle shall be so designed that a cylinder with a 70 mm radius, (50 mm in the case of an L-category vehicle), having at its axis, or one of the axes, of pivot or rotation which ensures deflection of the mirror in the direction of

impact concerned, passes through at least part of the surface to which the device is attached.

6.1.1.7 The parts of Classes II to VII mirrors referred to in clause 6.1.1.2. and 6.1.1.3. which are made of a material with a Shore A hardness not exceeding 60 are exempt from the relevant provisions.

6.1.1.8 In the case of those parts of Class I mirrors which are made of a material with a Shore A hardness of less than 50 and which are mounted on a rigid support, the requirements of clause 6.1.1.2. and 6.1.1.3 shall only apply to the support.

6.1.2 **Special specifications**

6.1.2.1. **Rear-view mirrors (Class I)**

The dimensions of the reflecting surface shall be such that it is possible to inscribe thereon a rectangle one side of which is 40 mm and the other 'a' mm in length, where

$$a = 150mm \times \frac{1}{1+\frac{1000}{r}} \text{ mm}$$

and r is the radius of curvature.

6.1.2.1.2 **Main rear-view mirrors (Classes II and III)**

6.1.2.1.2.1. The dimensions of the reflecting surface shall be such that it is possible to inscribe therein:

(a) a rectangle 40 mm high the base length of which, measured in millimetres, has the value 'a';

(b) a segment which is parallel to the height of the rectangle and the length of which, expressed in millimetres, has the value 'b'.

6.1.2.1.2.2 The minimum values of 'a' and 'b' are given in the table below:

Class of rear-view mirror	a (mm)	b (mm)
II	$\frac{170}{1+\frac{1000}{r}}$	200
III	$\frac{130}{1+\frac{1000}{r}}$	70

6.1.2.1.3 **"Wide-angle" view mirrors (Class IV)**

The contours of the reflecting surface shall be of simple geometric form and its dimensions such that it provides, if necessary, in conjunction with a Class II exterior mirror, the field of vision specified in clause 15.2.4.4. of AIS-002 (Part 1) (Rev.2).

6.1.2.1.4 **"Close-proximity" view mirrors (Class V)**

The contours of the reflecting surface shall be of simple geometric form and its dimensions such that the mirror provides the field of vision specified in clause 15.2.4.5. of AIS-002 (Part 1) (Rev. 2).

6.1.2.1.5. **Front- view mirrors (Class VI)**

The contours of the reflecting surface shall be of simple geometric form and its dimensions such that the mirror provides the field of vision specified in clause 15.2.4.6. of AIS-002 (Part 1) (Rev. 2).

Note: Conditions given in clause 6.1.2.1.3, 6.1.2.1.4 and 6.1.2.1.5 are for general guidelines and need not be verified at the time of type approval of the mirror

6.1.2.1.6. **Mirrors for Category L vehicles with bodywork (Class VII)**

6.1.2.1.6.1 Main' rear-view mirrors (Class VII)

The minimum dimensions of the reflecting surface shall be as per clause 7.1 of Part 2 of this standard.

6.1.2.2 **Reflecting surface and coefficients of reflection**

6.1.2.2.1 The reflecting surface of a mirror shall be either flat or convex. Exterior mirrors may be equipped with an additional aspherical part provided that the main mirror fulfils the requirements of the indirect field of vision.

6.1.2.2.2 Differences between the radii of curvature of mirrors

6.1.2.2.2.1 The difference between ri or r'i, and rp at each reference point shall not exceed 0.15 r

6.1.2.2.2.2 The difference between any of the radii of curvature (rp1, rp2, and rp3) and r shall not exceed 0.15 r.

6.1.2.2.2.3 When r is not less than 3,000 mm, the value of 0.15 r quoted in clause 6.1.2.2.2.1. and 6.1.2.2.2.2. is replaced by 0.25 r.

6.1.2.2.3 **Requirements for aspherical parts of mirrors**

6.1.2.2.3.1 Aspherical mirrors shall be of sufficient size and shape to provide useful information to the driver. This normally means a minimum width of 30 mm at some point.

6.1.2.2.3.2 The radius of curvature ri of the aspherical part shall not be less than 150 mm.

6.1.2.2.4 Value of 'r' for spherical mirrors shall not be less than:

6.1.2.2.4.1 1200 mm for rear-view mirrors (Class I);

6.1.2.2.4.2 1200 mm for Class II and III main rear-view mirrors;

6.1.2.2.4.3 300 mm for "wide-angle" mirrors (Class IV) and "close-proximity" mirrors (Class V);

6.1.2.2.4.4 200 mm for front mirrors (Class VI).

6.1.2.2.4.5 1000 mm or more than 1500 mm in the case of Class VII main rear-view mirrors

6.1.2.2.5 The value of the normal coefficient of reflection, as determined according to the method described in Annex F, shall be not less than 40 per cent.

In the case of reflecting surfaces with a changeable degree of reflection, the "day" position shall allow the colours of the signals used for road traffic to be recognized. The value of the normal coefficient of reflection in the "night" position shall be not less than 4 per cent.

6.1.2.2.6 The reflecting surface shall retain the characteristics laid down in 6.1.2.2.5. in spite of prolonged exposure to adverse weather conditions in normal use.

Note : 6.1.2.2.6 is general clause and no specific tests are required for verifying compliance to this clause.

6.2 **Devices for Indirect Vision other than Mirrors**

6.2.1. General requirements

6.2.1.1. If adjustment by the user is needed, the device for indirect vision shall be adjustable without the use of tools.

6.2.1.2. If a device for indirect vision can only render the total prescribed field of vision by scanning the field of vision, the total process of scanning, rendering and reset to its initial position together shall not take more than 200 milliseconds at room temperature of 22 °C ± 5 °C

6.2.1.3. The effectiveness of the CMS of Classes I to IV shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by compliance with the technical requirements and transitional provisions of AIS-004 (Part 3), as amended from time to time.

6.2.2. Camera-monitor systems

The requirements of paragraph 6.2.2.1. shall be considered to be satisfied in the case of monitors of a vehicle that fulfills the provisions of IS 15223: 2002.

6.2.2.1. General requirements

6.2.2.1.1. When the devices of the camera-monitor system are mounted in the position recommended by the manufacturer for normal driving, all parts, irrespective of the adjustment position of the device which are in potential, static contact with a sphere either 165 mm in diameter in the case of a CMS or parts of CMS installed inside the vehicle or 100 mm in diameter in the case of a CMS or parts of CMS installed outside the vehicle, shall have a radius of curvature "c" of not less than 2.5 mm.

6.2.2.1.2. Edges of fixing holes or recesses of which the diameter or longest diagonal is less than 12 mm are exempt from the radius requirements of clause 6.2.2.1.1. above provided that they are blunted.

6.2.2.1.3. For parts of the camera and the monitor which are made of a material with a Shore A hardness of less than 60 and which are mounted on a rigid support, the requirements of clause 6.2.2.1.1. above shall only apply to the support.

6.2.2.2. Functional requirements for camera-monitor devices of Classes V and VI.

6.2.2.2.1. The camera shall function well in conditions in which low sunlight falls on the camera. The saturated area, defined as the area in which the luminance contrast ratio (C=Lw/Lb) of a high contrast pattern falls below 2.0, shall not cover more than 15 percent of the displayed image under the conditions of clauses 6.2.2.2.1.1. to 6.2.2.2.1.4. below.

In the case the camera system shows dynamical changes in the blooming area during the test the maximum blooming area shall fulfill the requirements.

6.2.2.2.1.1 A black and white test pattern, having a minimum contrast ratio of 20 shall be positioned in front of the camera.

The test pattern shall be evenly illuminated at an illumination of 3,000 ± 300 lx.

The test pattern shall be medium gray on average and cover the complete area viewed by the camera; the camera shall view no other objects than the test pattern.

