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**Motor vehicles - Devices for indirect vision - Requirements  
of performance and installation**

机动车辆 间接视野装置性能和安装要求

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# Motor vehicles - Devices for indirect vision - Requirements of performance and installation

## 1 Scope

This document specifies the technical requirements, test methods, installation requirements, identification of the same type of device for indirect visions for category M and category N, as well as the category L motor vehicles, which have at least a partially enclosed cab.

This document applies to device for indirect visions for motor vehicles of category M and category N, as well as the category L with at least a partially enclosed cab.

## 2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to the date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB 11552 The interior fittings of passenger car

GB 34660 Road vehicles - Requirements and test methods of electromagnetic compatibility

ISO 9241-305 Ergonomics of human-system interaction - Part 305: Optical laboratory test methods for electronic visual displays

ISO 15008 Road vehicles - Ergonomic aspects of transport information and control systems - Specifications and test procedures for in-vehicle visual presentation

ISO 16505 Road vehicles - Ergonomic and performance aspects of Camera Monitor Systems - Requirements and test procedures

## 3 Terms and definitions

The following terms and definitions apply to this document.

### 3.1

#### **Device for indirect vision**

## 4.2.2.2 Reflecting surfaces and radii of curvature

### 4.2.2.2.1 Reflecting surfaces

The reflecting surface of the viewing mirror shall be flat or convex. The reflecting surface is allowed to add an aspheric reflecting surface, BUT the aspherical reflecting surface is not allowed to use for meeting the field of view requirements of 6.5.

Measure according to the method specified in Appendix A. For the mirror which has two working modes, it shall be able to correctly identify the color signal of road traffic when it is in the daytime position AND the reflectivity of the reflecting surface shall not be less than 40%; the reflectivity of the reflecting surface, in the nighttime position, shall not be less than 4%. For the mirror, which has only one working mode, the reflectivity of the reflecting surface shall not be less than 40%.

### 4.2.2.2.2 Radius of curvature

**4.2.2.2.2.1** Use the spherical gauge, which is specified in Appendix B, to measure the radius of curvature  $r_i$ , which is parallel to the horizontal direction of the line segment of length  $b$ , AND the radius of curvature  $r_i'$  perpendicular to the vertical direction of the line segment of length  $b$ , through the center of the reflecting surface. Calculate the arithmetic mean  $r_p$  of  $r_i'$  and  $r_i$ ,  $r_p = (r_i + r_i')/2$ .

**4.2.2.2.2.2** The difference -- between the radius of curvature -- meets the following requirements:

- a) When the  $r$  value of the mirror's reflecting surface is less than 3000 mm, the radius of curvature  $r_i'$  OR the difference between  $r_i$  and  $r_p$  shall not be greater than  $0.15r$ ;
- b) When the  $r$  value of the mirror's reflecting surface is less than 3000 mm, the difference between  $r_p$  and  $r$ , at any point, shall not be greater than  $0.15r$ ;
- c) When the  $r$  value of the reflecting surface of the mirror is not less than 3000 mm, the difference -- between the radius of curvature mentioned in a) and b) -- shall not be greater than  $0.25r$ .

**4.2.2.2.2.3** The additional aspheric reflecting surface, on the reflecting surface, meets the following requirements:

- a) The width of the additional aspherical reflecting surface shall be at least 30 mm;
- b) The radius of curvature  $r_i$  of the additional aspherical part shall not be less than 150 mm.

**4.2.2.2.2.4** Measure according to the method specified in Appendix B. The  $r$  value of the reflecting surface meets the following requirements:

- a) For category I mirrors (interior mirrors), category II and category III mirrors (main

exterior mirrors), it shall not be less than 1200 mm;

- b) For category IV mirrors (wide-angle exterior mirrors) and category V mirrors (replenishment exterior mirrors), it shall not be less than 300 mm;
- c) For category VI mirrors (front mirrors), it shall not be less than 200 mm;
- d) For category VII mirrors, it shall not be less than 1000 mm and not more than 1500 mm.

### **4.3 CMS**

#### **4.3.1 General requirements**

**4.3.1.1** The CMS shall be adjustable, without the use of tools.

**4.3.1.2** Install the CMS at the design position, which is specified by the manufacturer. At any adjustable position, the radius of curvature of the constituent parts c of the following parts shall not be less than 2.5 mm:

- a) All parts of the CMS and components, which are installed inside the vehicle that can be in contact with a sphere, which has a diameter of 165 mm, including the part that remains connected to the bracket;
- b) All parts of the CMS and components, which are installed outside the vehicle that can be in contact with a sphere, which has a diameter of 100 mm, including the part that remains connected to the bracket.

