

AMENDMENT NO. 2
TO
AIS – 001/2001
Automotive Vehicles - Rear - View Mirrors – Specification

1.0 Title of the standard:

Substitute following title for existing title:

“Automotive Vehicles including Agricultural Tractors – Rear – View Mirrors – Specification”.

2.0 Page No. 1, cl. No. 1.1, Scope:

Substitute following text for existing text:

“This standard specifies requirements of interior and exterior rear - view mirrors used in automotive vehicles including agricultural tractors. ”

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

December 2008

AMENDMENT NO. 1 / SEPTEMBER 2002
TO
AIS-001/2001
Automotive Vehicles – Rear – View Mirrors - Specification

1. Clause No. 11.7 : Substitute Clause No. 11.7 as follows:

Weather Resistance Test:

This test is applicable for exterior rear - view mirrors only. The test procedure shall be as per Annex : 5.

2. Substitute Annex : 5 with the following :

ANNEX : 5

WEATHER RESISTANCE TEST
(Ref. Cl. 11.7)

“ Test method for Weather Resistance Test using Xenon arc lamp :-

Two specimens of the specific size suitable for mounting in the weatherometer - one from reflecting surface and other from the non-metallic portion of the holder shall be subjected to the test in a weatherometer as described in ISO : 105-B. After the test, there shall be no cloudiness, deterioration, discoloration, cracks, deformation, etc. of the mirror surface and other parts. ”

Recommended Test Condition	
Radiation source	Xenon arc lamp
Relative spectral energy distribution	Appropriate filters shall be placed between the light source and the sample unit in order to have radiation between 295 nm and 2500 nm.
Sample surface irradiance W / m ² (Wave length range 300 nm to 800 nm)	550 ± 55 W / m ²
Temperature in side the chamber	63 °± 3° C (Black panel thermometer)
Humidity in side the chamber	50 ± 2 % RH
Radiant exposure	Test duration: 300 hrs. at the recommended irradiant level of 550 ± 55 W / m ² over a wave length range 300 to 800 nm.
Number of rotations (rpm)	1 rpm ± 0.1 rpm

Spraying conditions of water	Pressure kgf / cm ²	0.8 to 1.3
	Quantity of water ml / min.	2100 ± 100
	Spraying time	The exposure cycle shall be 102 min of light only at black panel temperature specified above followed by 18 min of light with specimen spray.
	Quality of water	Water may contain upto 1 ppm dissolved solids and 0.1 ppm maximum silica. Water of the required purity can be achieved by distilled or a combination of deionization and reverse osmosis.
Operating condition		Continuous radiation
Sample size		2 samples of 70 mm X 145 mm size - one cut from reflecting surface and another from non - metallic holder.

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AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

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

September 2002

AUTOMOTIVE INDUSTRY STANDARD

**Automotive Vehicles -
Rear - View Mirrors - Specification**

PRINTED BY:

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

ON BEHALF OF :
AUTOMOTIVE INDUSTRY STANDARD COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

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

June 2001

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

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

General remarks :

Introduction

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standard 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.

Rear-view mirrors and the field of vision provided by them is a safety requirement. This standard prescribes the requirements of the rear-view mirrors.

Considerable assistance has been taken from the following EEC directives and ECE Regulations in preparing this standard.

1. ECE 46 Uniform provisions concerning the approval of rear-view mirrors of motor vehicles with regard to the installation of rear-view mirrors.
2. ECE R 81 Uniform provisions concerning the approval of rear-view mirrors of two wheeled power driven vehicles, with or without side car, with regard to the mounting of rear-view mirrors on handle bars.
3. EEC directive 71/127/EEC as amended by Directive 79/795/EEC, 85/205/EEC, 86/562/EEC, 87/354/EEC and 88/321/EEC.
4. EEC directive 97/24/EC, Chapter 4.
5. IS 14210:1994 Automotive Vehicles- Rear-View Mirrors- Specifications

The Committee responsible for preparation of this standard is given in Annex. 6.

Automotive Vehicles - Rear - View Mirrors - Specification

1. SCOPE

- 1.1 This standard specifies requirements of interior and exterior rear-view mirrors used in Automotive vehicles.

Installation requirements of these mirrors are covered separately in AIS 002/2001.

2. REFERENCES.

- 2.1.1 Following Indian standards are necessary adjuncts to this standard.

- (1) IS 11825-1986 : Method of weighing of automotive vehicles.
- (2) IS 9727 -1981 : Terms and definitions of dimensions for Mopeds.
- (3) IS 9211 -1979 : Denominations and definitions of weights of road vehicles.
- (4) IS 11422-1985 : Terms and definitions of weights of Scooters and Motorcycles.
- (5) IS 14413-1996 : Automotive vehicles – Telltales symbols and controls on Two wheeled and Three wheeled vehicles.
- (6) IS 14272 Automotive vehicles – Types – Terminology - part 1 - (Part 1) –1995 : three and four wheelers.

3. TYPE APPROVAL

- 3.1 The manufacturer shall submit following for type approval of a rear-view mirror.

- (a) Application for type approval of Rear-View Mirrors.
- (b) Technical specification of the mirrors which shall include at least the details given in Annex 1.
- (c) Five samples of rear-view mirrors.

- 3.2 Modifications/changes in technical specification:

- 3.2.1 Every functional modification in technical specifications pertaining to rear-view mirror declared in accordance with 3.1(b), shall be intimated to the testing agency. Testing agency may then consider, whether,

- 3.2.1.1 mirror with modifications complies with specified performance requirements, or,

- 3.2.1.2 any testing is required.

- 3.2.2 For considering whether testing is required or not, guidelines given in Annex 2 shall be followed.

- 3.2.3 In case of 3.2.1.2, tests for those parameters which are affected by the modifications only need to be carried out.
- 3.2.4 In the event of 3.2.1.1 or in the case of 3.2.1.2 after successful compliance to performance requirements, the certificate of compliance shall be validated for the modified version.

4. DEFINITIONS

- 4.1 “Rear-View Mirror” means a device other than a complex optical system, such as a periscope, the aim of which is to give a clear view towards the rear of the vehicle.
- 4.2 “Interior Rear-View Mirror” means a device as defined in 4.1 which is intended, where appropriate, to be fitted inside the passenger compartment of the vehicle.
- 4.3 “Exterior Rear-View Mirror” means a device as defined in 4.1 which is intended to be mounted on an outside surface of the vehicle.
- 4.4 “Type of Rear-View Mirror” means devices, which do not differ significantly from one another in respect of the specifications given in Annex I.
- 4.5 “Class of Rear - View Mirrors” means all devices having one or more common characteristics of functions. The classification given below is of general nature and does not restrict their use at other locations.
- Class I: Interior rear-view mirrors, (Clause 4.2)
- Class II, III & VI : “Main” exterior rear-view mirrors, (Clause 4.3)
- Class IV: “Wide-angle” exterior rear-view mirrors,
- Class V: “Close proximity” exterior rear-view mirrors.
- 4.6 “ \bar{r} ” means the average of the radii of curvature measured in mm, on a reflecting surface in accordance with one of the methods described in Annex 3.
- 4.7 “Main radius of curvature at a point on the reflecting surface” means the values obtained using the apparatus defined in Annex 3 measured on the major arc of the reflecting surface passing through the center of that surface and lying within a vertical plane (r_i) passing through the center of that surface, and lying within a horizontal plane, (r'_i) and on the major arc which is perpendicular to that segment.
- 4.8 “Radius of curvature at a point on the reflecting surface (r_p)” means the arithmetical mean of the main radii of curvature r_i and r'_i or in other words;
- $$r_p = \frac{r_i + r'_i}{2}$$
- 4.9 “Center of reflecting surface” means the centroid of the visible zone of the reflecting surface.
- 4.10 “Radius of curvature of the constituent part of the rear-view mirror” means the radius ‘c’ of the arc of the circle which most closely approximates the rounded form of the part under consideration.

- 4.11 “Driver’s ocular points” means two points 65 mm apart located 635 mm vertically above the R point relating to the driving position defined in IS:13749 1993. The straight line joining these is at right angles to the vertical longitudinal median plane of the vehicle.

The center of the segment having its extremities, the two ocular points, is located within a vertical longitudinal median plane which shall pass through the center of the driver’s seating position as specified by the manufacturer.

In the absence of similar procedure for 3 wheeled vehicles, R point shall be as specified by vehicle manufacturer.

- 4.12 “Ambinocular vision” means the entire field of vision obtained by superimposing the monocular fields for the right and left eyes. (see figure a).