6.2.2.2.1.2 The camera shall be hit by a (simulated sun) light of 40 klx, spanning an angle between 0.6 and 0.9° with an elevation angle of 10°(directly or indirectly via a mirror) removed from the optical axis of the sensor. The light source shall:

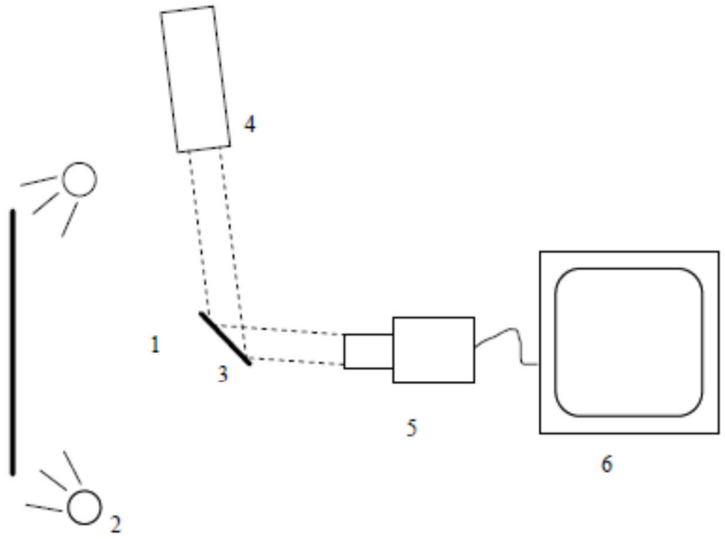
(a) Have a spectrum D65 with a tolerance of ±1,500 K;

(b) Be homogeneous in space and time within a tolerance of 2 klx.

The emission of the light source in infrared shall be negligible.

6.2.2.2.1.3. There shall be no ambient illumination of the monitor during the test.

6.2.2.2.1.4. An example of the set-up is given in the Figure A below.



1: Black and white test pattern.
2: Lamps to make the test pattern evenly illuminated.
3: Mirror.
4: High intensity light.
5: Camera.
6: Monitor.

Figure A – Diagram of the blooming measurement set-up

6.2.2.2.2 The monitor shall render a minimum contrast under various light conditions as specified by ISO 15008:2003.

6.2.2.2.3. It shall be possible to adjust the average luminance of the monitor either manually or automatically to the ambient conditions

6.2.2.2.4 The measurements for the luminance contrast of the monitor shall be carried out according to ISO 15008:2009.

6.2.2.3. Functional requirements for camera-monitor devices of Classes I to IV (see Annex M).

Unless otherwise specified in this standard, the definitions and symbols used in clause 6.2.2.3. are in accordance with ISO 16505:2015, Chapters 3 and 4.

Unless otherwise specified in this standard, the requirements given in clause 6.2.2.3. shall be verified according to the test procedures given in ISO 16505:2015, Chapter 7, where available.

6.2.2.3.1. Luminance adjustment

It shall be possible to adjust the average luminance of the monitor either manually or automatically to the ambient conditions.

6.2.2.3.2. Operating readiness (System availability)

If the system is not operational (e.g. CMS failure), it shall be indicated to the driver by i.e. warning indication, display information, absence of status indicator. The operator's manual shall explain the information indicated.

6.2.2.3.3. Image quality

6.2.2.3.3.1. Monitor isotropy

The monitor shall conform to optical requirements over the range of viewing directions that is specified in the following clauses.

6.2.2.3.3.1.1 Directional uniformity

When driven by an artificial 70 per cent grey-scale image, the deviation of the monitor luminance from the luminance white level with specific viewing direction (ɵ, ϕ) = (ɵ monitor/D, ϕ monitor/D**)** shall be such that the ratio relative to the luminance white level for the same specific viewing direction L(ɵ monitor/D, ϕ monitor/D) does not exceed 35 per cent of the luminance white level for the monitor standard isotropy range and shall not exceed 50 per cent of the luminance white level for the monitor extended isotropy range.

For the standard isotropy range:

$$\frac{\max\{\left[L_i - L\left(\theta_{monitor/D},\ \Phi_{monitor/D}\right)\right]\}}{L\left(\theta_{monitor/D},\ \Phi_{monitor/D}\right)} < 35\%$$

for points i =1,2,3,4,5,6,7,8,9, as defined in Table 1 below.

Table 1
Measurement directions for standard isotropy range

Direction i	Horizontal/degree	Vertical/degree
	-7	+6
2	0	+6
3	+7	+6
4	-7	0
5	N/A	N/A
6	+7	0
7	-7	-6
8	0	-6
9	+7	-6

For the extended isotropy range:

$$\frac{\max\{[L_{i}, - L(\theta_{monitor/D}, \Phi_{monotor/D})]\}}{L(\theta_{monitor/D}, \Phi_{monotor/D})} < 50\%$$

for points i'= 1,2,3,4,5,6,7,8,9 as defined in Table 2 below.

Table 2
Measurement directions for extended isotropy range

Direction i'	Horizontal/degree	Vertical/degree
1	-12	+11
2	0	+11
3	+12	+11
4	-12	0
5	N/A	N/A
6	+12	0
7	-12	-11
8	0	-11
9	+12	-11

6.2.2.3.3.1.2 Lateral uniformity

The luminance white lateral dependency shall satisfy:

The luminance white lateral dependency shall satisfy:|

$$\frac{\max\{(L_{j/white}(\Theta,\Phi))\} - \min\{(L_{j/white}(\Theta,\Phi))\}}{\max\{(L_{j/white}(\Theta,\Phi))\}} < 35\%,$$

for points j = 1, 2, 3, 4, 5, 6, 7, 8, 9 as defined in Table 3 below, where (q, f) = (0, 0).

Table 3
Measurement points for the lateral uniformity

Point i'	Percentage $W_{monitor/horizontal}$ from top left corner	Percentage of $H_{monitor/horizontal}$ from top left corner
1	20	20
2	50	20
3	80	20
4	20	50
5	50	50
6	80	50
7	20	80
8	50	80
9	80	80

6.2.2.3.3.2 Luminance and contrast rendering

For luminance and contrast rendering the following requirements shall apply:

(a) The minimum luminance contrast at the monitor (including any screen protector) reproducing a high contrast pattern shall be:

(i) For direct sunlight condition: 2:1;

(ii) For day condition with diffuse ambient light: 3:1;

(iii) For sunset condition: 2:1;

(iv) For night condition: 10:1 except in the case of Mirror and CMS dual function system of class I: 5:1.

(b) The night condition for the camera's field of view is replicated in a dark environment such that the maximum illuminance on the objects to be measured shall not exceed 2.0 lx;

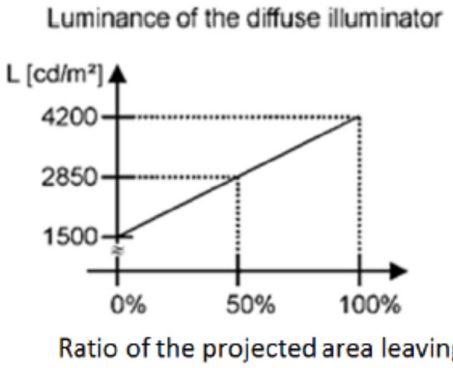
(c) The background luminance of the monitor shall be limited under the night condition. The maximum background luminance under the night condition shall be less than 2.0 cd/m²;

(d) The instructions for use shall contain a note that sunlight or light from other intense light source upon the monitor reduces the luminance contrast which may require the driver to be particularly alert and attentive.

6.2.2.3.3.2.1 Day condition with diffuse sky-light exposure test

For the day condition with diffuse sky-light exposure, the test method given in ISO 16505:2015, subclause 7.8.2., Test 2 shall be applied, but a value of 4,000 to 4,200 cd/m2 for luminance diffuse illuminator shall be used.

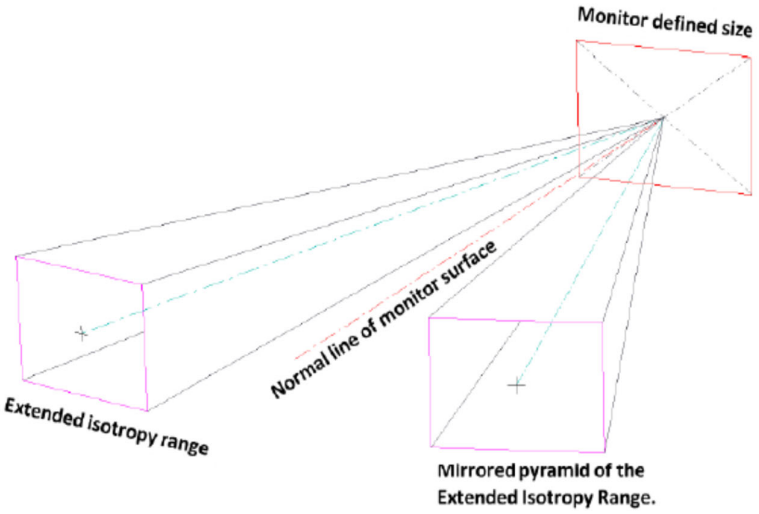
At the request of the manufacturer, the value for luminance diffuse illuminator may be determined by using the diagram of figure below.



