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Working Party on General Safety Provisions

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Item 4 of the provisional agenda

**Regulation No. 46 (Devices for indirect vision)****Proposal for a supplement to Regulation No. 46****Submitted by the expert from the Netherlands\***

The text reproduced below was prepared by the informal group on camera-monitor systems enabling the replacement of all mirrors by camera-monitor systems. It is based on ECE/TRANS/WP.29/GRSG/2011/23, taking into account the comments received during the 101<sup>st</sup> and 102<sup>nd</sup> session of the Working Party on General Safety Provisions (GRSG) on the basis of informal documents GRSG-101-03 and GRSG-102-04. Furthermore, suggestions to amend the size of the approval marking, the reference to the ISO standard and the recent 04 series of amendments (ECE/TRANS/WP.29/2012/87) have been included as well.

According to the decision of GRSG at its ninety-ninth session, the proposal has been prepared as a supplement rather than a new series of amendments. The relevant text was kept in square brackets for consideration at a later stage.

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\* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106 and ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

## I. Proposal

The whole text of Section 2., amend to read:

### "2. DEFINITIONS

For the purposes of this Regulation:

- 2.1. "*Devices for indirect vision*" means devices **intended to give a clear view to the rear, side or front of the vehicle within the fields of vision defined in paragraph 15.2.4.** ~~to observe the traffic area adjacent to the vehicle which cannot be observed by direct vision.~~ These can 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 paragraph 15.2.4. **by means of a reflective surface.**
- 2.1.1.1. "*Interior mirror*" means a device as defined in paragraph ~~2.1.1.~~ **2.1.1.**, which can be fitted in the passenger compartment of a vehicle.
- 2.1.1.2. "*Exterior mirror*" means a device as defined in paragraph ~~2.1.1.~~ **2.1.1.**, which can be mounted on the external surface of a vehicle.
- 2.1.1.3. "*Surveillance mirror*" means a mirror other than the ones defined in paragraph 2.1.1 which can be fitted to the inside or outside of the vehicle in order to provide fields of vision other than those specified in paragraph 15.2.4.
- 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 7.
- 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 7, measured on the arc of the reflecting surface passing through the centre of this surface parallel to the segment b, as defined in paragraph 6.1.2.1.2.1 and on the arc perpendicular to this segment.
- 2.1.1.6. "*The radius of curvature at one point on the reflecting surface ( $r_p$ )*" 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 surface, which has a constant and equal radius in all directions
- 2.1.1.8. "*Aspherical surface*" means a surface, which has only in one plane a constant radius.

- 2.1.1.9.** "*Aspherical mirror*" means a mirror composed of a spherical and an aspherical part, in which the transition of the reflecting surface from the spherical to the aspherical part has to be marked. The curvature of the main axis of the mirror is 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 device ~~for indirect vision~~*" means a device as defined in paragraph 2.1., where the field of vision is obtained by means of a camera-monitor combination as defined in paragraphs 2.1.2.1 and 2.1.2.2.
- 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.
- ~~2.1.2.3. "*Detection*" means the ability to distinguish an object from its background/surroundings at certain distance.~~
- 2.1.3. "*Other devices for indirect vision*" means devices as defined in paragraph 2.1, where the field of vision is not obtained by means of a mirror or a camera-monitor ~~type device for indirect vision~~.
- 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.
- 2.1.6.** "*Resolution*" means the smallest detail that can be 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. **For devices for Class V and VI it shall be 0.5 m high and with a diameter  $D_0 = 0.3$  m. For Classes I to IV and VII the dimensions shall be [.....]<sup>1</sup>**
- 2.1.8.** "*Critical perception*" means the level of perception that can just be obtained under critical conditions via the viewing system that is used. This corresponds to the situation in which the representative scale of the critical

<sup>1</sup> The critical object needs to be yet defined, preferably by ISO.

object is a 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 can just be 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 vertical bright bar displayed on the monitor while sun light or light from other bright light sources is directly hitting into the lens of the camera. Smear is an optical artefact.
- 2.2. "*Type of device for indirect vision*" means devices that do not differ on the following essential characteristics:
- (a) design of the device inclusive, if pertinent, the attachment to the bodywork;
  - (b) in case of mirrors the class, the shape, the dimensions and radius of curvature of the mirror's reflecting surface;
  - (c) in case of camera-monitor devices, **the class, the detection distance and the range of vision**
- 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 paragraph 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 paragraph 15.2.4 or to provide a security system within or around the vehicle.
- 2.4. "*Class of ~~mirror~~ device for indirect vision*" means all devices having one or more common characteristics or functions. They are classified as follows:
- 2.4.1. Class I: "**Interior Central rear-view ~~mirror~~ device**", giving the field of vision defined in paragraph 15.2.4.1.
- 2.4.2. Class II and III: "**Main ~~exterior~~ rear-view ~~device mirror~~**", giving the fields of vision defined in paragraphs 15.2.4.2. and 15.2.4.3.
- 2.4.3. Class IV: "**Wide-angle ~~view device exterior mirror~~**", giving the field of vision defined in paragraph 15.2.4.4.
- 2.4.5. Class V: "**Close-proximity ~~view device exterior mirror~~**", giving the field of vision defined in paragraph 15.2.4.5.
- 2.4.6. Class VI: "**Front-view ~~device mirror~~**", giving the field of vision defined in paragraph 15.2.4.6.
- 2.4.7. Class VII: "**Mirrors Main rear-view devices** intended for L category vehicles with bodywork **giving the field of vision defined in paragraph 15.2.4.7.**
- ~~2.5. "*Original camera-monitor device for indirect vision*" means a camera-monitor device of the type fitted to the vehicle at the time of type-approval or extension of type-approval."~~

Paragraphs 3.3., amend to read:

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

Delete paragraphs 3.3.1. and 3.3.2.

Paragraph 4.2., amend to read:

"4.2. Every device **for indirect vision, with the exception of original Camera-monitor devices**, shall possess **on at least one of the main components** ~~its protective housing~~ a space large enough to accommodate the approval mark, which ~~must~~ **shall** be legible when the device has been mounted on the vehicle; this space shall be shown on the drawings referred to in Annex 1. **Other components of the device shall bear the name of the manufacturer and a means of identification. In case of limited space for the approval mark(s), other means of identification that link it to the approval number mark shall be provided.**"

[Or alternative text from *GRSG-102-04*:

4.2. Every device for indirect vision, shall possess on at least one of the main components of its protective housing a space large enough to accommodate the approval mark, which must shall be legible when the device has been mounted on the vehicle; this space shall be shown on the drawings referred to in Annex 1. Other components of the device shall bear the name of the manufacturer and a means of identification. In case of limited **or no** space for the approval mark(s) **or when the approval mark(s) cannot be legible when the device has been mounted on the vehicle, the provisions of paragraph 5.7. may be applied as an alternative.]**

[Paragraph 5.2., amend to read:

"5.2. An approval number shall be assigned to each type approved. Its first two digits (at present ~~03~~ **04**.) ...indirect vision."]