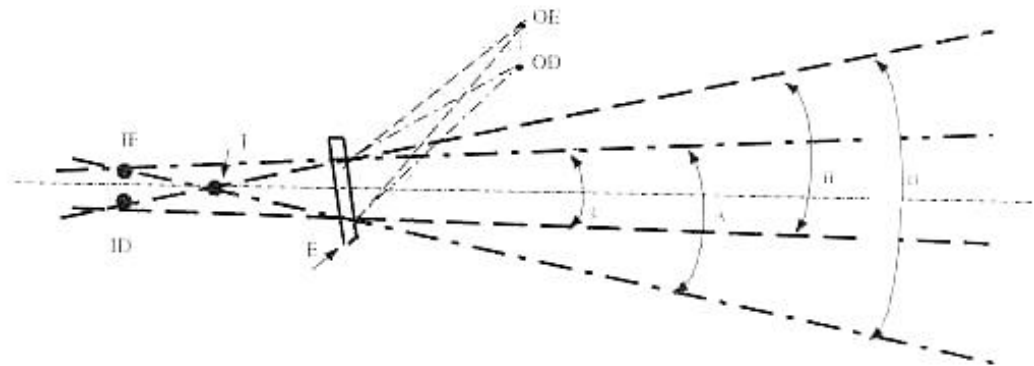


Figure a

- E = interior rear-view mirror.
- OD } driver’s eye
- OE }
- ID } monocular virtual image
- IE }
- I = Ambinocular virtual image.
- A = angle of view from the right eye.
- B = angle of view from the left eye.
- C = angle of binocular view.
- D = angle of Ambinocular view.

5. GENERAL SPECIFICATIONS

- 5.1 Assembly of reflective surfaces with housing or mirror plate holder of all rear-view mirrors or the mirrors shall be adjustable
- 5.2 The edge of the reflecting surface shall be enclosed in a protective housing (holder, etc.) which, on its perimeter, shall have a radius 'c' greater or equal to 2.5 mm at all points 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.
- 5.3 When the rear-view mirror is mounted on a plain 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 8.2, which are in potential, static contact with a sphere either 165 mm in diameter in the case of an interior rear-view mirror or 100 mm in diameter in the case of an exterior rear-view mirror, shall have a radius of curvature 'c' of not less than 2.5 mm.
- 5.3.1 Edges of fixing holes or recesses of which the diameter or longer diagonal is less than 12 mm are exempt from the radius requirements of item 5.3 provided that they are blunted.
- 5.4 The device for the attachment of rear-view mirrors to the vehicle shall be so designed that a cylinder with a 50 mm radius, having as its axis the axis, or one of the axes, of pivot or rotation which ensure deflection of the rear-view mirror in the direction of impact concerned, passes through at least part of the surface to which the device is attached.
- 5.5 In the case of those parts of interior rear-view mirrors which are made of a material with a Shore A hardness of less than 50 and which are mounted on a rigid support and also the part of exterior rear-view mirrors which are made of a material with a Shore A hardness not exceeding 60, the requirements of 5.2 and 5.3 shall only apply to the support.
- 5.6 All rear-view mirrors shall be examined visually for harmful defects.

6. DIMENSIONS

- 6.1 Interior 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 4 cm and the other side 'a' cm in length, where

$$a = 15 \text{ cm} \times \frac{1}{1 + \frac{1000}{r}}$$

(r as defined in clause 4.6)

- 6.2 Main exterior rear-view mirrors (Classes II and III).

- 6.2.1 The dimensions of the reflecting surface shall be such that it is possible to inscribe therein:
- a rectangle 4 cm high, the base length of which, measured in centimeters, has the value 'a',
 - a segment which is parallel to the height of the rectangle, and the length of which, expressed in centimeters, has the value 'b'.

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

Class of Rear-view mirrors	a	b
II	$17 / [1+ 1000/r]$	20
III	$13 / [1+ 1000/r]$	7

- 6.3 **Wide-angle exterior rear-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 rear-view mirror, the required field of vision.
- 6.4 **Close-proximity exterior rear-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 required field of vision.
- 6.5 **'Main' exterior mirrors (Class VI).**
- 6.5.1 The minimum dimensions of the reflecting surface shall be such that:
- 6.5.1.1 Its area shall not be less than 6900 mm² ;
- 6.5.1.2 The diameter of circular mirrors shall not be less than 94 mm;
- 6.5.1.3 Where rear-view mirrors are not circular, their dimensions shall enable a circle of diameter 78 mm to be inscribed on their reflecting surface.
- 6.5.2 The maximum dimensions of the reflecting surfaces shall be such that:
- 6.5.2.1 The diameter of any circular rear-view mirror shall not be greater than 150 mm,
- 6.5.2.2 The reflecting surface of any non-circular rear-view mirror shall lie within a rectangle measuring 120 mm x 200 mm.

7 REFLECTING SURFACE AND COEFFICIENTS OF REFLECTION

- 7.1 The reflecting surface of a rear-view mirror shall be either flat or spherically convex.
- 7.1.1 There shall be no cracks, cloudiness, spots, etc, on the mirror surface.
- 7.1.2 Differences between the radii of curvature for spherically convex mirrors.
- 7.1.2.1 The difference between r or r'_i and r_p at each reference point shall not exceed $0,15 r$.
- 7.1.2.2 The difference between any of the radii of curvature (rp_1 , rp_2 and rp_3) and r shall not exceed $0,15 r$.
- 7.1.2.3 When ' r ' is not less than 3000 mm, the value of $0.15 r$ quoted in items 7.1.2.1 and 7.1.2.2 is replaced by $0.25 r$.
- 7.1.3 The value of ' r ' for spherically convex mirrors shall not be less than;
- 7.1.3.1 1200 mm for interior rear-view mirrors (Class I) and Class III main exterior rear-view mirrors;
- 7.1.3.2 1800 mm for Class II main exterior rear-view mirrors;
- 7.1.3.3 400 mm for wide-angle exterior rear-view mirrors (Class IV) and close-proximity exterior rear-view mirrors (Class V).
- 7.1.3.4 1000 mm in the case of Class VI rear-view mirrors.
- 7.1.4 The value of the normal coefficient of reflection, as determined according to the method described in 10, shall not be less than 40%.
- If the reflecting surface has two positions ('day' and 'night') 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 not be less than 4%.

8 TESTS

- 8.1 Rear-view mirror shall be subjected to the tests described in items 8.2, 8.3, 10 and 11 for Type Approval.
- 8.1.1 The test provided for in item 8.2 shall not be required in the case of any exterior rear-view mirror 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 permissible weight (GVW).
This provision also applies to the attachments of rear-view mirrors (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 rear-view 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 rear-view mirror shall be mounted so as to conform with the above mentioned conditions for the positioning of its attachments on the vehicle shall be provided.

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

$$\frac{\Delta}{2m}$$

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

8.2 IMPACT TEST

8.2.1 *Description of the test rig.*

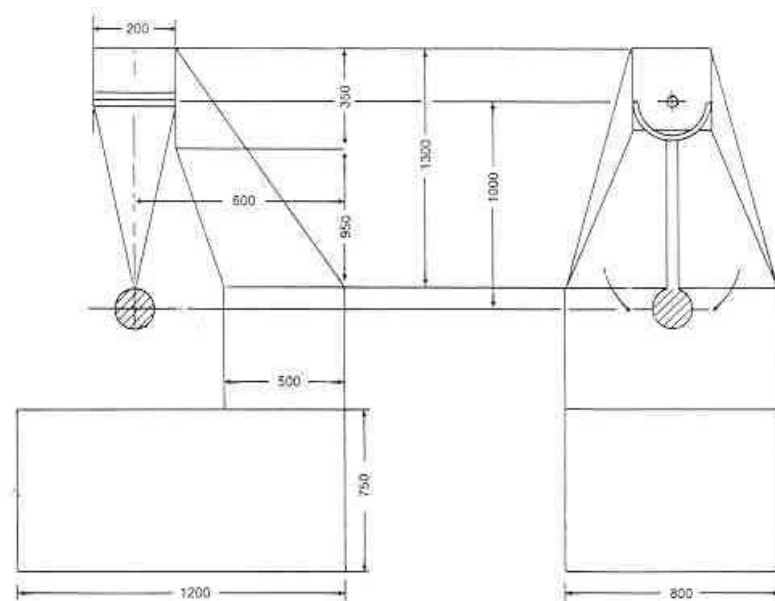
8.2.1.1 The test rig consists of a pendulum capable of swinging about two horizontal axes at right angles to each other, one of which is perpendicular to the plane containing the “release” trajectory of the pendulum.

The end of the pendulum comprises a hammer formed by a rigid sphere with a diameter of 165 ± 1 mm and having a 5 mm thick rubber covering of hardness shore A 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 item 8.2.2.6.