Ratio of projected area vs. luminance of the diffuse illuminator
Procedure for determining the ration of the projected area leaving the vehicle:

(a) Determine the projected area in the vehicle that represents the mirror reflected direction from the monitor extended isotropy range.

(b) Evaluation shall be made in the centre of the monitor defined size, under consideration of the monitor design viewing direction (see figure below).



This projected area represents the 100 per cent of the surface to be considered.

Based on virtual testing, evaluate the ratio of the projected area that leaves the vehicle openings (e.g. through a side door window, rear window or sunroof; however, for example a sunroof having an opaque shutter shall not be considered an opening).

Case when the orientation of the mirror and CMS dual function system of Class I is adjustable:

Based on virtual testing, if the applicant demonstrates that the Mirror and CMS dual function system of Class I adjustment range permits a driver to avoid any incident specular light from the vehicle opening while a driver's eye is within any fixed position of the standard isotropy range, then the value for luminance diffuse illuminator shall be the one of ISO 16505:2015 subclause 7.8.2., Test 2: 1,300 to 1,500 cd/m².

6.2.2.3.3.3 Grey scale rendering

A CMS shall have a sufficient grey scale rendering. CMS shall display a tonal range of at least eight distinguishable different grey tonal stepson the monitor.

For the grey scale rendering, the test method of clause 1.4. of Annex M shall be applied.

6.2.2.3.3.4 Colour rendering

For colour rendering, the hue angle of reproduced colour of the chart patches on the monitor shall satisfy the following requirements. The colour coordinates are described based in the CIE 1976 uniform colour space:

(a) Red colour coordinates shall not exceed the range of (0°, 44.8°) or (332.2°, 360°);

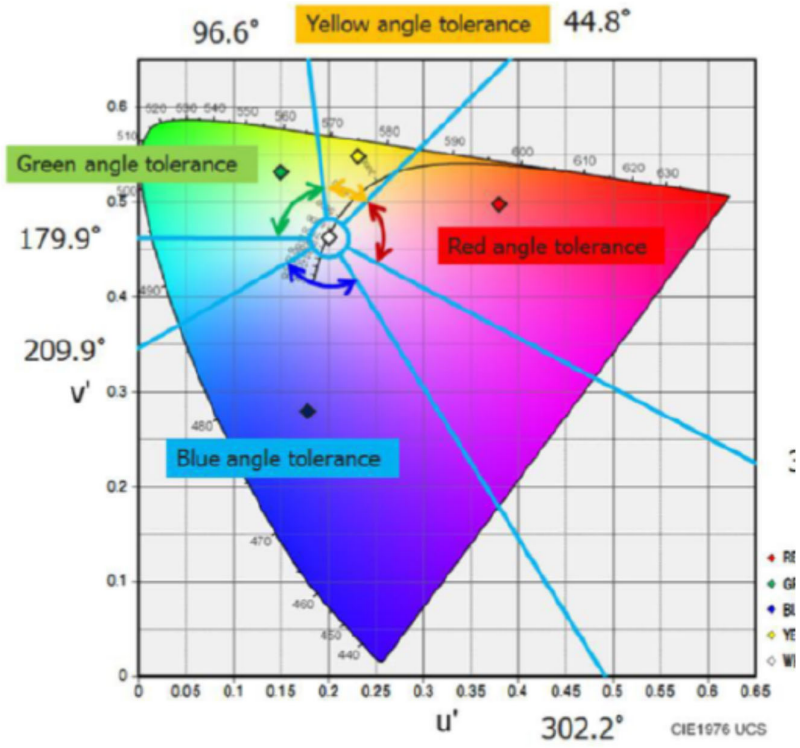
(b) Green colour coordinates shall not exceed the range of (96.6°, 179.9°);

(c) Blue colour coordinates shall not exceed the range of (209.9°, 302.2°);

(d) Yellow colour coordinates shall not exceed the range of (44.8°, 96.6°);

(e) To distinguish from the white colour, define distance from white as Ri ³ 0.02, where Ri is the chromatic distance of each colour patch (i= Red, Green, Blue, Yellow), relative to white (i = White).

Figure B shows an illustrative tolerance range described on CIE 1976 uniform colour space



Amber, blue and red light signals shall be distinguishable from each other.

6.2.2.3.3.5 Artefacts

The operator's manual shall refer to possible artefacts and their impact on the partial occlusion of the field of view and of the objects which may require the driver to be particularly alert and attentive.

6.2.2.3.3.5.1 Smear

Smear shall be transparent and not be more than 10 per cent of the maximum luminance value of the displayed glare source luminance level, which causes smear effect.

6.2.2.3.3.5.2 Blooming and lens flare

The total area of disturbing blooming and lens flare areas shall not cover more than 25 per cent of the displayed camera image.

6.2.2.3.3.5.3. Point light sources

The CMS shall have an operation mode in which the driver of the vehicle equipped with CMS can recognize two point light sources (e.g. passing beam headlights) rendered as two distinguishable separate point light sources.

In this operation mode, a set of two point light sources corresponding to a vehicle passing beam headlamp each having a reference luminous intensity 1,750 cd and being separated each other laterally by 1.3 m and located at a distance of 250 m away from the CMS shall be distinguishable as two point light source. This requirement is applicable to Class I, Class II and Class III devices for indirect vision. The point light source detection factor (PLSDF) shall be at least 2.7 or the point light source contrast factor (PLSCF) shall be at least 0.12, whichever is satisfied by the CMS test under the conditions and the test procedure described in Annex M, clause 1.3.

If the system is in a mode where point light sources are not rendered as described above, this shall be indicated to the driver. The information indicated shall be explained in the operator's manual.

6.2.2.3.3.6. Sharpness and depth of field

6.2.2.3.3.6.1 Sharpness

The sharpness is represented by the MTF50(1:1) and it shall satisfy:
Horizontal and vertical MTF50(1:1) at center

$$MTF50_{(1:1)} \geq \frac{1}{2} MTF10_{MIN(1:1)} \langle LW/PH \rangle$$

Horizontal and vertical MTF50(1:1) at corners (70 per cent of image height)

$$MTF50_{(1:1)} \geq \frac{1}{2} \cdot \frac{1}{2} \left(MTF10_{MIN(1:1)} \right) \langle LW/PH \rangle$$

6.2.2.3.3.6.2 Depth of field

The CMS shall enable the driver to observe the occupied space by the object and perceive the content shown within the range of interest with detailed resolution. The MTF10(1:1), when measured at different distances to the object, shall satisfy at least the minimum resolution for the following points:

(a) Resolution at point 1 (10 m as representative point for infinity) and point 2 (middle distance at 6 m)

$$MTF10_{(1:1)} \geq 0{,}9 \cdot MTF10_{MIN(1:1)} \langle LW/PH \rangle$$

(b) Resolution at point 3 (Close distance at 4 meters)

$$MTF10_{(1:1)} \geq \frac{1}{2} MTF10_{MIN(1:1)} \langle LW/PH \rangle$$

6.2.2.3.3.7 Geometric distortion

For CMS of Classes I, II and III the maximum distortion within the minimum required field of view shall not exceed 20 per cent relative to recto-linear or pinhole projection.

This performance shall be tested according to the method given in ISO 16505:2015, Annex G.3.

6.2.2.3.3.8. Further image quality requirements

6.2.2.3.3.8.1 Flicker

The entire image area of the monitor shall be free of flicker according to the test method of Annex M, clause 1.2. of AIS-002 (Part 1) (Rev. 2).

6.2.2.3.4 Time behavior

6.2.2.3.4.1. Frame rate

Movements of objects in front of the camera shall be rendered smooth and fluid. The minimum frame rate of the system (update rate of the image information) shall be at least 30 Hz. At low light conditions or while maneuvering at low speed, the minimum frame rate of the system (i.e., update rate of the image information) shall be at least 15 Hz.

6.2.2.3.4.2 Image formation time

The image formation time of the monitor shall be less than 55 ms at a temperature of 22 °C ±5 °C.

This performance shall be tested according to the method given in ISO 9241-305:2008.

6.2.2.3.4.3. System latency

A CMS shall have a sufficient short latency to render the scenery nearly at the same time. The latency shall be lower than 200 ms at room temperature 22 °C ±5 °C.