Paragraphs 5.4. to 5.5., amend to read:

"5.4. There shall be affixed **on at least one of the main components**, conspicuously and in the space referred to in paragraph 4.2 above, to every device for indirect vision, **with the exception of original Camera-monitor devices for indirect vision**, conforming to a type approved under this Regulation, in addition to the mark prescribed in paragraph 4.1, an international approval mark consisting of:

[[Or alternative text from *GRSG-101-03*:

5.4. There shall be affixed on at least one of the main components, conspicuously and in the space referred to in paragraph 4.2. above, to every device for indirect vision, conforming to a type approved under this Regulation, in addition to the mark prescribed in paragraph 4.1., an international approval mark consisting of:]

5.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval; 3/

5.4.2. An approval number;

5.4.3. ~~An additional~~ **Additional** symbol(s) I or **and** II or **and** III or **and** IV or **and** V or **and** VI or **and** VII, specifying the class to which the type of the ~~mirror~~ devices for indirect vision belongs ~~or the symbol S in case of any device for~~

~~indirect vision other than a mirror~~. The additional symbol shall be placed in any convenient position in the vicinity of the circle containing the letter "E".

- 5.5. The approval mark and the additional symbol(s) shall be clearly legible and be indelible."

[As an alternative text from GRSG-101-03: Insert new paragraph 5.7., to read:

- "5.7. **As an alternative to the approval mark described in paragraph 5.4. above, a certificate of conformity shall be issued for device for indirect vision offered for sale.**

**Where a device for indirect vision manufacturer supplies an approved unmarked system to a vehicle manufacturer, for fitment by that manufacturer as original equipment for a vehicle model or range of vehicle models, the device for indirect vision manufacturer shall supply a number of copies of the certificate of conformity to the vehicle manufacturer, sufficient for that manufacturer to obtain the vehicle approval to Part II of this Regulation.**

**If the device for indirect vision is made up of separate components, its main component(s) shall bear a reference mark and the certificate of conformity shall provide a list of such reference marks.**

**A model of the certificate of conformity is given in Annex 11 to this Regulation."**]

Paragraph 6.1.1.3., replace the reference to paragraph 6.1.3.2. by a reference to paragraph 6.3.2.

Paragraph 6.1.2.1.1., heading, amend to read:

"6.1.2.1.1. ~~Interior~~ **Central rear-view interior mirrors (Class I)**"

Paragraph 6.1.2.1.2., amend to read:

"6.1.2.1.2. ~~Main exterior~~ **Main rear-view exterior mirrors (Class II and III)**"

Paragraph 6.1.2.1.3., heading, amend to read:

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

Paragraph 6.1.2.1.4., heading, amend to read:

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

Paragraph 6.1.2.1.5., heading, amend to read:

"6.1.2.1.5. ~~Front view~~ **Front view mirrors (Class VI)**"

Paragraph 6.1.2.1.6.1., heading, amend to read:

"6.1.2.1.6.1. ~~Main rear view~~ **Main rear view exterior mirrors (Class VII)**"

Paragraphs 6.1.3. to 6.1.3.1.1., renumber as paragraphs 6.3. to 6.3.1.1. and amend to read:

"6.3. Test

- 6.3.1. ~~Mirrors~~ Devices for indirect vision** in Classes I to VI and Class VII (having fitments identical to Class III) shall be subjected to the tests described in paragraphs **6.3.2.1. and 6.3.2.2.** Class VII mirrors with a stem, shall be subjected to the tests described in paragraph **6.3.2.3.**

- 6.3.1.1.** The test provided for in paragraph 6.3.2 shall not be required in the case of any exterior ~~mirror~~ **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 ~~mirrors~~ **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 ~~mirror~~ **device for indirect vision** must 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

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

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

*Paragraphs 6.1.3.2. and 6.1.3.2.1., renumber as paragraphs 6.3.2. and 6.3.2.1.*

*Paragraph 6.1.3.2.1.1., renumber as paragraph 6.3.2.1.1. and replace the reference to paragraph 6.1.3.2.2.7. by a reference to paragraph 6.3.2.2.7.*

*Paragraphs 6.1.3.2.1.2. and 6.1.3.2.2., renumber as paragraphs 6.3.2.1.2. and 6.3.2.2.*

*Paragraphs 6.1.3.2.2. to 6.1.3.2.2.3., renumber as paragraphs 6.3.2.2. to 6.3.2.2.3. and amend to read:*

"**6.3.2.2.** Description of the test

**6.3.2.2.1.** The procedure used to clamp the ~~mirror~~ **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 ~~mirror~~ **device for indirect vision** for the test:

**6.3.2.2.2.1.** ~~Mirrors~~ **Devices 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~~ **device for indirect vision** 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 ~~mirror~~ **device for indirect vision** is adjustable ...by the applicant;

6.3.2.2.2.3. When the ~~mirror~~ **device for indirect vision** has a device... is shortest;

6.3.2.2.2.4. **In case of mirrors**, when the reflecting surface...to the housing.

6.3.2.2.3. **In case of mirrors**, except in the case of test 2 for interior mirrors (see paragraph **6.3.2.2.7.1.**), when the pendulum ... as defined in paragraph ~~2.1.1.11~~ **2.1.1.10.** The longitudinal ...vehicle."

*Insert a new paragraph 6.3.2.2.4., to read:*

"**6.3.2.2.4.** **In 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 in front of 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."**

*Paragraphs 6.1.3.2.2.4. (former) to 6.1.3.2.2.6.2., renumber as paragraphs 6.3.2.2.5. to 6.3.2.2.7.2. and amend to read:*

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

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

- (a) either the sphere delimiting the hammer remains at least tangential to the cylinder as defined in paragraph 6.1.1.5.;
- (b) or, **in 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 ~~mirror~~ **device for indirect vision** at the moment when the pendulum reaches the vertical position.

6.3.2.2.7. The ~~mirrors~~ **devices for indirect vision** are subjected to impact under the following different conditions:

6.3.2.2.7.1. Interior mirrors

- (a) Test 1: The points of impact shall be as defined in paragraph **6.3.2.2.3.** The impact must 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 must occur on the reflecting surface side.

6.3.2.2.7.2. Exterior mirrors

- (a) Test 1: The point of impact shall be as defined in paragraph **6.3.2.2.3.** **or 6.3.2.2.5.** The impact must 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 paragraph **6.3.2.2.3.** **or 6.3.2.2.5.** The impact must 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 Technical Service responsible for testing may repeat one or both of these tests on the upper mirror if this is less than 2 m from the ground."