Figure 1 below gives the dimensions of the test rig and the special design specifications



- 8.2.1.2 The center of percussion of the pendulum coincides with the center of the sphere which forms the hammer. It is at a distance L, (1000± 5 mm) from the axis of oscillation in the release plane.

The reduced mass of the pendulum to its center of percussion is $m_0 = 6.8 \pm 0.05$ kg . (The relation of reduced mass of pendulum 'm₀' to the total mass 'm' of the pendulum and to the distance 'd' between the center of gravity of the pendulum and its axis of rotation is expressed in the equation :

$$m_0 = m \cdot \frac{d}{L}$$

- 8.2.2 *Description of the test.*

- 8.2.2.1 The procedure used to clamp the rear-view mirror to the support shall be that recommended by the manufacturer of the device or, where appropriate, by the vehicle manufacturer.

- 8.2.2.2 Positioning of the rear-view mirror for the test.

- 8.2.2.2.1 Rear-view mirrors shall be so positioned on the pendulum impact rig such that the axes which are horizontal and vertical, when the rear-view mirror is installed on a vehicle in accordance with the applicant's mounting instruction, are in similar position.

- 8.2.2.2.2 When a rear-view mirror 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 applicants.

- 8.2.2.2.3 When the rear-view mirror 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.

- 8.2.2.2.4 When the reflecting surface is mobile in the housing, it shall be so adjusted that the upper corner which is farthest from the vehicle, is in the position of greatest projection relative to the housing.

- 8.2.2.3 Except in the case of test 2 for interior rear-view mirrors (see item 8.2.2.6.1), when the pendulum is in a vertical position the horizontal and longitudinal vertical planes passing through the center of the hammer shall pass through the center of the reflecting surface as defined in 4.9. The longitudinal direction of oscillation of the pendulum shall be parallel to the longitudinal plane of the vehicle.

- 8.2.2.4 When, under the conditions governing adjustment laid down in items 8.2.2.1 and 8.2.2.2, parts of the rear-view mirror 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.

This displacement shall be as minimum as possible for the conduct of the test; it shall be limited in such a way that:

- either the sphere delimiting the hammer remains at least tangential to the cylinder as defined in 5.4
- or the point of contact with the hammer is located at least 10 mm from the periphery of the reflecting surface.

8.2.2.5 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 rear-view mirror at the moment when the pendulum reaches the vertical position.

8.2.2.6 The rear-view mirrors are subjected to impact under the following different conditions:

8.2.2.6.1 Interior rear-view mirrors (Class I)

Test 1: The point of impact shall as defined in item 8.2.2.3. The impact shall be such that hammer strikes the rear-view mirror on the reflecting surface side.

Test 2: Point of impact on the edge of the housing, so 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 center of the surface. The impact shall occur on the reflecting surface side.

8.2.2.6.2 Exterior rear-view mirrors of all types.

Test 1: The point of impact shall as defined in item 8.2.2.3 or 8.2.2.4. The impact shall be such that hammer strikes the rear-view mirror on the reflecting surface side.

Test 2: The point of impact shall be as defined in item 8.2.2.3 or 8.2.2.4. The impact is such that the hammer strikes the rear-view 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 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.

8.3 Bending test on the protective housing fixed to the stem

8.3.1 This test shall be performed on all rear-view mirrors with stem.

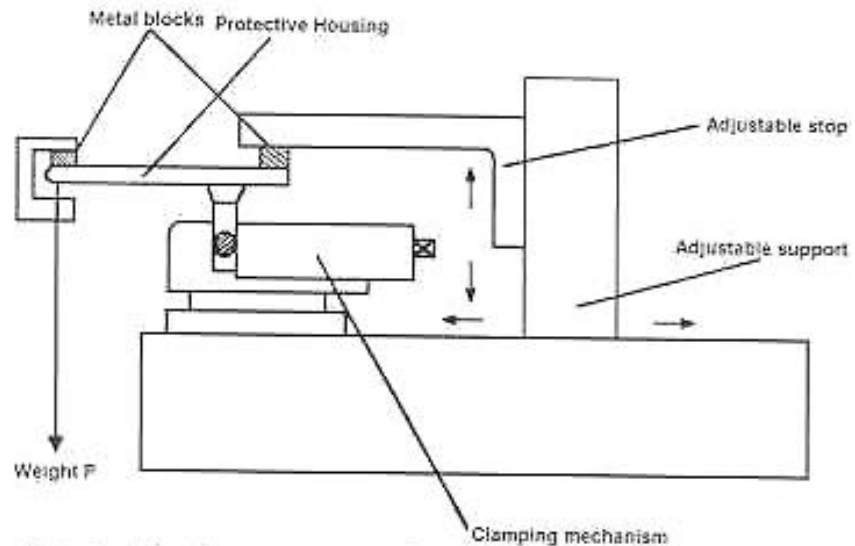
8.3.2 *Description of the test.*

The protective housing is placed horizontally in a device in such a way that the adjustment parts of the mounting can be clamped securely. In the direction of the greatest dimension of the housing, the end nearest to the point of fixing on the adjustment part is immobilized by means of a fixed stop 15 mm wide covering the entire width of the housing.

At the other end, a stop identical to the one described above is placed on the housing so that the specified test load can be applied to it.

The end of the housing opposite that at which the force is applied may be clamped instead of simply blocked, as shown in Figure 2.

Figure 2 Example of bending-test apparatus for rear-view mirror holders



8.3.3 The test load is 25 kgs. applied for one minute.

9 REQUIREMENTS

9.1 In the tests described in 8.2, the pendulum shall continue to swing after impact in such a way 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 $\pm 1^\circ$.

9.1.1 This requirement is not applicable to rear-view mirror stuck to the windscreen, in respect of which the requirement stipulated in item 9.2 shall apply after the test.

9.1.2 The required pendulum angle of return to the vertical is reduced from 20° to 10° for all Class II, Class III & Class VI rear-view mirrors which are fitted on the mounting normally used with Class IV rear-view mirrors.

- 9.2 Should the mounting of the rear-view mirror break during the tests described in item 8.2 for rear-view mirrors stuck to the windscreen, the part remaining shall not project beyond the base by more than 1 cm and the configuration after the test shall satisfy the conditions laid down in 5.3.
- 9.3 The reflecting surface shall not break during the tests described in 8.2 and 8.3. However, breakage of the reflecting surface will be allowed if one of the following conditions is fulfilled.
- 9.3.1 The fragments of glass still adhere to the back housing or to a surface firmly attached to the housing; partial separation of the glass from its backing is permitted provided 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.
- 9.3.2 The reflecting surface, if made of glass, shall be made of float glass.

10. TEST METHOD FOR DETERMINING REFLECTIVITY

10.1 DEFINITIONS

- 10.1.1 CIE standard illuminate A⁽¹⁾ - Colorimetric illuminant, representing the full radiator at $T_{68} = 2855.8$ K.
- 10.1.2 CIE standard source A⁽¹⁾ - Gas-filled tungsten filament lamp operating at a correlated colour temperature of $T_{68} = 2855.8$ K.
- 10.1.3 CIE 1931 standard colorimetric observer⁽¹⁾ - Receptor of radiation whose colorimetric characteristics correspond to the spectral tristimulus values.
 $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, $\bar{z}(\lambda)$ (see table 1).
- 10.1.4 CIE spectral tristimulus values⁽¹⁾ - Tristimulus values of the spectral components of an equi-energy spectrum in the CIE (XYZ) system.
- 10.1.5 Photopic vision⁽¹⁾ - Vision by the normal eye when it is adapted to levels of luminance of at least several candela per square meter.

10.2 APPARATUS

10.2.1 General

The apparatus shall consist of a light source, a holder for the test sample, a receiver unit with a photo-detector and an indicating meter (see Figure 3), 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 4).

10.2.2 Spectral characteristics of light source and receiver

The light source shall consist of a CIE standard source A⁽¹⁾ and associated optics to provide a near-collimated light beam. A voltage stabilizer is recommended in order to maintain a fixed lamp voltage during instrument operation.

The receiver shall have a photo detector with a spectral response proportional to the photopic luminosity function of the CIE (1931) standard calorimetric observer⁽¹⁾ (see table 1). Any other combination of illuminant-filter-receptor giving the overall equivalent of CIE standard illuminant A⁽¹⁾ 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 mat (diffusive) spectrally non-selective white coating.

10.2.3 Geometrical conditions

The angle of the incident beam (θ) should preferably be 0.44 ± 0.09 rad ($25 \pm 5^\circ$) 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 3). The incident beam upon the arrival at the test surface shall have a diameter of not less than 19 mm (0.75 in.). The reflected beam shall not be wider than the sensitive area of the photo-detector, shall not cover less than 50% 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 photo detector shall be so located as not to receive direct light from either the incident or the reflected beam.