6.2.2.3.5 Quality and further ergonomic requirements

6.2.2.3.5.1 Glare due to high luminance of the monitor
In order to avoid glare from a high luminance of the monitor, the luminance shall be dimmable in the night condition either manually or automatically.

6.2.3. Other devices for indirect vision

It has to be proved that the device meets the following requirements:

6.2.3.1. The device shall perceive the visual spectrum and shall always render this image without the need for interpretation into the visual spectrum.

6.2.3.2. The functionality shall be guaranteed under the circumstances of use in which the system shall be put into service. Depending on the technology used in obtaining images and presenting them clause 6.2.2.2. above shall be entirely or partly applicable. In other cases this can be achieved by establishing and demonstrating by means of system sensitivity analogous to clause 6.2.2.2. above that a function is ensured that is comparable to or better than what is required for and by demonstrating that a functionality is guaranteed that is equivalent or better than that required for mirror- or camera-monitor type devices for indirect vision.

6.3 **Test**

The requirements of clause 6.3. shall be considered to be satisfied in the case of monitors of a vehicle fulfilling the provisions of IS 15223: 2002.

6.3.1. Devices for indirect vision in Classes I to VI and Class VII mirror (having fitments identical to Class III) shall be subjected to the tests described in clause 6.3.2.1 and 6.3.2.2. below. Class VII mirrors with a stem, shall be subjected to the tests described in clause 6.3.2.3. below.

6.3.1.1 The test provided for in clause 6.3.2. shall not be required in the case of any Class II to IV exterior device for indirect vision of which no part is less than 2 m from the ground, regardless of the adjustment position, when the vehicle is under a load corresponding to its maximum technically permissible mass.

This derogation also applies to the attachments of devices for indirect vision (attachment plates, arms, swivel joints, etc.) which are situated less than 2 m from the ground and which do not project beyond the overall width of the vehicle, measured in the transverse plane passing through the lowest mirror attachments or any other point forward of this plane if this configuration produces a greater overall width.

In such cases, a description specifying that the device for indirect vision shall be mounted so as to conform to the above-mentioned conditions for the positioning of its attachments on the vehicle must be provided.

Where advantage is taken of this derogation, the arm shall be indelibly marked with the symbol

and the type-approval report shall be endorsed to this effect.

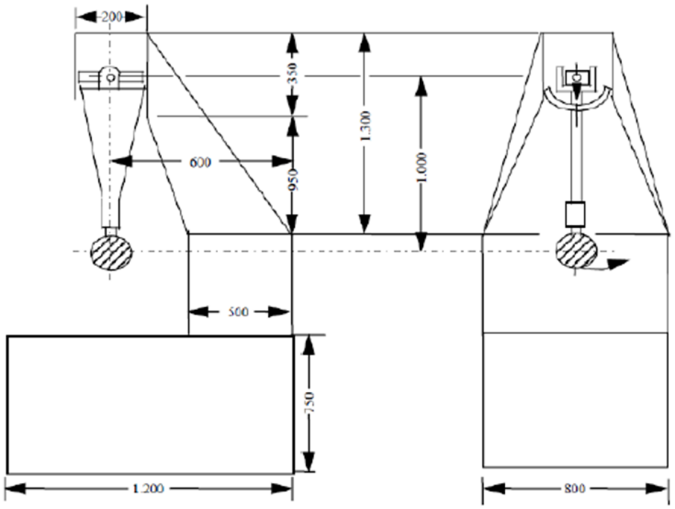
6.3.2. **Impact test**

The test according to this paragraph is not to be carried out for devices integrated in the bodywork of the vehicle and providing a frontal deflecting area of an angle not more than 45° measured in relation to the longitudinal median plane of the vehicle, or devices not protruding more than 100 mm measured beyond the circumscribing bodywork of the vehicle according to IS: 13942.

Note: If this test is not carried out, it shall be mentioned in the test report.

6.3.2.1. Description of the test rig

6.3.2.1.1. The test rig consists of a pendulum capable of swinging about two horizontal axes at right angles to each other, one of which is perpendicular to the plane containing the "release" trajectory of the pendulum.
The end of the pendulum comprises a hammer formed by a rigid sphere with a diameter of 165 ± 1 mm having a 5 mm thick rubber covering of Shore A hardness 50.
A device is provided which permits determination of the maximum angle assumed by the arm in the plane of release.
A support firmly fixed to the structure of the pendulum serves to hold the specimens in compliance with the impact requirements specified in 6.1.3.2.2.6. Figure 1 below Figure 1 gives the dimensions (in mm) of the test rig and the special design specifications:



6.3.2.1.2. The centre of percussion of the pendulum coincides with the centre of the sphere, which forms the hammer. It is at a distance l from the axis of oscillation in the release plane, which is equal to 1 m ± 5 mm. The reduced mass of the pendulum is mo = 6.8 ± 0.05 kilograms. The relationship of mo to the total mass m of the pendulum and to the distance d between the centre of gravity of the pendulum and its axis of rotation is expressed in the equation:

$$m_o = m \times \frac{d}{1}$$

6.3.2.2 Description of the test

6.3.2.2.1 The procedure used to clamp the device for indirect vision to the support shall be that recommended by the manufacturer of the device or, where appropriate, by the vehicle manufacturer.

6.3.2.2.2 Positioning of the device for indirect vision for the test:

6.3.2.2.2.1 Device for indirect vision shall be positioned on the pendulum impact rig in such a way that the axes which are horizontal and vertical when the mirror is installed on a vehicle in accordance with the applicant's mounting instructions are in a similar position;

6.3.2.2.2.2 When a device for indirect vision is adjustable with respect to the base, the test position shall be that in which any pivoting device is least likely to operate, within the limits of adjustment provided by the applicant;

6.3.2.2.2.3 When the device for indirect vision has a device for adjusting its distance from the base, the device shall be set in the position in which the distance between the housing and the base is shortest.

6.3.2.2.2.4 In the case of mirrors, when the reflecting surface is mobile in the housing, it shall be so adjusted that the upper corner, which is furthest from the vehicle, is in the position of greatest projection relative to the housing.

6.3.2.2.3 In the case of mirrors, except in the case of test 2 for Class I mirrors (see clause 6.3.2.2.7.1. below), when the pendulum is in a vertical position the horizontal and longitudinal vertical planes passing through the centre of the hammer shall pass through the centre of the reflecting surface as defined in clause 2.1.1.10. The longitudinal direction of oscillation of the pendulum shall be parallel to the longitudinal median plane of the vehicle.

6.3.2.2.4. In the case of camera-monitor systems, when the pendulum is in a vertical position the horizontal and longitudinal vertical planes passing through the centre of the hammer shall pass through the centre of the lens or of the transparent protection part protecting the lens. The longitudinal direction of oscillation of the pendulum shall be parallel to the longitudinal median plane of the vehicle. If the test is performed with a shutter camera system, the shutter has to be open during the pendulum impact.

6.3.2.2.5 When, under the conditions governing adjustment laid down in clause 6.3.2.2.1. and 6.3.2.2.2. above parts of the device for indirect vision limit the return of the hammer, the point of impact shall be displaced in a direction perpendicular to the axis of rotation or pivoting in question.

The displacement shall be no greater than is strictly necessary for the execution of the test; it shall be limited in such a way that:

a) either the sphere delimiting the hammer remains at least tangential to the cylinder as defined in 6.1.1.6;

b) or in the case of mirrors the point of contact with the hammer is located at least 10 mm from the periphery of the reflecting surface.

6.3.2.2.6. The test consists in allowing the hammer to fall from a height corresponding to a pendulum angle of 60° from the vertical so that the hammer strikes the device for indirect vision at the moment when the pendulum reaches the vertical position.

6.3.2.2.7. The device for indirect vision are subjected to impact under the following different conditions

6.3.2.2.7.1. **Class I rear-view mirrors**

a) **Test 1:** The points of impact shall be as defined in clause 6.3.2.2.3. above. The impact shall be such that the hammer strikes the mirror on the reflecting surface side.

b) **Test 2:** Point of impact on the edge of the protective housing, such that the impact produced makes an angle of 45° with the plane of the reflecting surface and is situated in the horizontal plane passing through the centre of that surface. The impact shall occur on the reflecting surface side.