*Insert a new paragraph 6.3.2.2.7.3., to read:*

**"6.3.2.2.7.3. Camera-Monitor-Systems**



- (a) **Test 1: The point of impact shall be as defined in paragraph 6.3.2.2.4. or 6.3.2.2.5. The impact must be such that the hammer strikes the camera on the lens side.**
- (b) **Test 2: The point of impact shall be as defined in paragraph 6.3.2.2.4. or 6.3.2.2.5. The impact must 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 Technical Service 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."**

*Paragraphs 6.1.3.2.3. to 6.1.3.2.3.2., renumber as paragraphs 6.3.2.3. to 6.3.2.3.2.*

*Paragraphs 6.1.3.3. to 6.1.3.3.3., renumber as paragraphs 6.3.3. to 6.3.3.3. and amend to read:*

"6.3.3. *Results of the tests*

In the tests described in paragraph 6.3.2., the pendulum must 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  $\pm 1$ .

6.3.3.1.1. **In case of mirrors**, this requirement is not applicable to mirrors stuck to the windscreen, in respect of which the requirement stipulated in paragraph 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 ~~rear-view mirrors~~ **devices for indirect vision** and for Class III ~~rear-view mirrors~~ **devices for indirect vision** which are attached to the same mounting as Class IV ~~mirrors~~ **devices for indirect vision**.

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

6.3.3.3. In case of mirrors, the reflecting surface must not break during the tests described in paragraph 6.3.2. However, breakage of the reflecting surface will be allowed if one of the following conditions is fulfilled:"

*Paragraphs 6.1.3.3.1. and 6.1.3.3.2., renumber as paragraphs 6.3.3.3.1. and 6.3.3.3.2.*

*Insert a new paragraph 6.3.3.4., to read:*

**"6.3.3.4. In case of camera-monitor-systems, the lens shall not break during the test described in paragraph 6.3.2."**

*Paragraphs 6.2.2., amend to read:*

"6.2.2. Camera-monitor devices ~~for indirect vision~~"

*Paragraph 6.2.2.1.1., amend to read:*

"6.2.2.1.1. When the camera-monitor device ~~for indirect vision~~ is mounted ~~on a plane surface in the intended installation position~~, 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 parts fitted in the interior or 100 mm in diameter in the case of parts fitted to the exterior, must have a

radius of curvature "c" of not less than 2.5 mm. **This does not apply to exterior parts of such devices which are installed 2.00 m or more above the ground.**

**Parts complying with Regulation No. 21 or Regulation No. 26 are deemed to satisfy the relevant requirements above."**

*Insert a new paragraph 6.2.2.2.5., to read:*

**"6.2.2.2.5. The camera-monitor device of Class I to IV and VII shall meet the provisions of newly to be developed standard ISO-16505:201x."**

*Paragraph 15.1.2., amend to read:*

"15.1.2. ~~Mirrors and other devices~~ Devices for indirect vision must be fitted in such a way ~~that the mirror or other device does not~~ **the devices do not** move so as significantly to change the field of vision as measured or vibrate to an extent which would cause the driver to misinterpret the nature of the image perceived."

*Paragraph 15.2., amend to read:*

"15.2. ~~Mirrors~~ **Devices for indirect vision"**

*Paragraph 15.2.1.1., amend to read:*

"15.2.1.1. Minimum number of compulsory **devices for indirect vision.**"

*Paragraph 15.2.1.1.1., amend to read (including the table):*

"15.2.1.1.1. The fields of vision prescribed in paragraph 15.2.4. shall be obtained from the minimum number ~~of~~ of mandatory mirrors **or camera monitor devices** set out in the following table. ~~Where the presence of a mirror is not requested on a mandatory base, this means that no other system for indirect vision can be requested on a mandatory base.~~

**In case of camera-monitor systems, there is no minimum number but they shall provide the same field of vision as given in this table and the provision on the minimum mounting height does not apply.**

**In case of camera-monitor devices the maximum number of monitors shall not exceed the corresponding number of mirrors."**

Vehicle category	<i>Interior mirror</i>	<i>Exterior mirrors</i>				
	<i>Interior mirror Central rear view Class I</i>	<i>Main mirror (large) rear view Class II</i>	<i>Main mirror (small) rear view Class III</i>	<i>Wide-angle mirror view Class IV</i>	<i>Close-proximity mirror view Class V</i>	<i>Front mirror view Class VI</i>
M <sub>1</sub>	<b>Compulsory</b> Unless the vehicle is fitted with anything other than safety glazing material in the field of vision prescribed in paragraph 15.2.4.1.	Optional	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side. <b>Class II mirrors devices</b> may be fitted as an alternative.	<b>Optional</b> 1 on the driver's side and / or 1 on the passenger's side	<b>Optional</b> 1 on the driver's side and 1 on the passenger's side (both shall be fitted at least 2 m above the ground)	<b>Optional</b> (shall be fitted at least 2 m above the ground)
M <sub>2</sub>	<b>Optional</b> (no requirements for the field of view)	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	Not permitted	<b>Optional</b> 1 on the driver's side and / or 1 on the passenger's side	<b>Optional</b> 1 on the driver's side and 1 on the passenger's side (both shall be fitted at least 2 m above the ground)	<b>Optional</b> (shall be fitted at least 2 m above the ground)
M <sub>3</sub>	<b>Optional</b> (no requirements for the field of view)	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	Not permitted	<b>Optional</b> 1 on the driver's side and / or 1 on the passenger's side	<b>Optional</b> 1 on the driver's side and 1 on the passenger's side  (both shall be fitted at least 2 m above the ground)	<b>Optional</b> (shall be fitted at least 2 m above the ground)
N <sub>1</sub>	<b>Compulsory</b> Unless the vehicle is fitted with anything other than safety glazing material in the field of vision prescribed in paragraph 15.2.4.1.	<b>Optional</b>	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side <b>Class II mirrors devices</b> may be fitted as an alternative.	<b>Optional</b> 1 on the driver's side and / or 1 on the passenger's side	<b>Optional</b> 1 on the driver's side and 1 on the passenger's side (both shall be fitted at least 2 m above the ground)	<b>Optional</b> (shall be fitted at least 2 m above the ground)