10.2.4 Electrical characteristics of the photo detector-indicator unit

The photo detector output as read on the indicating meter shall be a linear function of the light intensity on the photosensitive area. Means (electrical and/or optical) shall be provided to facilitate zeroing and calibration adjustments. Such means shall not affect the linearing or the spectral characteristics of the instrument. The accuracy of the receptor-indicator unit shall be within $\pm 2\%$ of full scale, or $\pm 10\%$ of the magnitude of the reading, whichever is the smaller.

10.2.5 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.

(1) *Definitions taken from CIE publication 50(45), International Electrotechnical Vocabulary, Group 45: Lighting.*

10.3 Procedure

10.3.1 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% point by swinging the receiver to a position directly on the axis of the light source (see Figure 3).

It may be desired in some cases (such as when measuring low-reflectivity surface) to use an intermediate calibration point (between 0 and 100 % 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.

10.3.2 Indirect calibration method

The indirect calibration method is applicable in the case of instruments with fixed source and receiver 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.

10.3.3 Flat Mirror measurement

The reflectance of flat mirror samples can be measured on instruments employing either the direct or the indirect calibration method. The reflectance value is read directly from the indicating meter.

10.3.4 Convex Mirror measurement

Measurement of the reflectance of convex mirrors requires the use of instruments which incorporate an integrating sphere in the receiver unit (see Figure 4). If the instrument indicating meter indicates n_e divisions with a standard mirror of E % reflectance, then, with a mirror of unknown reflectance, n_x divisions will correspond to a reflectance of X %, in accordance with the formula:

$$X = E \frac{n_x}{n_e}$$

Figure 3: General layout drawing of the reflectivity measuring apparatus using two calibration methods

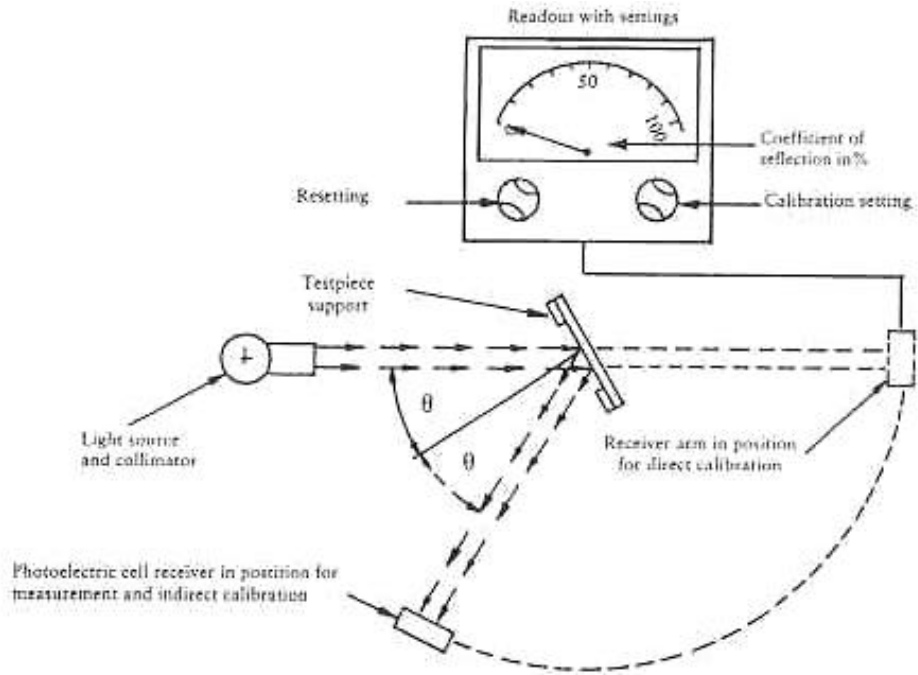


Figure 4: General layout drawing of the reflectivity equipment using an Ulbricht sphere in the receiver

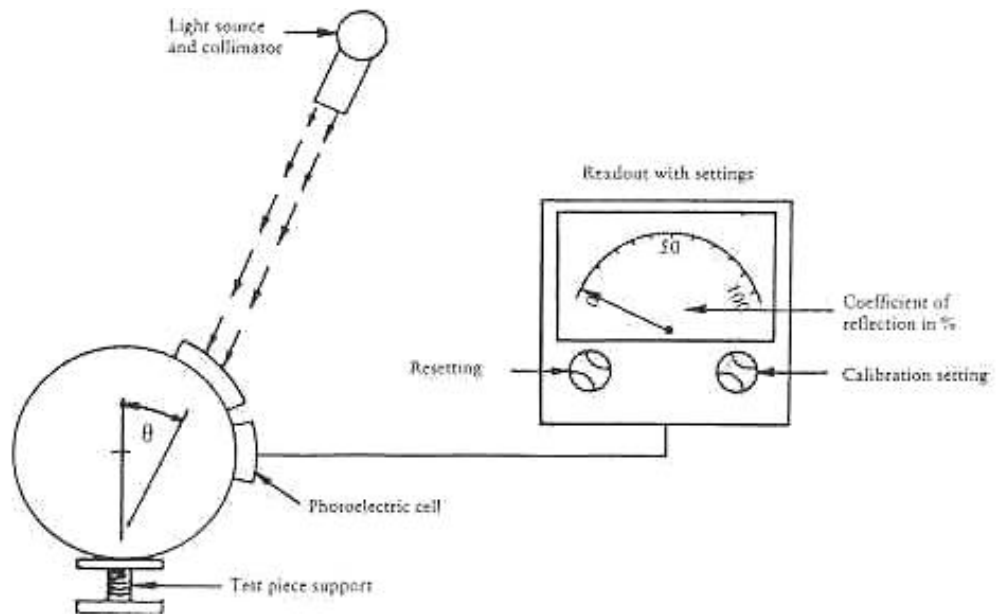


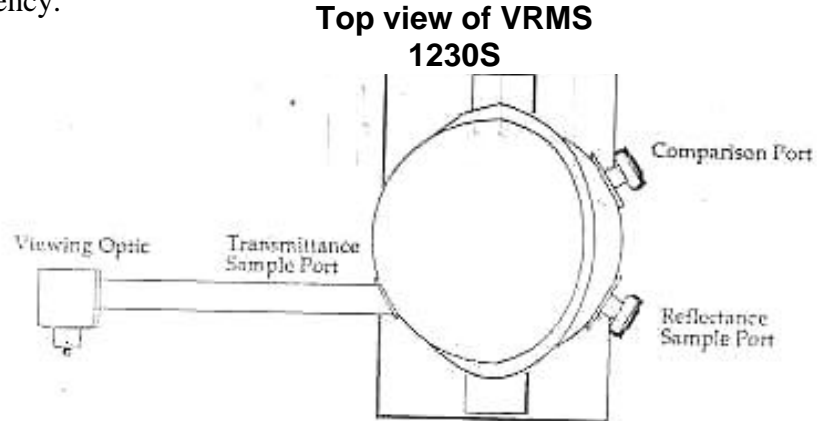
Table 1
Spectral tristimulus values for the CIE 1931 standard calorimetric observer ⁽¹⁾
 (This table is taken from CIE 50(45) 1970 publication)

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

⁽¹⁾ Abridged table . The values of $x(\lambda)$, $y(\lambda)$, $z(\lambda)$ are rounded off to four decimal places.

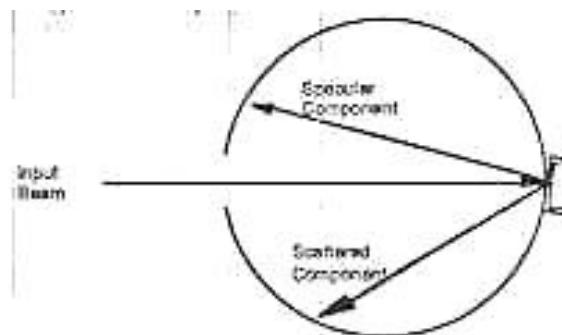
- Amended in 1966 (from 3 to 2).

- 10.4 Alternatively, the test apparatus VRMS-1230S (Visible Reflectance Measurement System) for reflectance measurement as described below may be used, if agreed between the mirror manufacturer and test agency.



10.4.1 Total Reflectance

The energy reflected by the sample at the reflectance port strikes the sphere wall. All of the reflected energy is integrated by the sphere wall before it reaches the detector for a measurement of total reflectance.