6.3.2.2.7.2. **Classes II to VII mirrors**

a) **Test 1:** The point of impact shall be as defined in clause 6.3.2.2.3. or 6.3.2.2.5. above. The impact shall be such that the hammer strikes the mirror on the reflecting surface side.

b) **Test 2**: The point of impact shall be as defined in clause 6.3.2.2.3. or 6.3.2.2.5. above. The impact shall be such that the hammer strikes the mirror on the side opposite to the reflecting surface.

Where Class II or III rear-view mirrors are fixed to the same mounting as Class IV rear-view mirrors, the above-mentioned tests shall be executed on the lower mirror. Nevertheless, the testing agency may repeat one or both of these tests on the upper mirror if this is less than 2 m from the ground.

6.3.2.2.7.3. Camera-Monitor Systems

a) Test 1: The point of impact shall be as defined in clause 6.3.2.2.4. or 6.3.2.2.5. The impact shall be such that the hammer strikes the camera on the lens side.

b) Test 2: The point of impact shall be as defined in clause 6.3.2.2.4. or 6.3.2.2.5. The impact shall be such that the hammer strikes the camera on the side opposite to the lens.

Where more than one camera is fixed to the same mounting, the above-mentioned tests shall be executed on the lower camera. Nevertheless, the test agency responsible for testing may repeat one or both of these tests on the upper camera if this is less than 2 m from the ground.

6.3.2.3 Bending test on the protective housing attached to the stem (Class VII)

6.3.2.3.1 Description of test

The test shall be carried out as per claque 8.3 of Part 2 of this standard.

6.3.3 **Results of the tests**

6.3.3.1 In the tests described in 6.3.2. above, the pendulum shall continue to swing after impact in such a way that the projection of the position assumed by the arm on the plane of release makes an angle of at least 20° with the vertical. The accuracy of measurement of the angle shall be within ± 1°.

6.3.3.1.1 In the case of mirrors this requirement is not applicable to mirrors stuck to the windscreen, in respect of which the requirement stipulated in clause 6.3.3.2. shall apply after the test.

6.3.3.1.2 The required angle to the vertical is reduced from 20° to 10° for all Class II and Class IV devices for indirect vision and for Class III devices for indirect vision which are attached to the same mounting as Class IV devices for indirect vision.

6.3.3.2 In the case of mirrors, should the mounting of the mirror break during the tests described in clause 6.3.2. above for mirrors stuck to the windscreen, the part remaining shall not project beyond the base by more than 10 mm and the configuration remaining after the test shall satisfy the conditions laid down in clause 6.1.1.3.

6.3.3.3 The reflecting surface shall not break during the tests described in 6.3.2. However, breakage of the reflecting surface will be allowed if one of the following conditions is fulfilled:

6.3.3.3.1. the fragments of glass still adhere to the back of the housing or to a surface firmly attached to the housing; partial separation of the glass from its backing is admissible provided that this does not exceed 2.5 mm on either side of the cracks. It is permissible for small splinters

to become detached from the surface of the glass at the point of impact.

6.3.3.3.2 the reflecting surface is made of safety glass.

6.3.3.4. In the case of camera-monitor systems, the lens shall not break during the tests described in clause 6.3.2. above.

7. EXTENSION OF TYPE APPROVAL

7.1 Every modification pertaining to the information, even if the changes are not technical in nature declared in accordance with 3.2 shall be intimated by the manufacturer to the testing 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, shall then consider, whether,

7.1.1 the device with the changed specifications still complies with provisions, or

7.1.2 any further verification is required to establish compliance.

7.2 For considering whether testing is required or not, guidelines given in clause 7.5 (Criteria for Extension of Approval) shall be used.

7.3 In case of clause 7.1.2, tests for only those parameters which are affected by the modifications need be carried out.

7.4 In case of fulfilment of criterion of clause 7.1.1 or after results of further verification as per clause of 7.1.2 are satisfactory, the approval of compliance shall be extended for the changes carried out.

7.5 **Criteria for extension of approval**

The criteria for extension of approval shall be as given in Annex N.

8. CONFORMITY OF PRODUCTION

8.1 Every device for indirect vision approved pursuant to this standard shall be so manufactured as to conform to the type approved by meeting the requirements set out in Clause 6 of this standard.

8.2 Verification of the Conformity of Production procedure by the testing agencies shall be as per AIS-037, as amended from time to time.

8.3. The normal frequency of these verifications shall be once every two years.

8.4. During the verification of Conformity of productions, the following tests may be conducted by the testing Agency.

8.4.1. General specifications as per 6.1.1 and 6.2.1.

8.4.2. Dimensions as per 6.1.2.1.

8.4.3. Reflecting surface requirements as per 6.1.2.2.

8.4.4. Impact test pursuant to the requirements of 6.3.2, where applicable.

8.4.5. Camera monitor devices as per 6.2.2.

8.4.6. Other devices for indirect vision as per 6.2.3

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

The provisions shall be as prescribed in AIS-037, as amended from time to time.

10 to 20 Reserved clauses

21. TRANSITIONAL PROVISION

21.1 At the request of the applicant, type approvals of Class I, II, III, IV, V and VI rear view mirrors and devices for indirect vision for compliance to AIS-001(Part 1) (Rev.2):2023 shall be granted by test agencies from 17th May 2023 (date of adoption in CMVR-TSC). Such type approvals shall be deemed to be compliance to Class I, II, III, IV, V and VI respectively rear view mirrors and devices for indirect vision of AIS-001 (Part 1) (Rev.1):2011.

21.2 At the request of applicant, type approval to the compliance to Class I, II, III, IV, V and VI rear view mirrors and devices for indirect vision of AIS-001 (Part 1) (Rev.1):2011 shall be granted up to the notified date of implementation of AIS-001 (Part 1) (Rev.2) :2023.

21.3 Type approvals issued for Class I, II, III, IV, V and VI rear view mirrors and devices for indirect vision for compliance to AIS-001 (Part 1) (Rev.1):2011 shall be extended to approval of Class I, II, III, IV, V and VI respectively for rear view mirrors and devices for indirect of AIS-001 (Part 1) (Rev.2) :2023 subject to satisfactory compliance of the following:

21.3.1 Marking as per clause 4.0.

21.3.2 In case of "E/e" approved devices, requirements specified in clause 22.

Note: Additional verification for the above need not be carried out, if compliance to the above requirements has already been established during the type approval as per AIS-001 (Part 1) (Rev.1):2011.

21.4 Extension of Approvals for engineering and administrative changes:

21.4.1 In the case of clause 21.1, extensions shall be granted subject to the conditions of AIS-001 (Part 1) (Rev.2) :2023. Such extensions shall be deemed to be compliance to AIS-001 (Part 1) (Rev.1):2011.

21.4.2 In the case of 21.2, extensions shall be granted subject to conditions of AIS-001 (Part 1) (Rev.1):2011 till the notified date of implementation AIS-001 (Part 1) (Rev.2) :2023.

21.5 Type approvals for compliance to AIS-037**,** already been granted, shall continue to be valid for AIS-001 (Part 1) (Rev.2) :2023.

Note: Necessary corrections to the reference of verification reports as per this standard shall be incorporated while issuing the next COP certificate. In the meantime for issuing of vehicle certificate, test/verification report as per this standard shall deemed to be the proof of compliance of AIS-037.

22. ESTABLISHING COMPLIANCE OF "E"/"e" APPROVED DEVICES TO THIS STANDARDS

22.1 As an exception to clause 7.4 of AIS-037, (or related administrative decisions) for certifying compliance of "E"/"e" approved rear-view mirrors devices to this standard, the test for the following shall be carried out by testing agency.

22.1.1 Requirements of dimension as per clause 6.1.2.1

22.1.2 Requirements of reflecting surfaces as per clause 6.1.2.2

23. AMENDMENTS TO UN REGULATIONS AFTER THE LEVEL DESCRIBED IN 0.3 OF INTRODUCTION

23.1 Supplements

In case of changes in UN regulation, which are issued as supplements (Supplements do not affect the earlier type approvals) at the request of applicant, approval of compliance to this standard shall be issued taking into account the changes arising out of such supplement(s) to UN regulation with approval from Chairman AISC.

This shall be incorporated in the test report.

Note: Such changes will be considered for inclusion in this standard at the time of its next amendment /revision.

23.2 Series of amendments

Changes in UN regulation, which are issued as series of amendments (series of amendments may affect the earlier type approvals) will not be considered for issuing approval to this standard.

However, Chairman, AISC may, on a case to case basis, permit to accept latest series of amendments.