Vehicle category	Interior mirror	Exterior mirrors				
	Interior mirror Central rear view Class I	Main mirror (large) rear view Class II	Main mirror (small) rear view Class III	Wide-angle mirror view Class IV	Close-proximity mirror view Class V	Front mirror view Class VI
N <sub>2</sub> ≤ 7.5 t	Optional (no requirements for the field of view)	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	Not permitted	<b>Compulsory</b> For both sides if a Class V mirror device can be fitted <b>Optional</b> For both sides together if not	<b>Compulsory</b> (see paragraphs 15.2.2.7. and 15.2.4.5.5.) One on the passenger's side <b>Optional</b> One on the driver's side (both shall be fitted at least 2 m above the ground). A tolerance of + 10 cm may be applied	<b>Optional</b> 1 front mirror (shall be fitted at least 2 m above the ground)
N <sub>2</sub> > 7.5 t	<b>Optional</b> (no requirements for the field of view)	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	Not permitted	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	<b>Compulsory</b> , see paragraph 15.2.2.7. and 15.2.4.5.5) 1 on the passenger's side <b>Optional</b> 1 on Driver's side (both shall be fitted at least 2 m above the ground)	<b>Compulsory</b> , see paragraph 15.2.1.1.2. 1. front mirror (shall be fitted at least 2 m above the ground)
N <sub>3</sub>	<b>Optional</b> (no requirements for the field of view)	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	Not permitted	<b>Compulsory</b> 1 on the driver's side and 1 on the passenger's side	<b>Compulsory</b> , see paragraph 15.2.2.7. and 15.2.4.5.5.) 1 on the passenger's side <b>Optional</b> 1 on driver's side (both shall be fitted at least 2 m above the ground)	<b>Compulsory</b> , see paragraph 15.2.1.1.2. 1. front mirror (shall be fitted at least 2 m above the ground)

Paragraph 15.2.1.1.2., amend to read:

"15.2.1.1.2. ~~In case the described field of vision of a front mirror prescribed in paragraph 15.2.4.6 and/or a close proximity mirror described in paragraph 15.2.4.5 can be obtained by another device for indirect vision that is approved according to paragraph 6.2 and that is installed according to paragraph 15., this device can be used instead of the relevant mirror or mirrors.~~

~~In case a camera/monitor device is used, the monitor must exclusively show:~~

- ~~(a) The field of vision prescribed in paragraph 15.2.4.5 when the close proximity mirror has been substituted;~~
- ~~(b) The field of vision prescribed in paragraph 15.2.4.6 when the front mirror has been substituted while the vehicle is moving forward with a speed of up to 10 km/h, or~~
- ~~(c) Simultaneously the fields of vision prescribed in paragraphs 15.2.4.5 and 15.2.4.6 when the close proximity mirror and the front mirror have been substituted. In the case where the vehicle is moving forward at a higher speed than 10 km/h or moving backwards, the monitor may be used for other information, provided that the field of vision prescribed in paragraph 15.2.4.5. is permanently displayed.~~

**In case a camera-monitor device is used for rendering the field(s) of vision, the relevant field(s) of vision shall be permanently visible to the driver when the ignition is on. However, when the vehicle is moving forward at a speed higher than 10 km/h or rearwards, the monitor or the part of the monitor intended for rendering the Class VI field of vision may be used for other information. Multiple images may be used or displayed provided that the monitor has been approved in this mode.**

**Additional vehicle information may be displayed provided that this does not compromise the required field(s) of vision."**

Paragraphs 15.2.1.1.3. and 15.2.1.1.4., amend to read:

"15.2.1.1.3. ~~Rear view m~~**Mirrors and camera monitor devices** required for L-category vehicles with body work

Category of vehicle	<del>Interior mirror</del> <b>Central rear-view</b> (Class I)	Main <b>rear-view</b> <del>exterior mirror(s)</del> (Classes III and VII)
L category motor vehicles fitted with bodywork which partly or wholly encloses the driver	1 <sup>1</sup>	1, if there is <del>an interior mirror</del> <b>a central rear-view device for indirect vision;</b> 2, if there is not <del>an interior mirror</del> <b>a central rear-view device for indirect vision</b>
<sup>1</sup> <del>No interior rear-view mirror</del> <b>central rear-view device for indirect vision</b> is required if the visibility conditions referred to in paragraph 15.2.5.4.1. below cannot be met. In this case two exterior rear-view mirrors <b>or camera monitor devices</b> are required, one <b>giving the view</b> on the left and one <b>giving the view</b> on the right hand side of the vehicle.		

Where a single exterior rear view mirror **or camera** is fitted this shall be located on the left hand side of the vehicle in those countries where the traffic drives on the right and on the right hand side of the vehicle in those countries where the traffic drives on the left.

**Multiple images may be used or displayed provided that the monitor has been approved in this mode.**

- 15.2.1.1.4. Optional ~~rear view mirrors~~ mirrors and camera monitor devices for L-category vehicles

The fitting of an exterior rear-view mirror **or camera monitor device giving the view** on the side of the vehicle opposite to that of the mandatory **main rear-view device for indirect vision** ~~mirror~~ referred to in paragraph 15.2.1.1.3., is permissible. **The rear-view mirror shall meet the requirements of this Regulation."**

*Paragraph 15.2.1.2., amend to read:*

- "15.2.1.2. The provisions of this Regulation do not apply to the surveillance mirrors defined in paragraph 2.1.1.3. **or surveillance camera-monitor recording device defined in paragraph 2.3.** Nevertheless, the exterior surveillance mirrors **shall** be mounted at least 2 m above the ground when the vehicle is under a load corresponding to its maximum technical permissible mass."

*Paragraph 15.2.2.1., amend to read:*

- "15.2.2.1. ~~Mirrors~~ **Devices for indirect vision** ~~must~~ **shall** be so placed that the driver, when sitting in the driving seat in a normal driving position, has a clear view of the road to the rear, side(s) or front of the vehicle."

*Paragraph 15.2.2.3., amend to read:*

- "15.2.2.3. In the case of any vehicle, which is in chassis/cab form when the field of vision is measured, the minimum and maximum body widths shall be stated by the manufacturer and, if necessary, simulated by dummy headboards. All vehicles and ~~mirror~~ **devices for indirect vision** configurations taken into consideration during the tests shall be shown on the type-approval certificate for a vehicle with regard to the installation of ~~mirrors~~ **devices for indirect vision** (see Annex 4)."

*Paragraph 15.2.2.5., amend to read:*

- "15.2.2.5. ~~Mirrors~~ **Devices for indirect vision** shall not project beyond the external bodywork of the vehicle substantially more than is necessary to comply with the requirements concerning fields of vision laid down in paragraph 15.2.4."

*Paragraph 15.2.2.7., amend to read:*

- "15.2.2.7. Class V and Class VI mirrors shall be mounted on vehicles in such a way that, regardless of their position after adjustment, no part of these mirrors or their holders is less than 2 m from the ground when the vehicle is under a load corresponding to its technically permissible maximum laden mass.

These mirrors shall not, however, be mounted on vehicles the cab height of which is such as to prevent compliance with this requirement. In this case ~~an other device for indirect vision is not requested~~ **another device for indirect vision is not mandatory."**

Paragraph 15.2.2.8, amend to read:

"15.2.2.8. Subject to the requirements of paragraphs 15.2.2.5, 15.2.2.6 and 15.2.2.7, ~~mirrors~~ **devices for indirect vision** may project beyond the permissible maximum widths of vehicles."

Paragraphs 15.2.3.1. and 15.2.3.2., amend to read:

"15.2.3.1. ~~The interior mirror~~ **If a Class I mirror is fitted it** shall be capable of being adjusted by the driver from his driving position.