**4.3.1.3** Determine the size of the protruding part, according to the method specified in 4.2.1.5. The outer surface, which has a protruding height greater than or equal to 1.5 mm and less than or equal to 5 mm, shall be chamfered; the outer surface, which has a protruding height greater than 5 mm, shall comply with the requirements of 4.3.1.2.

**4.3.1.4** The requirements of 4.3.1.2 do not apply, if the edges of the fixing holes or recesses, which have a diameter or maximum diagonal length less than 12 mm on the CMS, have been chamfered.

**4.3.1.5** The cylinder, which uses the rotation axis of the CMS as the center of rotation AND has a radius of 70 mm, shall at least be tangent to the base or body surface, to which the CMS connector is connected, except for CMS, whose minimum installation height is higher than 1.8 m.

**4.3.1.6** If the Shore hardness of the camera and monitor components is not greater than 60 HA and they are installed on a rigid bracket, the requirements of 4.3.1.2 are only applicable to the rigid bracket.

**4.3.1.7** If the vehicle monitor complies with the provisions of GB 11552, it is deemed to meet the requirements of 4.3.1.2.

$E_{pred}$  - The predicted flicker energy.

#### **4.3.2.14 Frame rate**

Carry out the test, according to the method specified in ISO 16505. The frame rate of CMS shall be at least 30 Hz; however, the frame rate of CMS shall be at least 15 Hz, under low light conditions or when the vehicle is running at low speed.

#### **4.3.2.15 Imaging time**

At an ambient temperature of  $22\text{ °C} \pm 5\text{ °C}$ , the test shall be carried out, according to the method specified in ISO 9241-305. The imaging time of the monitor shall be less than 55 ms.

#### **4.3.2.16 System delay**

Under the condition of ambient temperature  $22\text{ °C} \pm 5\text{ °C}$ , carry out the test, according to the method specified in ISO 16505. The CMS delay time shall be less than 200 ms.

#### **4.3.2.17 Glare caused by high monitor luminance**

The luminance of the monitor shall be manually or automatically dimmed at night.

#### **4.3.2.18 Electromagnetic compatibility**

The electromagnetic compatibility of the CMS of category I, category II, category III, category IV shall comply with the provisions of GB 34660.

### **4.3.3 Functional requirements of CMS of category V and category VI**

**4.3.3.1** The CMS shall work normally under direct sunlight; the maximum value of the overexposed area (the area where the luminance contrast drops below 2:1) shall not exceed 15% of the displayed image.

**4.3.3.2** Under various light conditions, the monitor shall meet the minimum contrast ratio requirements, which are specified in ISO 15008.

**4.3.3.3** According to the environmental conditions, the average luminance of the monitor shall be adjusted manually or automatically.

## **5 Test method**

### **5.1 General rules for testing**

**5.1.1** Category I, category II, category III, category IV, category V, category VI device for indirect visions, as well as the category VII mirrors (same installation method as category III mirrors) for category L vehicles shall be subject to the test specified in 5.2.

Category VII mirrors with support rods shall be subjected to the test specified in 5.3.

**5.1.2** When the vehicle is under the condition of the maximum design total mass, meanwhile the height of all parts of the device for indirect vision from the ground, at any adjustable position, is not less than 1.8 m, for device for indirect visions of category II, category III, category V, category VI, the test specified in 5.2 may be exempted; however, there shall be a visible mark of 1.8 m.

**5.1.3** The height of the device for indirect vision and its connecting parts, from the ground, is less than 1.8 m. However, the test specified in 5.2 may be exempted, when the projected width of the vertical cross-section, which is formed by the joint with the vehicle body, does not exceed the projected width of the vehicle. When the width of the device for indirect vision, in this vertical cross-sectional projection, exceeds the projected width of the vehicle, BUT does not exceed the maximum vehicle body width in the forward driving direction, based on this plane, the test specified in 5.2 may be exempted.

**5.1.4** For the device, that is integrally installed on the vehicle body AND whose angle between the front rotation area and the longitudinal reference plane of the vehicle does not exceed 45°, OR the device, which protrudes no more than 100 mm relative to the periphery of the vehicle body, the test specified in 5.2 may be exempted.