This shall be incorporated in the test report.

Note: Such changes will be considered for inclusion in this standard at the time of its next revision.

ANNEX A
(See 3.1)
INFORMATION TO BE SUBMITTED AT THE TIME OF APPLYING FOR TYPE APPROVAL

A1	The information given in Table A1, if applicable, shall be supplied and shall include a list of contents
A2	Any sketches shall be supplied in appropriate scale and in sufficient detail.
A3	Photographs, if any, shall show sufficient detail.

Table A1 (See A1)

1.	Make (trade name of manufacturer):
2.	Type and general commercial description(s):
3.	Means of identification of the type, if indicated on the device:
4.	Category of vehicle for which the device is intended:
5.	Name and address of manufacturer:
6.	Location and method of affixing of the approval mark:
6.1	Other mean of identification link to the approval mark:
7.	Address(es) of assembly plant(s):
8.	Mirrors (state for each mirror):
8.1	Variant
8.2	Sketch(s) for the identification of the mirror:
8.3	A technical description of Rear view mirror, including ounting instructions. Details of the method of attachment
8.4	Dimensions of reflecting surfaces
8.5	Radius of curvature of reflecting surface.
8.6	Type of reflective coating.
8.7	Overall shape of the housing
9.	Devices for indirect vision other than mirrors:
9.1	Type and characteristics (such as a complete description of the device):

	9.1.1	In the case of camera-monitor systems of Classes V and VI, the class, the detection distance (mm), contrast, luminance range, glare correction, display performance (black and white/colour) image repetition frequency, luminance reach of the monitor:
	9.1.2	In the case of camera-monitor systems of Classes I to IV, the class, field of view, magnification and resolution:
	9.2	sufficiently detailed sketches to identify the complete device including installation instructions; the position for the type-approval mark has to be indicated on the sketche (s):

ANNEX B to ANNEX E
Reserved

ANNEX F
(See 6.1.2.2.5)
TEST METHOD FOR DETERMINING REFLECTIVITY

F-1. DEFINITIONS

F-1.1. CIE standard illuminant A (see F-1.2) : Colorimetric illuminate, respecting the full radiator at T_{68} = 2 855.6 K.

λ	x	(λ)
600	1.062	2
620	0.854	4
650	0.283	5

F-1.1.2. CIE standard source A (see F-1.2) : Gas-filled tungsten filament lamp operating at a correlated colour temperature of T_{68} = 2,855.6 K.

F-1.1.3. CIE 1931 standard colorimetric observer (see F-1.2) : Receptor of radiation whose colorimetric characteristics correspond to the spectral tristimulus values x (λ), γ (λ), z (λ) (see table).

F-1.1.4 CIE spectral tristimulus values (see F-1.2) : Tristimulus values of the spectral components of an equi energy spectrum in the CIE (XYZ) system. Abridged table is given as Table F-1.

F-1.1.5 Photopic vision (see F-1.2): Vision by the normal eye when it is adapted to levels of luminance of at least several cd/m_2.

F-1.2 The above definitions taken from CIE publication 50 (45), International Electronical Vocabulary, Group 45, Lighting.

F-2 APPARATUS

F-2.1. General

The apparatus shall consist of a light source, a holder for the test sample, a receiver unit with a photodetector and an indicating meter (see Figure F-1), and means of eliminating the effects of extraneous light.

The receiver may incorporate a light-integrating sphere to facilitate measuring the reflectance of non-flat (convex) mirrors (see Figure F-2).

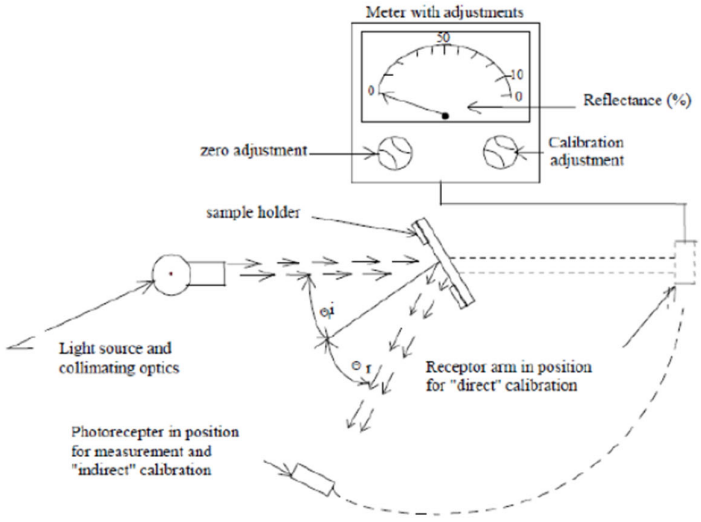
F-2.2. Spectral characteristics of light source and receiver

The light source shall consist of a CIE standard source A and associated optics to provide a near-collimated light beam.

A voltage stabiliser is recommended in order to maintain a fixed lamp voltage during instrument operation.

The receiver shall have a photodetector with a spectral response proportional to the photopic luminosity function of the CIE (1931) standard colorimetric observer (see table). Any other combination of illuminate-filter-receptor giving the overall equivalent of CIE standard illuminant A and photopic vision may be used. When an integrating sphere is used in the receiver, the interior surface of the sphere shall be coated with a matt (diffusive) spectrally non-selective white coating.

F-2.3	Geometrical conditions The angle of the incident beam (θ) should preferably be 0.44 ± 0.09 rad (25 ± 5°) from the perpendicular to the test surface and shall not exceed the upper limit of the tolerance (i.e. 0.53 rad or 30°). The axis of the receptor shall make an angle (θ) with this perpendicular equal to that of the incident beam (see Figure F-1). The incident beam upon arrival at the test surface shall have a diameter of not less than 13 mm (0.5 in.). The reflected beam shall not be wider than the sensitive area of the photodetector, shall not cover less than 50 per cent of such area, and as nearly as possible shall cover the same area segment as used during instrument calibration. When an integrating sphere is used in the receiver section, the sphere shall have a minimum diameter of 127 mm (5 in.). The sample and incident beam apertures in the sphere wall shall be of such a size as to admit the entire incident and reflected light beams. The photodetector shall be so located as not to receive direct light from either the incident or the reflected beam.
F-2.4	Electrical characteristics of the photodetector-indicator unit The photo detector output as read on the indicating meter shall be a linear function of the light intensity of the photosensitive area. Means (electrical and/or optical) shall be provided to facilitate zeroing and calibration adjustments. Such means shall not affect the linearity or the spectral characteristics of the instrument. The accuracy of the receptor indicator unit shall be within ± 2 per cent of full scale, or ± 10 per cent of the magnitude of the reading, whichever is the smaller
F-2.5.	Sample holder The mechanism shall be capable of locating the test sample so that the axes of the source arm and receptor intersect at the reflecting surface. The reflecting surface may lie within or at either face of the mirror sample, depending on whether it is a first surface, second surface or prismatic "flip" type mirror.
F-3.	**PROCEDURE**
F-3.1.	Direct calibration method In the direct calibration method, air is used as the reference standard. This method is applicable for those instruments, which are so constructed as to permit calibration at the 100 per cent point by swinging the receiver to a position directly on the axis of the light source (see Figure F-1). It may be desired in some cases (such as when measuring low-reflectivity surfaces) to use an intermediate calibration point (between 0 and 100 per cent on the scale) with this method. In these cases, a neutral density filter of known transmittance shall be inserted in the optical path, and the calibration control shall then be adjusted until the meter reads the percentage transmission of the neutral density filter. This filter shall be removed before reflectivity measurements are performed.