15.2.3.2. ~~The exterior mirror situated on the driver's side~~ **If a Class II or Class III mirror is fitted on the driver's side, it** shall be capable of being adjusted from inside the vehicle while the door is closed, although the window may be open. The mirror may, however, be locked in position from the outside."

Paragraph 15.2.4.1., amend to read:

"15.2.4.1. ~~Interior rear view mirror~~ **Central rear-view field of vision** (Class I)  
The field of vision ... driver's ocular points (Figure 4) to the horizon.

Paragraph 15.2.4.1., Figure 4, heading, amend to read:

"Figure 4:  
**Class I field of vision** ~~of Class I mirror~~"

Paragraphs 15.2.4.2. to 15.2.4.2.2., amend to read:

"15.2.4.2. ~~Main exterior rear view mirrors~~ **Class II field of vision**

15.2.4.2.1. ~~Exterior Main rear-view mirror~~ **field of vision** on the driver's side  
The field of vision m... driver's ocular points (see Figure 5).

15.2.4.2.2. ~~Exterior Main rear-view mirror~~ **field of vision** on the passenger's side  
The field of vision ... driver's ocular points (see Figure 5)."

Paragraphs 15.2.4.2.2, Figure 5, heading, amend to read:

"Figure 5:  
~~Field of vision of Class II mirrors~~ **Class II field of vision**"

Paragraphs 15.2.4.3. to 15.2.4.3.2., amend to read:

"15.2.4.3. ~~Main exterior Class III field of vision mirrors~~ **Class III**

15.2.4.3.1. ~~Exterior Main rear-view mirror~~ **field of vision** on the driver's side  
The field of vision ... driver's ocular points.

15.2.4.3.2. ~~Exterior Main rear-view mirror~~ **field of vision** on the passenger's side  
The field of vision .... driver's ocular points."

Paragraph 15.2.4.3.2., Figure 6, heading, amend to read:

"Figure 6:  
~~Field of vision of Class III field of vision mirrors~~"

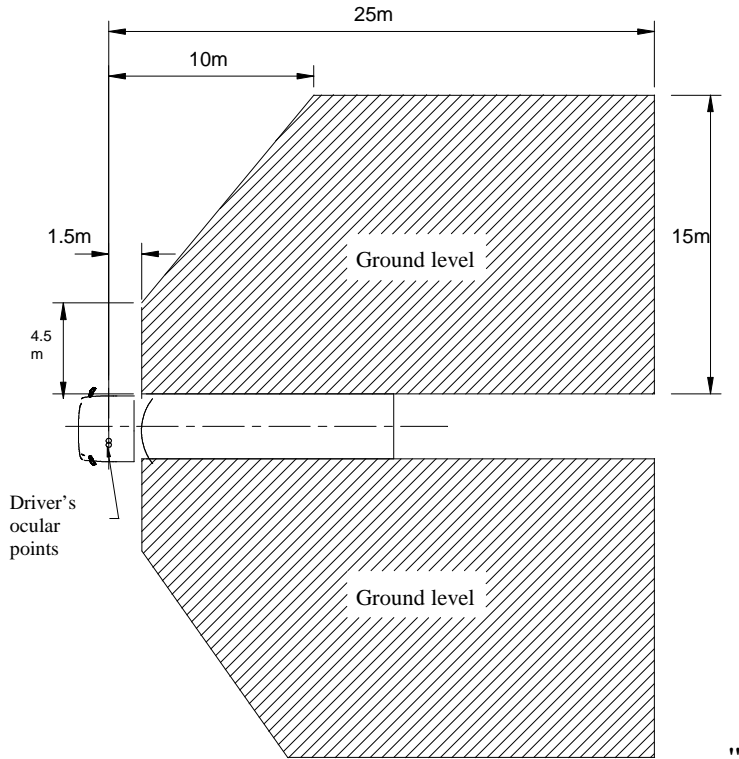
Paragraph 15.2.4.4. to 15.2.4.4.2., amend to read:

"15.2.4.4. ~~Wide angle~~ **exterior mirror (Class IV) Class IV field of vision**

15.2.4.4.1. **Field of vision** ~~exterior mirror~~ on the driver's side  
The field of vision ... driver's ocular points (see Figure 7).

15.2.4.4.2. **Field of vision exterior mirror** on the passenger's side  
 The field of vision ... driver's ocular points (see Figure 7).

Figure 7:  
 Field of vision of Class IV wide-angle mirrors **Class IV field of vision**



Paragraph 15.2.4.5., amend to read:

"15.2.4.5. **Close proximity" exterior mirror (Class V) Class V fields of vision**

The field of vision shall be such that the driver can see a flat horizontal portion of the road along the side of the vehicle, bounded by the following vertical planes (see Figures 8a and 8b):"

Paragraph 15.2.4.5.5., amend to read:

"15.2.4.5.5. In case the field of vision described in Figures 8a and 8b can be perceived through the combination of the field of vision from a Class IV **device for indirect vision wide-angle mirror** and that of a Class VI **device for indirect vision mirror**, the installation of a Class V **device for indirect vision mirror** is not compulsory."

Paragraph 15.2.4.5.5., Figures 8a and 8b unchanged, but amend the title to read:

"Figures 8a and 8b:  
**Field of vision of Class V mirror field of vision**"



Paragraph 15.2.4.5.9. and 15.2.4.5.10., amend to read:

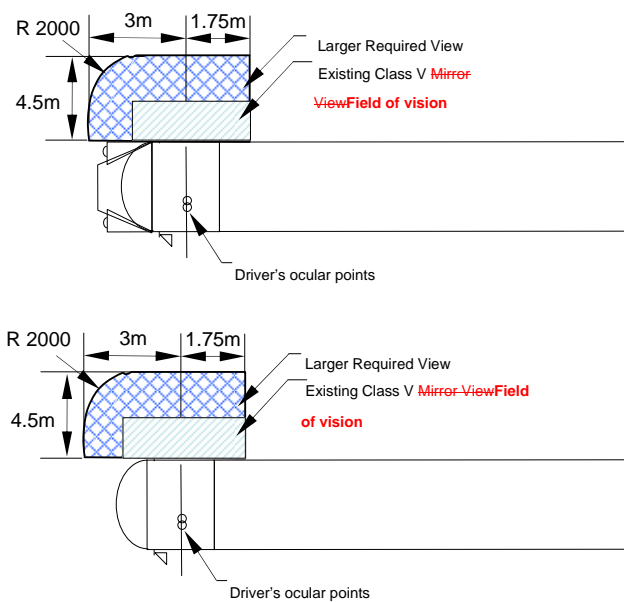
- "15.2.4.5.9. to the front, the plane parallel to the vertical plane passing through the driver's ocular points and situated at a distance of 3 m in front of that plane. This field of vision may be partially provided by a front-view device ~~mirror~~ (Class VI).
- 15.2.4.5.10. The field of vision prescribed in paragraphs 15.2.4.5.6. to 15.2.4.5.9. may be partially provided by a ~~'wide angle' exterior mirror~~ **wide-angle view device** (Class IV) or a combination of a close-proximity **view device** ~~exterior mirror~~ (Class V) and a front-view device ~~mirror~~ (Class VI)."