## **5.2 Impact test**

### **5.2.1 Test device**

**5.2.1.1** The impact test equipment consists of a sample holder and a pendulum, one of which is in the plane of the vertical release trajectory. The end of the pendulum is a rigid ball, which has a diameter of 165 mm ± 1 mm, its surface is covered with a layer of rubber, which has a Shore hardness of 50 HA and a thickness of 5 mm; an indicator used to determine the maximum angle of the swing arm in the release plane, the accuracy of the measurement shall be ±1°. According to the impact requirements specified in 5.2.2.7, the support used to hold the sample shall be firmly fixed on the test equipment. The dimensions and design requirements of the test equipment are as shown in Figure 4.

located within the adjustment range, which is specified by the manufacturer of the device for indirect vision or the vehicle manufacturer, AND the position that is most unfavorable to impact rotation;

- c) If the device for indirect vision is telescopically adjustable, as relative to its base, the device for indirect vision shall be adjusted to the position, which is closest to the base;
- d) For the mirror, if the reflecting surface can be adjusted within the protective shell, the upper corner farthest from the vehicle body shall be adjusted to the position, where it protrudes the largest from the protective shell.

**5.2.2.3** For the mirror, when the pendulum is in the vertical position, both the horizontal plane and the longitudinal vertical plane, which pass through the center of the rigid ball, shall pass through the center of the reflecting surface; the longitudinal movement direction of the pendulum shall be parallel to the longitudinal reference plane of the vehicle.

**5.2.2.4** For CMS, when the pendulum is in the vertical position, the horizontal plane and longitudinal vertical plane, which pass through the center of the rigid ball, shall pass through the center of the lens or the center of the transparent protective cover of the lens. The longitudinal swing direction of the pendulum shall be parallel to the longitudinal reference plane of the vehicle. For cameras with a protective cover, the protective cover shall be open, during the impact.

**5.2.2.5** When installing and adjusting according to the provisions of 5.2.2.1 and 5.2.2.2, if the parts of the device for indirect vision limit the return of the rigid ball, the impact point shall be adjusted, along the direction perpendicular to the rotation axis or the rotation center, meanwhile it shall meet one of the following requirements:

- a) The outer contour of the rigid ball shall at least be tangent to the surface of the cylinder, which is mentioned in 4.2.1.7;
- b) The contact point of the rigid ball is at least 10 mm, from the edge of the reflecting surface.

**5.2.2.6** During the test, make the pendulum fall freely, from an angle of 60° relative to the vertical line; it hits the device for indirect vision, when the pendulum reaches the vertical position.

**5.2.2.7** The device for indirect vision shall be subjected to impact, under the following different conditions.

- a) Interior mirror:
  - 1) Under the conditions specified in 5.2.2.3 or 5.2.2.5, the rigid ball shall hit the reflecting surface;



At the point of impact, small fragments are allowed to escape from the above-mentioned parts.

b) The reflecting surface is made of safety glass.

**5.4.4** For CMS, after the test in 5.2, the lens shall not break.

## **6 Installation requirements**

### **6.1 General requirements**

**6.1.1** The following visual field is the visual field under the condition of total visual field of both eyes. When the field of view is measured, through the window glass, the vertical total transmittance of visible light shall be at least 70%. However, when two exterior mirrors are installed, the light transmittance of the rear window glass may be less than 70%. When measuring the field of view of a vehicle, the measured vehicle of category M<sub>1</sub>/N<sub>1</sub> shall be the curb weight of the vehicle plus the mass of the driver and a front passenger (each 75 kg); the measured vehicle of other categories shall be the curb weight of the vehicle plus the mass of the driver.

**6.1.2** The mirror shall be fixed, in such a way that it will not move to significantly change its field of view, OR the driver will not have an illusion of the image, due to vibration.

**6.1.3** When the vehicle is running at a speed not exceeding 80% of the maximum design speed and not exceeding 150 km/h, the device for indirect vision shall meet the requirements of 6.1.2.

**6.1.4** If the mirror has several reflecting surfaces at the same time, meanwhile the radii of curvature of the reflecting surfaces are different from each other OR the reflecting surfaces form different angles with each other, then at least one reflecting surface shall meet the field of view and size requirements of the mirror.

### **6.2 Quantity requirements for device for indirect visions**

**6.2.1** See Table 4 for the minimum installation quantity requirements of device for indirect visions; the maximum installation quantity of CMS monitors shall not be greater than the number of sight mirrors of the corresponding category.

**6.2.2** In the case where the CMS is used to provide a field of view, when the ignition switch is turned on OR the vehicle's main control switch is activated, the relevant field of view (except for the temporarily adjusted field of view specified in 7.1.4) shall be permanently visible to the driver. However, when the vehicle is moving backwards OR moving forward at a speed higher than 10 km/h, the monitor, which is used to display the device for indirect vision of category VI or a part thereof, can be used to provide other information.

## 7 CMS installation requirements

### 7.1 Requirements for the installation of CMS from category I ~ category IV

#### 7.1.1 ON/OFF

The ON/OFF strategy of the system shall be described in the user manual. The ON/OFF process of CMS of category II and category III shall meet the following requirements.