F-3.2.	Indirect calibration method The indirect calibration method is applicable in the case of instruments with fixed source and receiver geometry. A properly calibrated and maintained reflectance standard is required. This reference standard should preferably be a flat mirror with a reflectance value as near as possible to that of the test samples.
F-3.3.	Flat mirror measurement The reflectance of flat mirror samples may be measured on instruments employing either the direct or the indirect calibration method. The reflectance value is read directly from the indicating meter.
F-3.4	Non-flat (convex) mirror measurement Measurement of the reflectance of non-flat (convex) mirrors requires the use of instruments which incorporate an integrating sphere in the receiver unit (see Figure F-2). If the instrument indicating meter indicates n_e divisions with a standard mirror of E percent reflectance, then, with a mirror of unknown reflectance, n_x divisions will correspond to a reflectance of X percent, in accordance with the formula: $$X = E\,\frac{n_x}{n_e}$$
	 **Figure F-1:** (See F-2.1 and F-3.1) **Generalised reflectometer showing experimental set-ups for the two calibration methods**
	OR

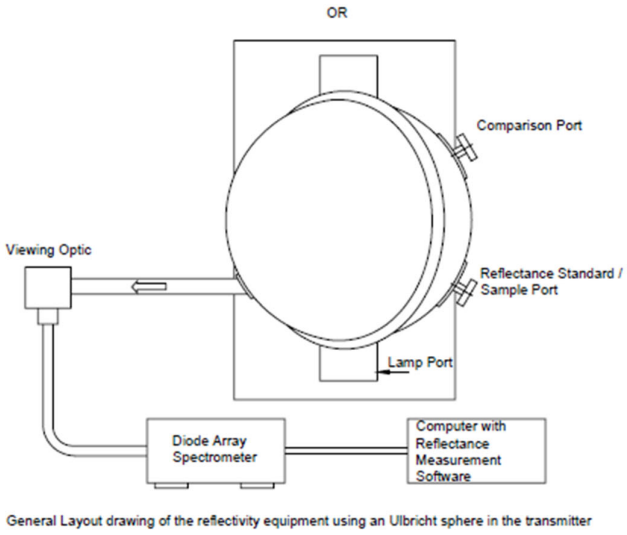


Figure F-1(a)

Alternate Generalised reflectometer showing experimental set-ups for the two calibration methods

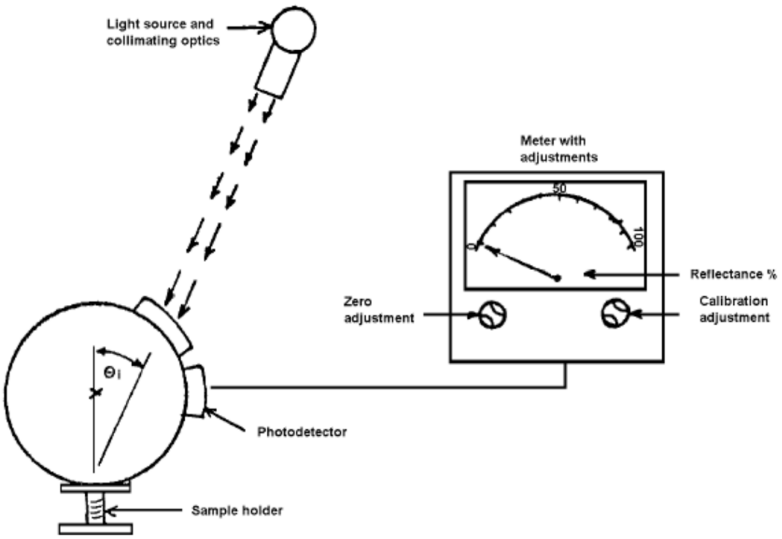


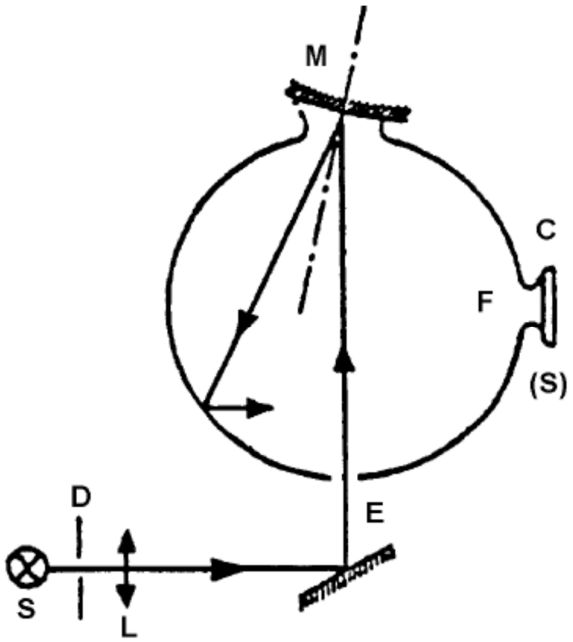
Figure 2
(See F-2.1 and F-3.4)
Generalised reflectometer, incorporating an integrating sphere in the receiver

Table F-1
(See F-1.1.4.)
SPECTRAL TRISTIMULUS VALUES FOR THE CIE 1931 STANDARD COLORMETRIC OBSERVER (see note below)
This table is taken from CIE publication 50 (45) (1970)

λ nm	$\bar{x}(\lambda)$	$\bar{y}(\lambda)$	$\bar{z}(\lambda)$
380	0.001 4	0,000 0	0,006 5
390	0,004 2	0,000 1	0,020 1
400	0,014 3	0,000 4	0,067 9
410	0,043 5	0,001 2	0,207 4
420	0,134 4	0,004 0	0,645 6
430	0,283 9	0,011 6	1,385 6
440	0,348 3	0,023 0	1,747 1
450	0,336 2	0,038 0	1,772 1
460	0,290 8	0,060 0	1,669 2
470	0,195 4	0,091 0	1,287 6
480	0,095 6	0,139 0	0,813 0
490	0,032 0	0,208 0	0,465 2
500	0,004 9	0,323 0	0,272 0
510	0,009 3	0,503 0	0,158 2
520	0,063 3	0,710 0	0,078 2
530	0,165 5	0,862 0	0,042 2
540	0,290 4	0,954 0	0,020 3
550	0,433 4	0,995 0	0,008 7
560	0,594 5	0,995 0	0,003 9
570	0,762 1	0,952 0	0,002 1
580	0,916 3	0,870 0	0,001 7
590	1,026 3	0,757 0	0,001 1
600	1,062 2	0,631 0	0,000 8
610	1,002 6	0,503 0	0,000 3
620	0,854 4	0,381 0	0,000 2
630	0,642 4	0,265 0	0,000 0
640	0,447 9	0,175 0	0,000 0
650	0,283 5	0,107 0	0,000 0
660	0,164 9	0,061 0	0,000 0
670	0,087 4	0,032 0	0,000 0
680	0,046 8	0,017 0	0,000 0
690	0,022 7	0,008 2	0,000 0
700	0,011 4	0,004 1	0,000 0
710	0,005 8	0,002 1	0,000 0
720	0,002 9	0,001 0	0,000 0
730	0,001 4	0,000 5	0,000 0
740	0,000 7	0,000 2 (*)	0,000 0
750	0,000 3	0,000 1	0,000 0
760	0,000 2	0,000 1	0,000 0
770	0,000 1	0,000 0	0,000 0
780	0,000 0	0,000 0	0.000 0
(*) : Changed in 1966 (from 3 to 2)			

EXPLANATORY FIGURE

Example of device for Measuring the Reflection Factor of Spherical Mirrors



C = Receiver

D = Diaphragm

E = Window of entry

F = Window of measurement

L = Lens

M = Object window

S = Light source

(S) = Integrating sphere

ANNEX G

(See 2.1.1.5 and 2.1.1.6)

PROCEDURE FOR DETERMINING THE RADIUS OF CURVATURE "r" OF THE REFLECTING SURFACE OF A MIRROR

G-1. MEASUREMENT

G-1.1. Equipment

A "spherometer" similar to the one described in Figure G-1 of this annex having the indicated distances between the tracing pin of the dial gauge and the fixed legs of the bar is used.

G-1.2. Measuring points

G-1.2.1. The principal radii of curvature shall be measured at three points situated as close as possible to positions at ⅓ , ½ and ⅔ of the distance along the arc of the reflecting surface passing through the centre of this surface and parallel to segment b, or of the arc passing through the centre of the reflecting surface which is perpendicular to it if this arc is the longer.

G-1.2.2. Where, owing to the size of the reflecting surface, it is impossible to obtain measurements in the directions defined in 2.1.1.5 of this standard, testing agency may take measurements at the said point in two perpendicular directions as close as possible to those prescribed above.