Paragraph 15.2.4.5.12., amend to read:

- "15.2.4.5.12. Paragraphs 15.2.4.5.6. to 15.2.4.5.9 shall not apply to a vehicle where no part of the **device for indirect vision** ~~mirror~~, or its holder, is less than 2.4 m above the ground, regardless of its position after adjustment."

Paragraph 15.2.4.5.6., Figures 8c and 8d, amend to read:

"Figures 8c and 8d:  
Larger field of vision on the passenger side



Paragraphs 15.2.4.6. to 15.2.4.6.1., amend to read:

- "15.2.4.6. ~~"Front" mirror~~ **Device for indirect vision** of Class VI.
- 15.2.4.6.1. The field of vision ...  
... see also paragraph 15.2.4.9.2.
- The provisions for **Class VI devices for indirect vision** are compulsory ...  
N<sub>3</sub>.

If vehicles ... by using ~~mirror or a camera/monitor device~~ **a device for indirect vision**, a vision support system ... in Figure 9."

Paragraph 15.2.4.6.1., Figure 9 heading, amend to read:

"Figure 9:

~~Field of vision of Class VI front mirror~~ **Class VI field of vision**"

Paragraph 15.2.4.6.2., amend to read:

"15.2.4.6.2. However, if the driver ...to the driver's side, a ~~front mirror~~ **Class VI device for indirect vision** of Class VI is not mandatory."

Paragraphs 15.2.4.7. to 15.2.4.7.2., amend to read:

"15.2.4.7. ~~L-category mirror (Class VII)~~ **Class VII field of vision**

15.2.4.7.1. ~~Exterior field of vision mirror~~ on the driver's side

The field of vision ... (see Figure 10).

15.2.4.7.2. ~~Exterior field of vision mirror~~ on the passenger's side

The field of vision ... (see Figure 10)."

Paragraph 15.2.4.7.2, Figure 10, heading, amend to read:

"Figure 10:

~~Field of vision of Class VII field of vision mirrors.~~"

Paragraphs 15.2.4.9.1. and 15.2.4.9.2., amend to read:

"15.2.4.9.1. Interior-mounted **Class I** rear-view ~~devices mirror (Class I)~~

The field of vision ...folded back.

15.2.4.9.2. Exterior ~~mirrors~~ **mounted devices for indirect vision** (Classes II, III, IV, V and VI).

In the fields of vision ...a Class VI ~~mirror~~ **device for indirect vision** caused by ...special function."

Paragraph 15.3.4., amend to read:

"15.3.4. Installation requirements for the monitor

~~The viewing direction of the monitor shall roughly be the same direction as the one for the main mirror.~~ **Monitor(s) shall be located in an ergonomically favourable position.**"

Paragraph 15.3.6., replace the reference to paragraph 2.1.2.13. by a reference to paragraph 2.3.

[Paragraphs from 21.1. to 21.11., amend to read<sup>2</sup>:

"**21.1.** As from the official date of entry into force of the **04** series of amendments to this Regulation, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the **04** series of amendments.

**21.2.** As from [**12 months after entry into force of the 04 series of amendments to this Regulation**], Contracting Parties applying this Regulation shall grant

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<sup>2</sup> Transitional provisions have to be aligned with ECE/TRANS/WP.29/2012/87 and ECE/TRANS/WP.29/1044/Rev.1

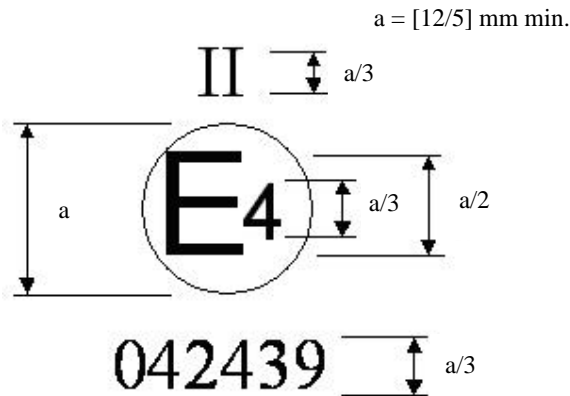
- approvals to a type of devices for indirect vision only if the type meets the requirements of this Regulation as amended by the **04** series of amendments.
- 21.3.** As from **[18 months after entry into force of the 04 series of amendments to this Regulation]**, Contracting Parties applying this Regulation shall grant approvals to a type of vehicle with regard to the installation of devices for indirect vision only if the type of vehicle meets the requirements of this Regulation as amended by the **04** series of amendments.
- 21.4.** As from 26 January 2010 for vehicles of category M1 and N1 and from 26 January 2007 for vehicles of other categories, Contracting Parties applying this Regulation may refuse to recognize approvals of a device for indirect vision which have not been granted in accordance with the 02 series of amendments to this Regulation.
- 21.5.** Approvals which were granted to devices for indirect vision of Classes I or III pursuant to this Regulation in its original form (00 series) or modified by the 01 or 02 **or 03** series of amendments before the date of entry into force of this series of amendments shall remain valid.
- 21.6.** Approvals which were granted to devices for indirect vision of Classes II, IV, V, VI or VII pursuant to this Regulation as modified by the 02 **or 03** series of amendments before the date of entry into force of this series of amendments shall remain valid.
- 21.7.** The provisions of this Regulation shall not prohibit the approval of a type of vehicle with regard to the mounting of devices for indirect vision pursuant to this Regulation as modified by the **04** series of amendments, if all or part of the devices for indirect vision of Classes I or III, with which it is fitted, bear the approval mark prescribed by this Regulation in its original form (00 series) or modified by the 01, 02 **or 03** series of amendments.\*
- 21.8.** The provisions of this Regulation shall not prohibit the approval of a type of vehicle with regard to the mounting of devices for indirect vision pursuant to this Regulation as modified by the 04 series of amendments, if all or part of the rear-view mirrors of Classes II, IV, V, VI or VII, with which it is fitted, bear the approval mark prescribed by the 02 **or 03** series of amendments of this Regulation.\*
- 21.9.** **Notwithstanding the provisions of paragraphs 21.2. and 21.5. above, for the purpose of replacement parts, Contracting Parties applying this Regulation shall continue to grant approvals according to the 01 series of amendments to this Regulation, to devices for indirect vision of Classes I to V and VII for use on vehicle types which have been approved before 26 January 2006 pursuant to the 01 series of amendments of Regulation No. 46 and to devices for indirect vision of Class VI for use on vehicles which have been approved before 26 January 2007 pursuant to the 01 series of amendments of Regulation No. 46, and, where applicable, subsequent extensions to these approvals.**
- 21.10.** Notwithstanding the provisions of paragraphs 21.2. and 21.4. above, for the purpose of replacement parts Contracting Parties applying this Regulation shall continue to grant approvals according **02 and 03 series** of amendments to this Regulation, to devices for indirect vision for use on vehicle types which have been approved before the date mentioned in paragraph 21.2. pursuant to the 02 **or 03** series of amendments of Regulation No. 46, and, where applicable, subsequent extensions to these approvals.