1. Place the light trap in the reflectance port.
2. Place the port plug in the comparison Port.
3. Select the Scan Dark button on the computer.
4. Select the Dark On button on the computer.
5. Select the Calibrate - Scan Reference from the pull down menu.
6. Place the USRS-99-020 Spectralon Reflectance standard in the reflectance port. Select the appropriate reflectance file. For example, select the 99% reflectance standard file for use with the USRS-99-020. Other standards can be purchased from Labsphere with the appropriate standard file.
7. Select the Scan Reference button on the computer.
8. Replace the SRS-99-010 Spectralon Reflectance standard with the sample.
9. Select the Scan Sample button on the computer.

To eliminate the substitution error of this procedure, place the USRS-99-020 Spectralon Reflectance Standard in the comparison port and the sample in the reflectance port in step 8.

11. FURTHER TESTS FOR REAR VIEW MIRRORS

Following tests shall be carried out on mirrors and they should satisfy the requirements specified therein.

- 11.1 Distortion factor test as per IS 14210 : 1994 (Clause 6.6)
- 11.2 Moisture resistance test as per IS 14210 : 1994 (Clause 6.9) - For exterior mirrors only.
- 11.3 Temperature resistance test as per IS 14210 : 1994 (Clause 6.10)

The high temperature for an outside mirrors for cooling and heating repetition test shall be 70 °C instead of 79 °C as specified in clause 6.10 of IS 14210 : 1994.

- 11.4 Vibration test as per IS 14210 : 1994 (Clause 6.8).
- 11.5 During testing mirrors for the above tests i.e. tests specified in clauses from 11.1 to 11.4, the state of a test room shall be at temperature of 20 ±15 °C and humidity of 65 ± 20 percent.
- 11.6 Salt spray test
This test shall be conducted as per procedure given in Annex 4. After the test there shall be no visible discolouration, poor adhesion or cracking of the reflective surface. There shall be no loss of reflectivity less than 85%, as obtained when tested as per clause 10.
- 11.7 Weather resistance test
The test procedure shall be as per Annex 5. Xenon lamp or UV lamp may be used instead of Carbon filament lamp due to cost consideration.

12. MARKINGS

- 12.1 All rear-view mirrors shall have following markings:
 - 12.1.1 Rear-View Manufacturer's name or trade mark and identification code for complete mirror assembly.
 - 12.2 Marking provided on rear-view mirror shall be indelible and visible when the mirror is fitted on vehicle.
 - 12.3 For convex mirrors, following marking shall be provided:
OBJECT IN THE MIRROR ARE CLOSER THAN THEY APPEAR
The height of these letters shall not be less than 5 mm and not more than 6.5 mm.

13 CONFORMITY OF PRODUCTION (COP) TESTS

- 13.1 The following tests shall be carried out on Rear-View mirrors for verification of Conformity of Production
 - 13.1.1 Dimensions of mirror.
 - 13.1.2. Dimensions of mounting.
 - 13.1.3 Marking on mirror
 - 13.1.4 General requirements
 - 13.1.4 Co-efficient of Reflection (as per clause 6.3 of IS 14210: 1994)
 - 13.1.5 Distortion factor test (as per clause 6.6 of IS 14210: 1994)
 - 13.1.6 Test of Radius of curvature of convex surface of mirrors.

ANNEX 1

Technical specifications to be submitted by Rear-View Mirror Manufacturer.

1. Name of the Manufacturer :
2. Address of the Manufacturer :
3. Address of plant(s) where
Mirrors are manufactured :
4. Class of Mirror :
- 4.1 Manufacturer's identification :
No. for Mirror
5. Trade name or mark & location:
6. Sketch showing dimensions :
of mirror and Radius of
curvature of reflecting surface
7. Sketch showing mounting :
details and dimensions
of mirror.

ANNEX 2
PARAMETERS FOR DECIDING THE NECESSARY TESTS FOR
EXTENSION OF TYPE APPROVAL

PREAMBLE:

This Annex gives factors to be considered while selecting a mirror to represent a range of variants for establishing compliance for Type Approval. This is also applicable to :

- Extension of Type Approval for changes in Technical Specifications of an already Type Approved Mirror.
- Establishing compliance of new mirrors /variants based on an already Type Approved mirror.

In general, when changes in Technical Specifications of a mirror do not affect the performance adversely, and are still within the stipulated limits, the Type Approval can be extended without further checking/testing. If the changes affect some of the performance parameters, tests shall be carried out only for those parameters.

Where some parts comments / assemblies, used on an already Type Approved mirror are used in another mode / variant, no additional tests will be needed to establish compliance of these parts, components / assemblies to the respective performance requirements.

In the case of following changes, tests shown against each, are necessary to be carried out for establishing compliance.

SR. NO.	PARAMETER AND CHANGE	TEST TO BE CONDUCTED
1.	Dimensions of reflecting surfaces.	If maximum and minimum dimensions are type approved and changed dimensions are within these values, no test is required, other wise dimensional check to be conducted.
2.	Reduction in cross-section of material and hardness of stem.	Bending and impact tests are to be conducted.
3.	Change in Radius of curvature of reflecting surface.	Radius of curvature, reflectivity test and distortion factor test to be conducted.
4.	Change in reflective coating.	Reflectivity test, Reflective surface adhesion test, Salt spray test, Temperature resistance test, to be conducted.
5.	Changes in mounting dimensions adversely affecting, the performance against impact / bending test.	Bending test and Impact test to be conducted.
6.	Changes adversely affecting the performance against Moisture, Temperature and Weather resistance	Moisture resistance test, Temperature resistance test and Weather resistance test to be conducted

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

ANNEX 3

**PROCEDURE FOR THE DETERMINATION OF THE RADIUS OF
CURVATURE 'r' OF THE REFLECTING SURFACE OF
THE REAR - VIEW MIRROR**

1. MEASUREMENTS

1.1 Apparatus

The piece of apparatus known as 'Spherometer' described in Figure 5 shall be used.

1.2 Measuring Point

1.2.1 The principal radii of curvature shall be measured at three points as close as possible to one-third, one-half and two-thirds of the length of the major arc of the reflecting surface passing through the center of that surface, in a vertical plane, or of the major arc passing through the center of that surface, in a horizontal plane, if the latter part is the longer.

1.2.2 However, if the dimensions of the reflecting surface make it impossible to obtain the measurements defined in Item 7, the inspecting bodies responsible for the tests may proceed with measurement at this point in two perpendicular directions which shall be as close to as possible to those required above.

1.3 Calculation of Radius of Curvature 'r'

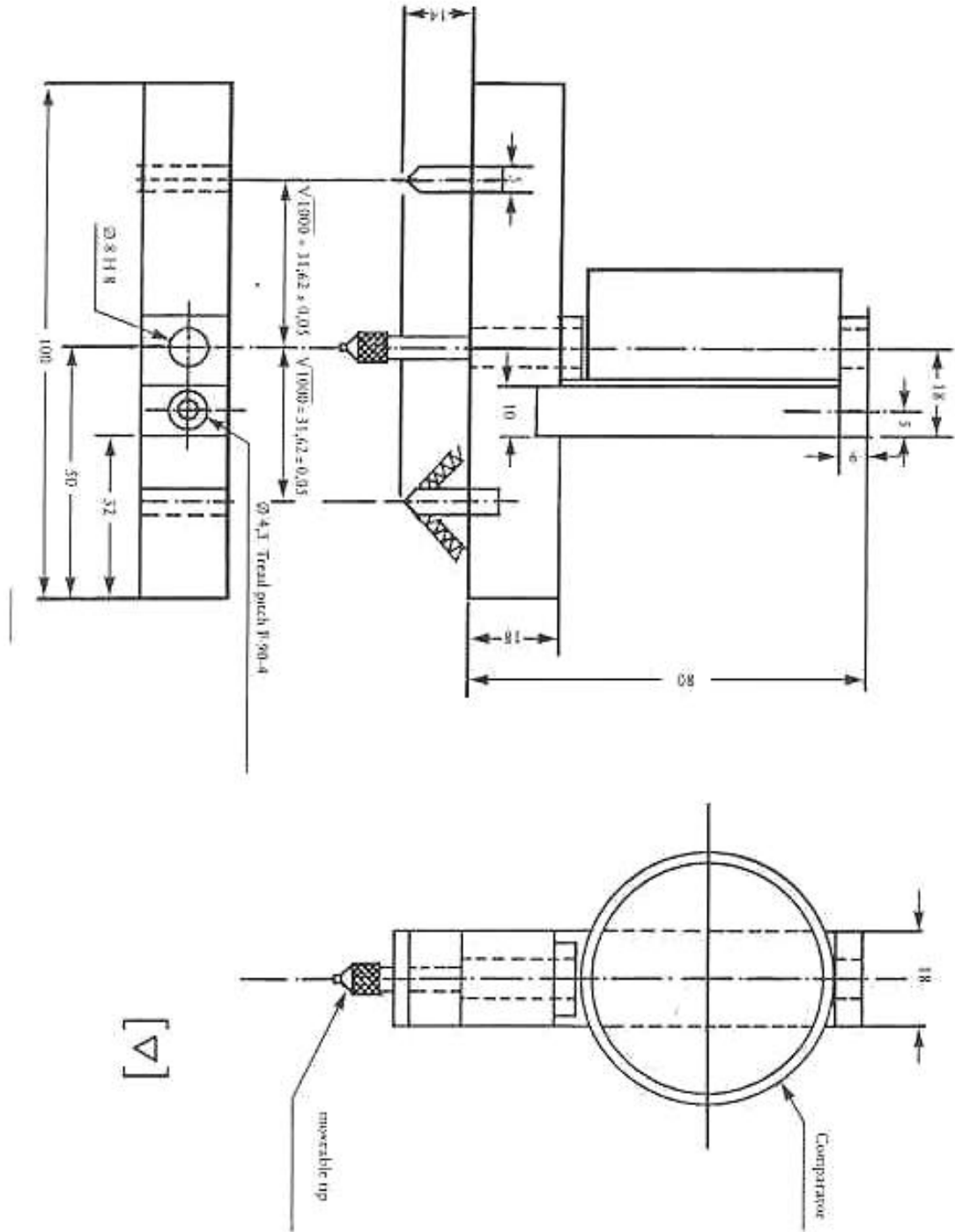
'r', expressed in millimeters, is calculated via the formula:

$$r = \frac{r_{p1} + r_{p2} + r_{p3}}{3}$$

Where,

r_{p1} = radius of curvature of the first measuring point,
 r_{p2} = radius of curvature of the second measuring point,
 r_{p3} = radius of curvature of the third measuring point.

Figure 5



2. Alternately, following procedure shall be followed for determination of radius of curvature for rear-view mirror.

2.1 Apparatus

- 2.1.1 The apparatus shall consist of linear spherometer (see Figure 6) with two fixed posts of equal height and ends so constructed that only point contact is made with the mirror. These posts shall be placed 38.1 mm \pm 0.02) apart. The center probe shall be placed midway between the fixed posts on the line returning through the contract points of these posts and shall also make only point contact with the mirror. The center probe shall be capable of vertical movement and shall be attached to a gauge which can display the linear displacement of the probe in units not greater than 0.002 mm.

Optionally, a third fixed post may be placed 19.05 mm rearward of the center movable post (see Figure 6, side view) to provide stability and facilitate easier measurement.

2.2 Procedure

2.2.1 Radius of curvature at one location

The apparatus shall be placed on a flat surface such as an optical flat accurate to at least 76×10^{-5} mm over a 51 mm diameter and the gauge shall be set to zero. The spherometer shall then be placed on the mirror in such that the device is normal to the surface (all three fixed posts shall be in contact with the mirror) and the displacement of the center probe read. Radius is defined by the equation:

$$R = \frac{C^2}{8H} + \frac{H}{2}$$

where,

R = Radius of curvature

H = Linear displacement of the center probe

C = cord length - distance between fixed posts of the spherometer.

2.2.2 Radius of curvature of Mirror

Radius of curvature of mirror shall be defined as the average of at least ten readings taken over the surface of the mirror. The readings shall consist of two readings at the center of mirror, one parallel and one perpendicular to the longitudinal axis of the mirror: four readings along the perimeter of the mirror with the spherometer placed parallel to and 3.04 mm from the edge: and either four readings, one at each of the corners with the spherometer placed along a line that approximately bisects the corner angle with the outer post 1.5 mm from the edge (see Figure 7a) or four readings at 45° to the longitudinal axis of the mirror with the outer post 1.5 mm from the edge (see Figure 7b).

For mirrors with an area greater than 200 cm^2 , sufficient readings shall be taken in addition to those prescribed such that there is at least one reading for each 20 cm^2 of the surface area. These additional readings shall be taken at enough locations to obtain an accurate average of the radius of curvature over the entire surface.

Figure 6 : Measuring Apparatus

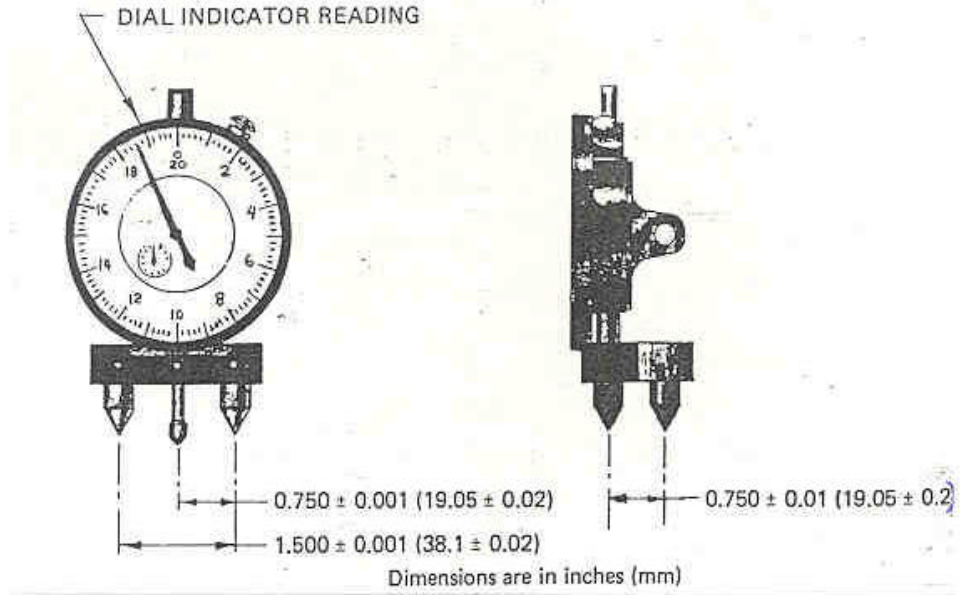
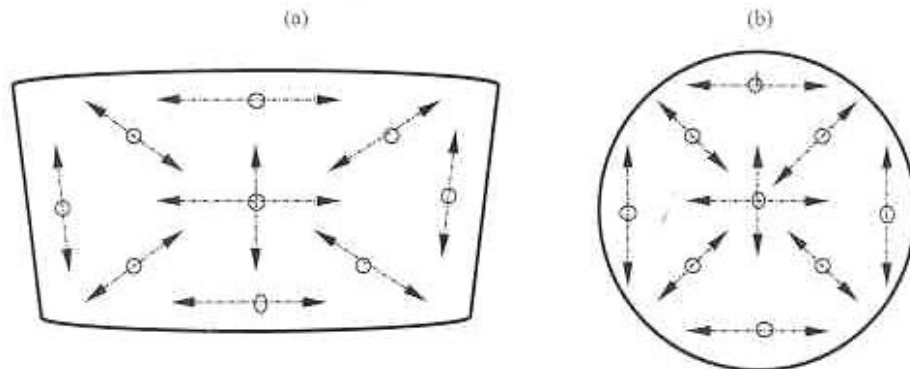


Figure 7 : Measurement of locations

Figure 7 : Measurement of locations



ANNEX 4 SALT SPRAY TEST

1 Principle

For the purposes of this standard, spray tests are tests in which the corrosive agent is an aqueous sodium chloride solution with concentration by mass of 5 g/100ml (main constituent) that is sprayed continuously by means of compressed air.