G-2. CALCULATION OF THE RADIUS OF CURVATURE "r"

"r" expressed in mm is calculated from the formula

$$r = \frac{r_p 1 + r_p 2 + r_p 3}{3}$$

where:

r_p1 = the radius of curvature at the first measuring point,

r_p2 = the radius of curvature at the second measuring point,

r_p3 = the radius of curvature at the third measuring point,

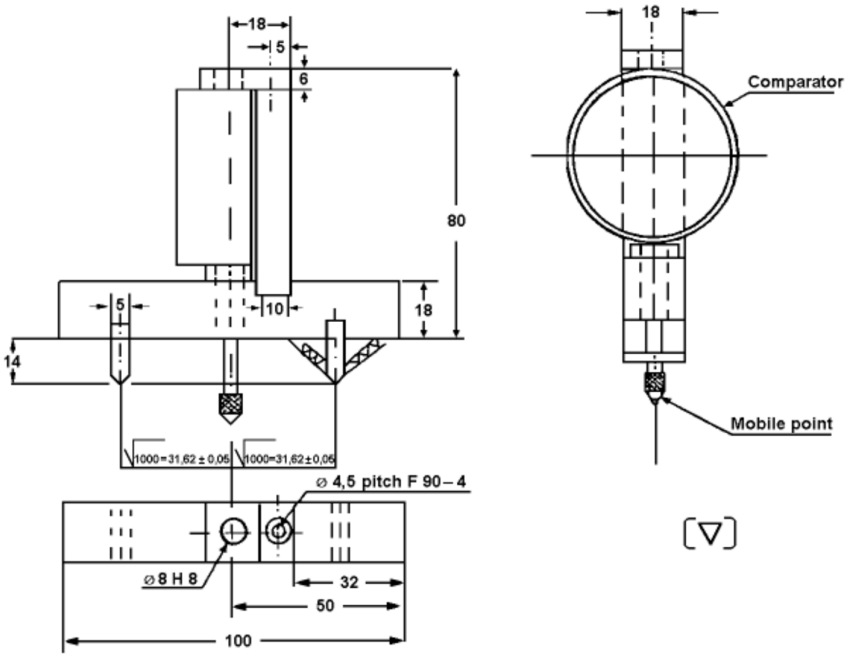


Figure G-1

Spherometer
(see G-1.1.)

ANNEX H to ANNEX M

Reserved

ANNEX N

(See 7.5)

CRITERIA FOR EXTENSION OF APPROVAL

N-1 The verification/tests to be carried out for extending the approval to changes in the parameters are listed in the **Table N-1** below for mirror.

N-2 Changes other than those listed above are considered to be having no adverse effect on Rear View Mirror.

Table N-1

1.	Make (trade name of manufacturer):	If different manufacturer complete type approval to be carried out. In case of changes in the name of manufacturer's or trademark for commercial reasons, type approval shall be extended without any testing.
2.	Type and general commercial description(s):	In the case of type change, subject to other provisions of this table, all verification shall be carried out. In case of change in commercial description, type approval shall be extended without any testing, unless additional tests are called for, because of changes in technical parameters.
3.	Means of identification of the type, if indicated on the device:	Type approval shall be extended without any testing.
4.	Category of vehicle for which the device is intended:	No extension of approval is required
5.	Name and address of manufacturer:	Same as for sl. No. 1
6.	Location and method of affixing of the approval mark:	Type approval shall be extended without any testing.
7.	Address(es) of assembly plant(s):	Verification of compliance to following requirements in AIS-037 need be carried out: - 5.0 Initial documentary appraisal - 6.0 Pre-test inspection Subject to compliance of the above type approval shall be extended without any further testing of samples.
8.	Mirrors (state for each mirror):	
8.1.	Variant	Based on the change in parameters listed in this table

8.2.	Sketch for the identification of the mirror:	No verification required.
8.3.	Details of the method of attachment:	See 8.8
8.4	Dimensions of reflecting surfaces.	If maximum and minimum dimensions are type approved and changed dimensions are within these values, no test is required, otherwise dimensional check to be conducted.
8.5	Change in Radius of curvature of reflecting surface.	Radius of curvature to be verified.
8.6	Change in reflective coating.	Reflectivity test to be verified.
8.7	Increase in cross-section of material and hardness of stem.	Bending and impact tests are to be conducted.
8.8	Changes in mounting dimensions adversely affecting, the performance against impact / bending test.	If height is reduced and/or horizontal distance between centre of the mirror to the base is reduced, bending test and Impact test to be conducted.
8.9	Overall shape of Housing	Bending and impact tests are to be conducted. Note: Bending test is applicable only for rear mirrors described in Part 2 of this standard
9	Devices for indirect vision other than mirrors:	As agreed between test agency and device manufacturer/ applicant.

ANNEX- P
(See 0.6)
THE AISC PANEL RESPONSIBLE FOR PREPARATION OF THIS STANDARD*

Panel Convener	
Mr. P. S. Gowrishankar	SIAM (Tata Motors Ltd.)
Members	**Representing**
Dr. B. V. Shamsundara	The Automotive Research Association of India
Ms. Sonali Tambolkar	The Automotive Research Association of India
Mr. Vishal P. Rawal	The Automotive Research Association of India
Mr. Ankit Sinha	The Automotive Research Association of India
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Mr. Rohit Yadav	International Centre for Automotive Technology
Mr. Ravi M	Global Automotive Research Centre
Mr. S. Nagarajan	Global Automotive Research Centre
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Mr. Manikandan Rama	SIAM (Daimler India Com. Veh. Pvt., Ltd.)
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Mr. Shailesh Kulkarni	SIAM (Mahindra & Mahindra Ltd.)
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Mr. Tangri Devinder	SIAM (Mahindra & Mahindra Ltd.)
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Mr. Devender	SIAM (Mahindra & Mahindra Ltd.)
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Mr. Rajesh Kumar	SIAM (Maruti Suzuki India Ltd.)
Mr. Nitish Seth	SIAM (Maruti Suzuki India Ltd.)
Mr. Tarun Nagar	SIAM (Mercedes Benz India Ltd.)
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Mr. Vivekraj S	SIAM (Renault Nissan)
Mr. Mohit Gupta	SIAM (SML Isuzu Ltd.)
Mr. Abhinav Sharma	SIAM (SML Isuzu Ltd.)
Mr. Pushpinder Singh	SIAM (SML Isuzu Ltd.)
Mr. Vishal Jain	SIAM (Isuzu Motors India)
Mr. M Raju	SIAM (Toyota Kirloskar Motor Private Limited)

Mr. Shekar M. B.	SIAM (Toyota Kirloskar Motor Private Limited)
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Mr. Pramodkumar Hugar	SIAM (Volvo Trucks India)
Mr. Rahul Jain	SIAM (VECV)
Mr. Sivaramakrishnan	SIAM (Ather Energy)
Ms. Aditi Nandanwar	SIAM (Ather Energy)
Mr. Philip Koshy	TMA (Sonalika Int. Tractors Ltd)
Mr. Mohit	TMA (Sonalika Int. Tractors Ltd)
Mr. Mansigh Jagadale	TMA (M/s John Deer)
Mr. Uday Harite	Automotive Component Manufacturers Association of India - ACMA
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Mr. Gitesh Mutha	ACMA (UNO Minda)
Mr. Mohsin Hasan	Krishna Ishizaki Auto Ltd. (Lab).
Mr. Subrat Dash	Ola Electric
Mr. B. N. S, Mogallana	Sandhar Automotives
Mr. K. Velmurugan	Sandhar Automotives
Mr. Chandran	SMR-Chennai
Mr. Sidhartha Mitra	SMR-Chennai
Mr. Umashankar Gnanagurusamy	SMR-Chennai
Mr. Venkatasubramanian Saminathan	CREAT, Pune
Mr. Kishor Jadhao	CREAT, Pune

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEX R
(See Introduction)

COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

Chairperson	
Dr. Reji Mathai	Director, The Automotive Research Association of India
Members	**Representing**
Representative from	Ministry of Road Transport and Highways, New Delhi
Representative from	Ministry of Heavy Industries, New Delhi
Representative from	Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises, New Delhi
Shri Shrikant R. Marathe	Former Chairman, AISC
Shri P. V. Srikanth	Bureau of Indian Standards
Director	Central Institute of Road Transport
Director	Global Automotive Research Centre
Director	International Centre for Automotive Technology
Director	Indian Institute of Petroleum
Director	Vehicles Research and Development Establishment
Director	Indian Rubber Manufacturers Research Association
Representatives from	Society of Indian Automobile Manufacturers
Representative from	Tractor Manufacturers Association
Representative from	Automotive Components Manufacturers Association of India
Representative from	Indian Construction Equipment Manufactures' Association (ICEMA)
Member Secretary	
Shri Vikram Tandon	The Automotive Research Association of India

* At the time of approval of this Automotive Industry Standard (AIS)