21.11. Notwithstanding the transitional provisions above, this 04 series of amendments to Regulation No. 46 shall become applicable to camera-monitor devices for indirect vision of Classes I to IV and VII as soon as the ISO-standard mentioned in paragraph 6.2.2.2.5. has been approved by ISO and adopted by the World Forum WP.29.]"

Annex 3, item 9, replace the reference to paragraph 6.1.3.1.1. by a reference to paragraph 6.3.1.1.

[Annex 5, amend to read:<sup>3</sup>

"...



The above approval mark ... under approval number 0342439. .. Regulation No. 46 already included the ~~03~~ 04 series of amendments when the approval was granted...."]

Annex 7, point 1.2.2., replace the reference to paragraph 2.1.1.6 by a reference to paragraph 2.1.1.5.

[As an alternative from GRSG-101-03, add new Annex 11, to read:

**"Annex 11**

**MODEL OF CERTIFICATE OF CONFORMITY**

I the undersigned.....  
(surname and name)

Testify that the device for indirect vision described below:

Make: .....

Type: .....

is in total conformity with the type approved

<sup>3</sup> Approval marking to be amended in case of adoption as a new series of amendments.

at ..... on.....  
(place of approval) (date)

as described in the communication form bearing approval No.....

Identification of the main component(s):

Component: .....Marking: .....

Done at: ..... on: .....

Manufacturer's full address and stamp: .....

Signature : ..... (please specify position)"]

## II. Justification

### Section 2.

1. The definitions have been reordered such that those related to mirrors are grouped as subparagraphs of paragraph 2.1.1.; those related to camera-monitor devices become subparagraphs of 2.1.2. and general definitions are numbered separately as 2.1.3. to 2.4.
2. The definition of "device for indirect vision" (para. 2.1.) has been aligned with the text of paragraph 2.1.1. and relates to the required field of vision according to paragraph 15.2.4.
3. The definition of mirror (para. 2.1.1.) has been amended to clarify that a mirror is only a device with a reflective surface for rendering the field of vision and excludes other devices.
4. The definitions of interior mirror and exterior mirror have been clarified so as to relate to the definition of mirror (para. 2.1.1.) and not to the general definition of "device for indirect vision" (para. 2.1.).
5. The names of the classes of devices have been amended as the mounting of a device for indirect vision in the case of a camera-monitor system is not by definition interior or exterior to the vehicle.
6. Simplification of the definition for camera-monitor device (para. 2.1.2.) as "for indirect vision" is already included in the definition of paragraph 2.1.
7. The Informal Group on Camera Monitor Systems (IGCMS) has suggested in its proposal for the testing of camera-monitor systems, to amend the definition for the critical object for Class V and VI devices and to delete footnote 2/. The dimension of a diameter of 0.8 m for Class V and VI will be replaced by a cylinder aligned with the provisions of paragraph 15.2.4.6.1. For other classes, the dimensions of the critical object have to be defined later on, preferably by ISO. A consequence of deleting the footnote is that the definition of "detection" (para. 2.1.2.3.) is no longer needed.
8. The IGCMS has two tasks in its terms of references, one dealing with the test procedure for camera monitor systems and the other for the replacements of mirrors by camera monitor systems. This proposal anticipates on the adoption of the proposals for the first task like:
  - (a) The deletion of former definitions 2.1.5. for "detection", 2.1.12. for "critical field of vision" and 2.1.13. for the "reference viewing point",
  - (b) The introduction of a definition of "smear" in former paragraph 2.1.2.14.; and
  - (c) The amendment of the size of the critical object from a circle of 80 cm to a cylindrical figure; for the second task of the informal group the size of the critical object for devices of Class I to IV and VII has to be defined in a standard that still has to be developed by ISO.
9. The parameters defining a camera monitor type device (para. 2.2.) have been limited to the class as the class defines the required field of vision.
10. For camera-monitor devices the mounting position interior or exterior of the vehicle is not relevant, which justifies amending the definitions for the mirror classes in paragraph 2.4. In addition, the new text is also made applicable to other devices than mirrors.

11. The definition of original camera monitor device for indirect vision has been introduced because of amended provisions on markings in paragraphs 4.2. and 5.4., where it is proposed that no marking is needed for original devices for indirect vision. However this principle is questioned by GRSG-101-03.

### **Paragraphs 3.3. to 3.3.2.**

12. In general only three samples are needed as the retaining of one sample by the laboratory is not needed anymore.

### **Paragraph 4.2.**

13. The identification of original systems can be verified by means of the vehicle type approval data so no separate marking for original devices is needed. Having regarded the limited space on the components for the approval marking, it should be sufficient that only one main component has that mark. The identification of the other components can be verified by means of the system approval data. As an alternative, GRSG-101-03 offers the possibility to deliver a Certificate of Conformity similarly to the provisions specified in UN Regulation No. 116.

### **[Paragraph 5.2.**

14. Consequence of the 04 series of amendments.]

### **Paragraphs 5.4. to 5.5.**

15. Consequence of amended paragraph 4.2. and editorial correction in paragraph 5.5. as consequence of new wording of paragraph 5.4.3. that permits the use of more than one additional symbol.

### **Paragraphs 5.7.**

16. This is an alternative for the exemption of having an approval mark on OEM devices for indirect vision.

### **Paragraph 6.1.1.3.**

17. Consequence of the new numbering of former paragraph 6.1.3.

### **Paragraphs 6.1.2.1.1., 6.1.2.1.2., 6.1.2.1.3. 6.1.2.1., 6.1.2.1.5. and 6.1.2.1.6.1.**

18. Align with the class definitions of paragraph 2.4.

### **Paragraph 6.1.3.**

19. Text moved to paragraph 6.3. so that the provision on the impact test applies also to other devices than mirrors. The provisions on the impact test have been moved from

paragraph 6.1.3. to a new paragraph 6.3. by which the provisions become applicable to all devices for indirect vision. Moreover the set-up for the impact test for camera-monitor systems has been described. Finally, it will be necessary that, similar to mirrors, the lens of the camera will not be broken after the tests.