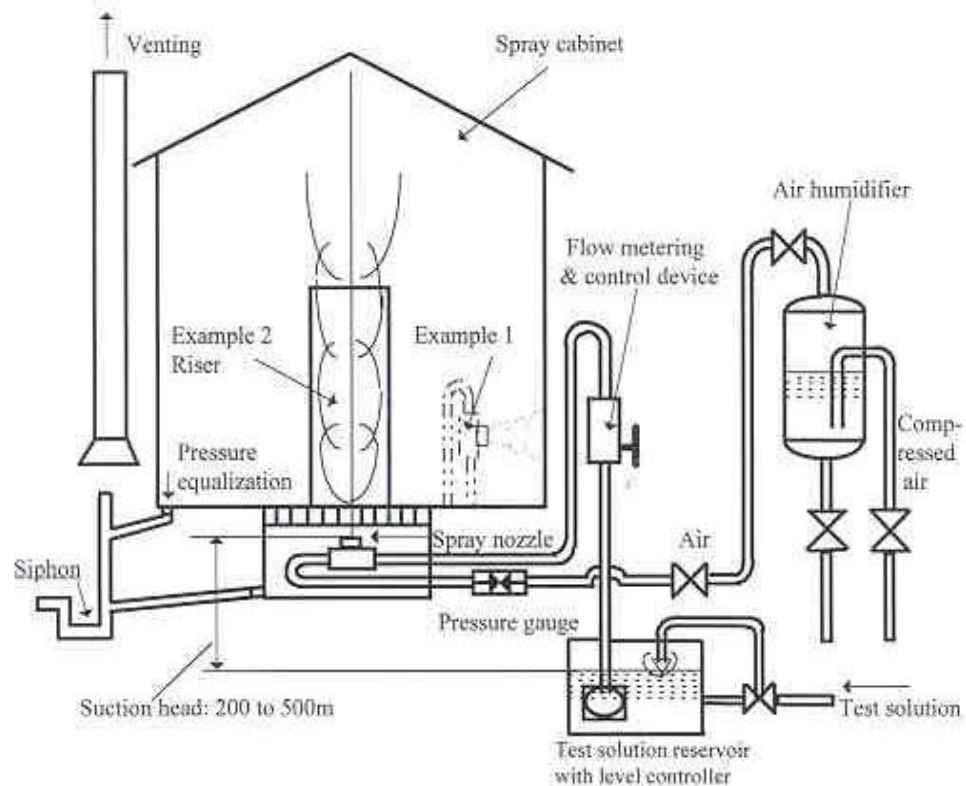
2 Conditions for Spray Testing

Test solution	Concentration by mass of Sodium Chloride, in g/l	50 ± 5
	Other additives	None
PH value		6.5 to 7.2
Temperature in spray cabinet, in $^{\circ}\text{C}$		35 ± 2

3 Apparatus

The test apparatus, illustrated in Figure 8, shall essentially comprises the components described in sub-clauses 3.1 to 3.5. All parts of the test apparatus which come in contact with the spray or the test solution shall be made of material that is resistant to the test solution and does not influence the corrosive action of the test solution or of the spray.

Figure 8: Illustration of test apparatus with two examples of nozzle arrangement



3.1 Spray Cabinet

A cabinet can be heated and in which the pressure can be equalized is required, equipped with the measuring and control devices needed for setting and maintaining a test temperature of 35 ± 2 °C. The test chamber shall have minimum capacity of 400 liters or the type and dimensions of the spray cabinets shall be chosen so as to ensure that, assuming the optimum configuration of the useful space, the conditions specified in clauses 6 and 7 are met, and be designed to ensure that the drops of spray does not fall from top cover, side walls and baffles on the specimens. After being sprayed, the test shall not return to the reservoir. The useful space for test purposes is limited to that part of the cabinet which lies outside the spray jet and in which a uniform dispersion of the spray can be verified as described in 6.2, third paragraph.

3.2 Spray Nozzle(s)

To produce the spray, nozzles of polyacrylate glass or stainless austenitic chromium-nickel-molybdenum steel shall be used; the use of other materials is permitted if they unable the conditions specified in subclause 6.2 and 7.6 to be met. Spray nozzles with an aperture diameter of 1 mm and an angle of dispersion of about 30° , operating at a gauge pressure at about 0.7 to 1.4 bar and a suction head of 200 to 500 mm, have prove effective. It is expedient to fit a metering and control device for monitoring the flow rate (see Figure 8). Such devices allow the amount of test solution to be sprayed to be set and monitor, so as to ensure that the amount of spray collected in the cabinet each hour lies within the limits specified in sub-clause 6.2.

The operation of the spray nozzles can be monitored by means of the flow metering device. If more than one nozzle is used, each nozzle shall be assigned its own flow metering and control device. The spray jet shall not be aimed directly at the specimen. That may require the spray jet to be directed against a baffle or a wall of the apparatus (see figure 8, Example 1). Of the nozzle is located at the bottom of the chamber, a riser may be used (see figure 8, Example 2). The spraying arrangement shown in example 1 shall only be used in apparatus of large capacity, to ensure that none of the specimens are mounted above the nozzles.

The number and arrangement of the spray nozzles shall be chosen so as to ensure that the specifications of the sub-clauses 6.2 and 7.6 for the useful space are met.

3.3 Reservoir with supply pipe

The reservoir for the test solution to be sprayed shall be designed to ensure that the suction head remains virtually constant throughout the test.

3.4 Compressed air supply pipe and air humidifier

The air humidifier shall be designed to ensure that the compressed air is saturated with water at the required temperature (see table below) throughout the test. The compressed air pipe between the humidifier and the nozzle shall be fitted with a pressure gauge for monitoring the air pressure and the nozzle.

Compressed air pressure in bar \approx	Air humidifier temperature, in $^{\circ}\text{C}$ to give a temperature after decompression of 35°C .
0.7	45
0.84	46
0.98	47
1.12	48
1.26	49
1.4	50

3.5 Devices for supporting the specimen

Racks shall be used that allow the specimens (specimen panels and product parts) to be arranged in a useful space of the spray cabinet so as not to touch one another, this precluding contact corrosion. The specimens shall be arranged in such a way that drops accumulated on one specimen can not fall on another.

Specimen panels shall be inclined by about 60° to 75° from the horizontal. The side of the tested shall be mounted or suspended in the apparatus as a function of their size. Shape and/or the corrosion to which they are exposed in service. This position may be agreed. Care shall be taken to ensure that as little salt solution as possible can collect in any cavities.

4 Test solution

4.1 The water to be used for preparing the solution as specified in subclause 4.2 shall be distilled or deionised, the electrical conductivity of the water not exceeding 2 mS/m at a temperature of $23 \pm 2^{\circ}\text{C}$. The sodium chloride used for making up the test solution shall contain no more than 0.3% of additives, the content of sodium iodide shall not exceed 0.001%.

4.2 The pH value of sodium chloride solution shall be adjusted so that the solution collected has a pH value of 6.5 to 7.2, measured at $23 \pm 2^{\circ}\text{C}$. Dilute, chemically pure hydrochloric acid or chemically pure sodium hydroxide solution shall be used for pH adjustment. The pH value shall be determined electrometrically at $23 \pm 2^{\circ}\text{C}$ using a glass electrode. Where water containing CO_2 is used for preparation of sodium chloride solutions, it should be borne in mind when adjusting the pH that CO_2 escapes if the solution is sprayed at the temperature of 35°C , so that the collected solution has a higher pH than the solution before spraying. For this reason, sodium chloride solution prepared with water containing CO_2 shall be adjusted to a pH of less than 6.5 at a temperature of $23 \pm 2^{\circ}\text{C}$ to ensure that the collected solution has a pH value of 6.5 to 7.5. To verify correct adjustment of the pH value of the solution before spraying, take 50 ml, boil gently for about 30 seconds, and cool to a temperature of $23 \pm 2^{\circ}\text{C}$. Then measure the pH value immediately. If it is between 6.5 to 7.2, experience shows that the pH value of the collected

solution will also will be in this range value immediately. If it is between 6.5 to 7.2, experience shows that the pH value of the collected solution will also will be in this range.

The solution collected shall have a concentration by mass of 50 ± 5 g of sodium chloride per liter.

5. **Compressed air**

The compressed are used for producing a spray at a gauge pressure about 0.7 to 1.4 bar shall be free from dirt, oil and other contaminants, these being removed by means of oil and liquid separators and a ceramic pressure filter. The residual contamination of compressed air after cleaning shall not be more than 0.2 mg/m^3 , in the form of oil and dust (of less than $5 \mu\text{m}$ practical size).

The clean compressed air shall then saturated in an humidifier filled with deionised water at a temperature selected to give a temperature after expansion of 35 ± 2 °C.

When it emerges from the spray nozzle, the compressed air is decompressed to the ambient atmospheric pressure and cools in the process. In order to ensure a temperature of spray jet 30 ° to 50 °, the compressed air saturated with water shall be at a higher temperature.

Note: Saturation of compressed air with water is necessary to prevent an increase in the concentration by mass of sodium chloride in the spray solution during expansion.

6. **Procedure**

6.1 Test temperature

The temperature in the useful space of the closed spray cabinet shall be 35 ± 2 °C. The spray test shall be interrupted and the spray cabinet opened only briefly to enable specimens to be removed and introduced and to carry out interim assessments. The variation in the temperature over time should be registered by a temperature recorder.

6.2 Quantity and distribution of spray

The quantity of test solution, as specified in sub-clauses 4.1, to be sprayed per unit of time in the spray cabinet shall be adjusted so that the average rate of sprayed rate collected in each of the collector vessels provided in the cabinet, assuming for each device a horizontal collecting are of about 80 cm^2 and a minimum collection period of 16 hours, is 1.5 ± 0.5 ml per hour. For tests taking less than 16 hours, the minimum period for determining the average shall be 8 hours.