- a) The CMS shall be turned on, when the vehicle is opened (such as unlocking the vehicle, opening a front door, or other operations selected by the manufacturer).
- b) Carry out the test, according to the method specified in ISO 16505. After the vehicle is powered off, the CMS shall be able to continue to run for at least 120 s ( $T_1$ ). After the  $T_1$  time period, within the time  $T_2 = (420 - T_1)$ , when the front door of the vehicle is opened, the CMS shall be able to turn on within 1 s. After the  $T_2$  time period, the CMS shall be able to turn on again, within 7 s (e.g., open of any front door).

Any other means of starting or shutting down the system shall provide proof to the testing agency, in accordance with Appendix C.

#### 7.1.2 Default field of view

The default field of view shall meet the following requirements:

- a) The default field of view of the CMS shall at least meet the requirements of 6.5; the magnification and resolution shall meet the requirements of 7.1.8 and 7.1.9;
- b) For category I mirrors and CMS dual-function systems, the CMS mode shall be set by the driver; the ON/OFF device shall be placed directly on the mirror.

#### 7.1.3 Adjustable default field of view

The CMS shall allow the user to change the field of view. The adjusted field of view may not meet the requirements of 6.5, BUT other requirements of the CMS still need to be met. The adjusted field of view can be restored at the next startup.

#### 7.1.4 Temporary adjustment of field of view

The CMS shall be able to temporarily adjust the field of view, in some special driving situations, such as lane merging, parking to observe the surrounding conditions of the vehicle. During the system adjustment process and temporary field of view display, the requirements of 7.1.8 and 7.1.9 may not be met. The temporary adjustments of field of view shall have a prompt on the monitor. This function can be manually turned off; it shall also be explained in the user manual.

### **7.1.5 Luminance and contrast adjustment**

If the CMS luminance and contrast can be adjusted manually, the adjustment information shall be given in the user manual.

### **7.1.6 Superimposed display requirements within the specified field of view**

The superimposed display, within the specified field of view, shall meet the following requirements:

- a) The superimposed display shall only display safety-related rear view information;
- b) Regardless of their transparency, all superimposed displays shall be considered as obstacles;
- c) Each superimposed display shall not exceed 2.5% of the display area of the specified field of view of the corresponding category;
- d) The total area of all superimposed displays shall not exceed the provisions of 6.5.8.1 or 6.5.8.2, at the same time;
- e) The occlusion of superimposed display and other obstacles shall be determined, under the condition that the occlusion area is the largest.

### **7.1.7 System availability**

If the system does not work properly (such as CMS failure), the driver shall be informed by means of warning prompts, display information or status indicators missing; the prompt information shall be explained in the user manual.

### **7.1.8 Magnification**

Carry out the test, according to the method specified in ISO 16505. In the horizontal and vertical directions, the minimum magnification and average magnification of CMS are not lower than the minimum magnification and average magnification listed below.

- a) The minimum magnification shall not be lower than:
  - 1) Category I: 0.31;
  - 2) Category II (driver's side): 0.26;
  - 3) Category III (driver's side): 0.29;
  - 4) Category IV (driver's side): 0.054;
  - 5) Category II (passenger side): 0.13;
  - 6) Category III (passenger side): 0.19;

displayed on the monitor.

**7.1.11.3** The defined dimensions of the monitor shall be free of any obstructions, when viewed from the ocular reference point.

#### **7.1.12 Obstruction of the driver's direct field of view**

Obstruction of the driver's direct field of view, due to the installation of device for indirect visions, shall be minimized.

#### **7.1.13 Electronic system safety of CMS**

The electronic system safety of CMS shall comply with the provisions of Appendix C.

### **7.2 Installation requirements for CMS of category V and category VI**

**7.2.1** According to the requirements of Appendix D, the device for indirect vision shall enable the driver to observe critical objects, within the entire specified field of view, meanwhile determine the size of the displayed object according to Appendix E.

**7.2.2** The installation position of the device for indirect vision shall minimize the impact on the driver's direct vision.

**7.2.3** The viewing direction of the monitor shall be roughly the same as that of the main mirror.

## **8 Identification of the same type**

### **8.1 The same type of device for indirect vision**

Devices, that do not differ in the following main features, are considered to be of the same type.

- The structure design of the device (such as the connection between the device and the body).
- Type, shape, size, radius of curvature of the reflecting surface of the mirror.
- CMS model and manufacturer; lens optical components, image sensors, image transmission sending unit, control unit, image transmission receiving unit, display screen, model and manufacturer of external structural shell (camera, monitor); CMS software; category, field of view, magnification, resolution and system delay.

### **8.2 Vehicle types associated with device for indirect visions**

Motor vehicles, that are identical in the following essential features, are considered to be of the same type:

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