### **Paragraph 6.2.2.**

20. A camera monitor system is by definition for indirect vision.

#### **Paragraph 6.2.2.1.1.**

21. The original wording could only be checked as part of the installation provisions. Furthermore it has been clarified that the provisions on the radius of curvature do not apply to parts that are 2 metres or more above the ground and that verification is not needed when approvals according Regulation No. 21 or 26 are available.

#### **Paragraph 6.2.2.2.5.**

22. The IGCMS is of the opinion that the approval of camera-monitor systems should be based on a world-wide standard that has to be developed by ISO. In detail, the ISO standard should address the following topics:

- (a) CMS–Applications (Use Cases, especially "Use Classes I to IV and VII as defined in Regulation No. 46, 02 series of amendments" and split screen use cases);
- (b) Viewing conditions like viewing distance, viewing direction, viewing area and mirror class related to the display monitor;
- (c) Illuminance conditions (in vehicle, outside vehicle, night, day);
- (d) Task requirements for the different use cases (mirror classes);
- (e) Special physical requirements (vibration, wind, rain, snow, ice, excessive temperatures...) and coatings for protection against rain, snow and dirt, sensitivity of the system for rain;
- (f) Performance requirements on detection and identification of the critical object as well as readability and/or legibility if required (representative and critical object(s) specifications): Implications for the size of the critical object related to the display and viewing conditions like geometric proportions between the size of the real critical object and the size of the displayed critical object;
- (g) CMS-Performance requirements under different lighting conditions: display luminance and luminance contrast of the monitor under different illumination conditions, night sight (minimum illumination level), adaptation of the light intensity during the night, colour presentation and colour uniformity;
- (h) Image artefacts (blooming, smear, lens reflection, geometric distortion) and freezing risk due to processing of image information;
- (i) Image interpretation;
- (j) Camera and display defects (Sensor pixel and display pixel defects);
- (k) Temporal fidelity (flicker);
- (l) Spatial instability (jitter);



- (m) Detection of motion in real time, image moving artefacts, motion blur;
- (n) Latency (delay of time until image is displayed);
- (o) Image compression;
- (p) Failure of the system;
- (q) Wireless technology issues (image artefacts during image processing, ...).

The new provisions according the proposed ISO standard will not apply to Class V and VI devices as more stringent requirements are not needed for rendering the field of vision very close to the vehicle. There are no signs that the present provisions for these classes are insufficient.

### **Paragraph 15.1.2.**

23. Simplification of the text.

### **Paragraph 15.2.**

24. Needed for making the provisions independent from the kind of device for indirect vision.

#### **Paragraph 15.2.1.1.**

25. Needed for making the provisions independent from the kind of device for indirect vision.

#### **Paragraph 15.2.1.1.1.**

26. An amendment is needed because:
- (a) It is necessary to clarify that the minimum number of devices is not relevant for camera-monitor systems;
  - (b) There may in future, be cases where devices for indirect vision other than mirrors are mandated without a corresponding requirement for a mirror, e.g. a rear-view camera-monitor system on a truck or bus;
  - (c) The number of monitors should be limited.

#### **Table of paragraph 15.2.1.1.1.**

27. Align the amended definitions for class (para. 2.4.); furthermore, the position such as interior or exterior is not relevant in the case of camera-monitor systems.

#### **Paragraph 15.2.1.1.2.**

28. The field of vision should always be rendered as it is always available in case of mirrors. Furthermore, the purpose of all these amendments is to permit the replacements of all mirrors by camera-monitor systems and to make the provisions independent from the used device. Therefore, the present wording of Regulation No. 46, 02 series of

amendments, is no longer relevant. Moreover all devices installed on a vehicle shall be type-approved (para. 15.1.1.). All this leads to a limitation of this paragraph to the use of the monitor for front-view for other purposes. Finally the text has been clarified to permit split screen of combined fields of vision for adjacent Classes like V and VI.

**Paragraph 15.2.1.1.3.**

29. Align the text with the new definition of classes (para. 2.4.). Furthermore, it has been clarified that when two devices are requested, the use of split screen is permissible.

**Paragraph 15.2.1.1.4.**

30. Align the text with the new definition of classes (para. 2.4.). The former provision that the device shall meet the requirements of this Regulation is superfluous as it is already covered by paragraph 15.1.1.

**Paragraph 15.2.1.2.**

31. To clarify that this Regulation does not apply to surveillance camera-monitor systems.

**Paragraphs 15.2.2.1., 15.2.2.3., 15.2.2.5., 15.2.2.7. and 15.2.2.8.**

32. The text has been amended so that it applies also for devices other than mirrors.

**Paragraphs 15.2.3.1. and 15.2.3.2.**

33. Align the text with the new definition of classes (para. 2.4.) and specify that these provisions apply only to mirrors.

**Paragraphs 15.2.4.1., 15.2.4.2., 15.2.4.3. and 15.2.4.4. to 15.2.4.4.2.**

34. Align the text with the new definition of classes (para. 2.4.). Figure 7 has been corrected on the passenger's side so that the indicated dimensions are in correspondence with the front of the grey area.

**Paragraphs 15.2.4.5., 15.2.4.6. and 15.2.4.7.**

35. Align the text with the new definition of classes (paragraph 2.4.).

**Paragraphs 15.2.4.9.1. and 15.2.4.9.2.**

36. The text has been amended so that the provisions are related to where they are fitted, in the interior or on the exterior.

**Paragraph 15.3.4.**

37. To follow the Human Machine Interaction (HMI) principles giving a certain direction in this and to prevent design restrictive provisions.

**Paragraph 15.3.6.**

38. Consequence of the renumbering of the definitions in paragraph 2.

**[Paragraphs from 21.1 to 21.11.**

39. These transitional provisions aim:

(a) To regulate the acceptance of type approvals which are granted according the 04 series of amendments to Regulation No. 46 as from the date of entry into force;

(b) To mandate the new provisions after 12 months for new system approvals;

(c) To mandate the new provisions for new installations as from 18 months after the entry into force;

(d) To continue the present options for Contracting Parties to refuse approvals that are not approved according the 02 series of amendments;

(e) To keep valid present approvals which are not subject to new provisions;

(f) To permit the approval of new installations which are based on present approvals that are not subject to new provisions;

(g) To permit under certain conditions new approvals for replacement parts on the basis for previous series of amendments; and

(h) To clarify that for certain classes of camera-monitor systems, the 04 series of amendments can only be applied after ISO has developed the relevant standard and the World Forum WP.29 has adopted that standard.]

**Annex 3**

40. Consequence of the renumbering of former paragraph 6.1.3.

**Annex 5**

41. Consequence of the 04 series of amendments. The size of the approval mark may be reduced to 5 mm to permit the marking as there is not always sufficient space for a marking of 12 mm.

**Annex 7, paragraph 1.2.2.**

42. Consequence of the renumbering of the definitions of paragraph 2.

## **Annex 11**

43. This is an alternative for the exemption of having an approval mark on OEM devices for indirect vision

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