When the nozzle described in sub-clause 3.2 is used, it has been proved expedient to set the test solution spraying rate, given a predetermined, constant pressure and a constant head, solely by means of a means of the metering and control device.

To check that the spray is uniformly dispersed, at least two collector vessels shall be provided at representative points in the useful space.

Suitable as collector vessels are, for example, glass or plastic funnels 10cm in diameter (equivalent to a collecting area 78.5 cm^2), which are passed through a stopper into a glass or plastic measuring cylinder.

On no account shall drops that have formed on the top cover and walls of spray cabinet, on any baffles provided, on the racks or on the specimens fall into a collector vessel.

7. **Functional check on test apparatus**

To check the repeatability of the test results obtained with a test apparatus, the reproducibility of test results from different test apparatuses, functional checks are to be made. The type of specimens, duration of tests and the permissible losses in mass per unit are shall be agreed accordingly.

7.1 Specimens

Specimens shall be complete mirror assembly with its mounting support. Five specimens are required.

7.2 Preparation of Specimens

Prior to functional check, the specimens as specified in sub-clause 7.1 shall be degreased with white spirit or another suitable solvent using soft, non-fibrous cloth or a brush and subsequently weighed to the nearest $\pm 0.1 \text{ mg}$. If they cannot be weighted immediately after degreasing, The specimen shall be kept in a disiccator until weighing.

After weighing the specimens shall be coated on one side with a strippable protection (e.g. self adhesive films or strippable varnishes).

7.3 Exposure

The specimens shall be set up on edge, inclined at an angle of 60° to 75° to the horizontal, in the test apparatus with the test surface upwards and exposed for 240 hours under the specified test conditions.

7.4 Removal of corrosion products

Before the corrosion products are removed, the coatings applied before exposure shall be stripped off. The corrosion products shall be removed from the specimens by pickling at a temperature of 18°C to 28°C . A hydrochloric acid inhibited with 3.5 g of hexomethylene-tetramine per liter, with $\rho = 1.10 \text{ g/ml}$, may be used for this purpose, e.g. 500 ml of HCL with $\rho = 1.19 \text{ g/ml}$, chemically pure, made up to 1 liter with de ionised water.

After the removal of corrosion products, the specimens shall be thoroughly rinsed in water, dried and subsequently kept until weighing in a desiccator at temperature of 18° to 28° C.

7.5 Weighing of Specimen

The specimen to be weighed to the nearest ± 1 mg.

7.6 Evaluation of functional check results

The loss in mass shall be related to the surface area exposed to corrosion and expressed in g/m^2 . The average loss shall be 140 ± 20 g/m^3 .

ANNEX 5

WEATHER RESISTANCE TEST

- 1 The test site shall be generally be placed under temperature condition of $20 \pm 15^{\circ}\text{C}$.
- 2 Test Method
- 2.1 The test shall be conducted in accordance with the following procedure.
- 2.1.1 Mount the test parts on the test apparatus and carry out the test in accordance with the conditions given in the Table of clause 2.1.3. for 300 hours.
- 2.1.2 Carbons, glass filters and safety devices for electric discharge shall fit the test apparatus and be capable of correctly maintaining the performances of the test apparatus.
- 2.1.3

Type of test		Test conditions	
Type of test apparatus		Sunshine carbon arc system Weatherability tester / UV lamp / Xenon lamp	
Item of test condition			
Construction of test apparatus		See reference Figure 3 of JIS B 7753	
Shape of the lamps		Open system	
Number of lamps		1	
Carbon Electrodes	Upper electrode mm	Copper coated sunshine carbon Approx. $\varnothing 36 \times 350$ Approx. $\varnothing 13 \times 305$	
	Lower electrode mm	Copper coated sunshine carbon Approx. $\varnothing 23 \times 350$ Approx. $\varnothing 13 \times 305$	
Continuous light table hours h		60 or over 22 or over	
Discharge voltage V	Range	48 to 52	
	Central value	50 ($\pm 2\%$)	
Discharge Current A	Range	58 to 62	
	Central value	60 ($\pm 2\%$)	
Glass Filter	Shape	Panel type	
	Spectral transmission factor % (before use)	250 nm :	1 or under
		302 nm :	68 or over
		375 to 700 nm :	90 or over
Limit hours for service h	2000		
Relative spectral energy distribution		In accordance with Fig. 7 of JIS D 0205	
Sample surface irradiance W/m^2 [wavelength range 300 to 700 nm].		255 ($\pm 10\%$)	
Test radiant energy (kJ/m^2) [wavelength range 300 to 700 nm].		As agreed between the parties concerned.	

Type of test		Test conditions
Type of test apparatus		Sunshine carbon arc system Weatherability tester / UV lamp / Xenon lamp
Item of test condition		
Black panel	Controlled temperature	63 ± 3 or 83 ± 3
Thermometer	Dimensions	See fig. 2 of JIS B 7753.
	Specification	The sensor of bimetal dial type thermometer (1 °C scale, 3.5 mm in sensor diameter) closely attached to a stainless sheet (SUS 304) of 1 mm x 150 mm x 70 mm and processed with lightproof black enamel. Prepare a pair of black panel thermometers, one is for measurement to be used in the test, and the other is to be preserved for calibration. In the calibration make two of them face towards a light source in parallel. When respective indicated temperatures have been read out, the indication for the measurement thermometer shall be within ±2°C of that of correction one.
Humidity %		50 ± 5
Rotating frame of sample	Distance between the center of arc and sample surface mm	477 to 483
	Diameter mm	960 ± 6
	Number of rotations (rpm)	Approx. 1
Relations between arc lamp, sample frame and sample frame		See Reference Fig. 1 of JIS B 7753
Dimensions of nozzle		See Reference Fig. 2 of JIS B 7753
Spraying conditions of water	Pressure (Mpa) {kgf/cm ² }	0.08 to 0.13 {0.8 to 1.3}
	Quantity of water ml/min	2100 ± 100
	Spraying time	12 min during radiation for 60 min.
	Quality of water	PH 5.8 to 8.6, 200 to 250 S/cm or under
	Temperature of water	16 ± 5

Type of test	Test conditions
Type of test apparatus	Sunshine carbon arc system Weather ability tester / UV lamp / Xenon lamp
Operating condition	Continuous radiation
Conditions in test tank	<ol style="list-style-type: none"> 1) In adjusting the temperature in the tank, care shall be taken so that the test parts in the tank are not directly exposed to the open air of 15⁰C or lower. 2) An apparatus shall be appended for warding off the influences of excessive heat generated in electric discharge and the harmful gases like Ozone.
Item of test condition	
Mounting method of test parts	<ol style="list-style-type: none"> 1) The test parts shall be mounted so that they will not come in touch with each other. Furthermore, any test part having staining property shall not be tested together with other test parts. 2) The test parts shall generally be made to change place top and bottom at every replacement of carbons.

After the test, cloudiness and any deterioration of the mirror surface such as discolouration, cracks, deformation of the other parts shall not be present.

Annex 6
(See Introduction)

COMMITTEE COMPOSITION
Automotive Industry Standards Committee

Chairman

Shri. B. Bhanot	Director The Automotive Research Association of India, Pune
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Members

Representing

Shri. Alok Rawat	Ministry of Road Transport & Highways, New Delhi.
Shri. V.C. Mathur	Department of Heavy Industry, Ministry of Industries & Public Enterprises, New Delhi
Shri. G. S. Kashyab Shri. M.K. Bhat (Alternate)	Office of the Development Commissioner Small Scale Industries, Ministry of Industry, New Delhi.
Shri. A. R. Gulati	Bureau of Indian Standards, N. Delhi..
Shri. R. C. Sethi Shri. N. Karuppaiah (Alternate)	Vehicle Research & Development Establishment, Ahmednagar.
Shri. D. G. Shirke Shri. P. C. Barjatia (Alternate)	Central Institute of Road Transport, Pune
Shri. R. M. Srivastava	Society of Indian Automobile Manufacturers.
Shri. T. M. Balaraman	Society of Indian Automobile Manufacturers.
Shri. I. V. Rao	Society of Indian Automobile Manufacturers.
Shri. Z. A. Mujawar (Alternate)	Society of Indian Automobile Manufacturers.
Shri. Vivek Adyanthaya (Alternate)	Society of Indian Automobile Manufacturers.
Shri. U. K. Kini (Alternate)	Society of Indian Automobile Manufacturers.
Shri. T. C. Gopalan	Tractor Manufacturers Association, New Delhi.
Shri. Vishnu Mathur	Automotive Components Manufacturers Association.
Shri. K. N. D. Nambudiripad	Automotive Components Manufacturers Association

Member Secretary

Mrs. Rashmi Urdhwareshe

Sr. Assistant Director,

The Automotive Research Association of India, Pune