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Item 8 of the provisional agenda

Regulation No. 27 (Advance warning triangle)

Proposal for 04 series of amendments to Regulation No. 27 (Advance warning triangle)

Submitted by the experts from the Working Party "Brussels 1952"*

The text reproduced below was prepared by the expert from the Working Party "Brussels 1952" (GTB) to update the test requirements. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106, 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

List of contents

Insert a new reference to new paragraph 14., to read:

"14. Transitional provisions"

Insert a new reference to new Annex 9, to read:

"9. Colour fastness to artificial light: Xenon-arc lamp test"

The text of the Regulation

Paragraph 5.2., amend to read:

"5.2. The approval number shall be assigned to each type approved. Its first two digits (at present **04** corresponding to the **04** series of amendments) shall indicate..."

Paragraph 7.2.1.2., amend to read:

"7.2.1.2. ~~When the retro reflecting device is illuminated by the CIE standard illuminant A, with an angle of divergence of $1/3^\circ$ and an illumination angle $V = H = 0^\circ$, or, if this produces a colourless surface reflection, an angle $V = \pm 5^\circ$, $H = 0^\circ$,~~ **The testing of the colour shall be carried out according to the method described in Annex 5, paragraph 2.1. and the trichromatic coordinates of the red reflected luminous flux shall be within the limits according to paragraph 2.30. of Regulation No. 48.**"

Paragraph 7.2.1.3., shall be deleted.

Paragraph 7.2.2.2., amend to read (including the deletion of the table):

"7.2.2.2. ~~When the fluorescent material is illuminated by the CIE standard illuminant C the trichromatic co-ordinates of the light reflected and emitted by the fluorescence shall be within an area of which the corner points are determined by the following co-ordinates (the angle of illumination being 45° and the observation being made at an angle of 90° to the sample ($45^\circ/0^\circ$ measuring geometry)):~~

The testing of the colour of the fluorescent materials shall be carried out according to the method described in Annex 5, paragraph 2.2. and the colour of the material in new condition shall be within the limits according to paragraph 2.32. of Regulation No. 48."

Paragraph 7.2.2.3., amend to read:

"7.2.2.3. ~~The testing of the colour shall be carried out according to the method described in Annex 5, paragraph 2.2.~~

The testing of the Luminance factor of the fluorescent materials shall be carried out according to the method described in Annex 5, paragraph 3.

The luminance factor including the luminance by reflection and fluorescence shall not be less than 30 per cent."

Paragraphs 7.3.2. to 7.3.2.2., shall be deleted.

Insert a new paragraph 14., to read:

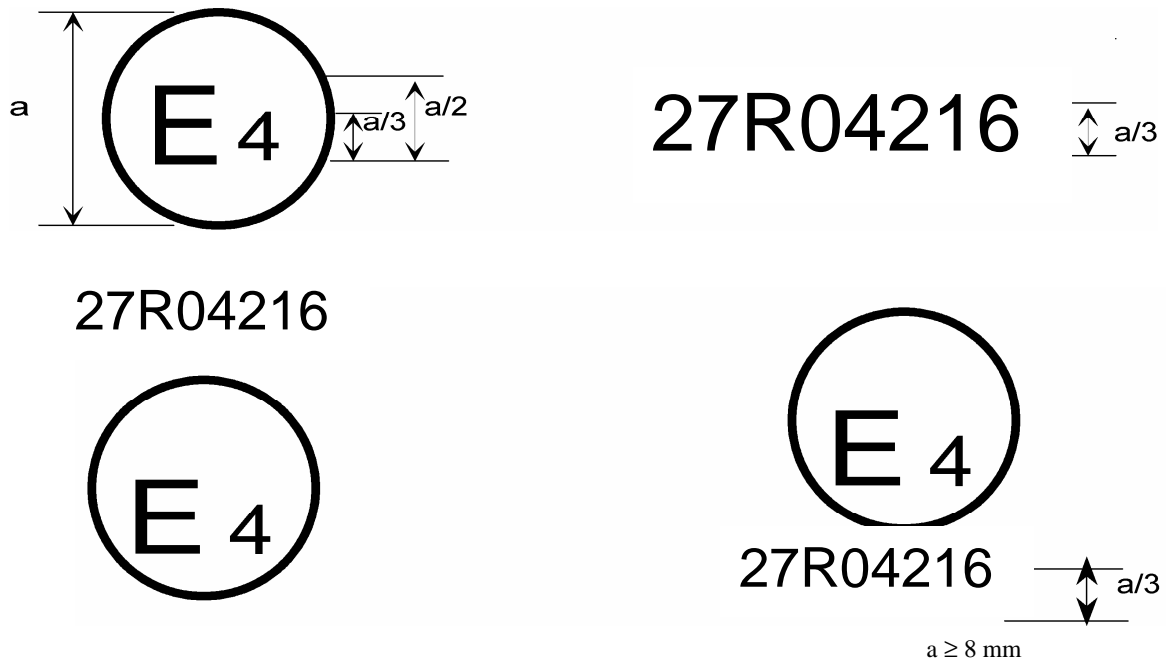
"14. Transitional provisions

- 14.1. From the date of entry into force of the 04 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approvals under this Regulation as amended by the 03 series of amendments.
- 14.2. As from 36 months after the date of entry into force of the 04 series of amendments, Contracting Parties applying this Regulation shall grant approvals only if the Advance Warning Triangle meets the requirements of this Regulation as amended by the 04 series of amendments.
- 14.3. Existing approvals for Advance Warning Triangles already granted under this Regulation before the date of entry into force of the 04 series of amendments shall remain valid indefinitely.
- 14.4. Contracting Parties applying this Regulation shall not refuse to grant extensions of approvals to the preceding series to this Regulation."

Annex 2, amend to read:

"Annex 2

Arrangements of the approval marks



An advance-warning triangle bearing one of the approval marks shown above has been approved in the Netherlands (E4) under approval number **04216**. The first two digits of the

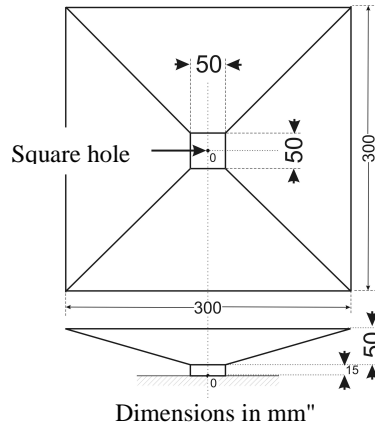
approval number indicate that the approval was granted according to the requirements of this Regulation as amended by the **04** series of amendments.

Note: The drawings show several possible embodiments and are given by way of example. The competent authorities shall avoid using Roman numerals for the approval, in order to prevent any confusion with other symbols."

Annex 3, Figure 2, amend to read:

"Figure 2

Test device for clearance to ground



Annex 5, delete paragraph 1.4.

Annex 5, paragraphs 1.5. to 1.5.2., renumber as paragraphs 1.4. to 1.4.2. and amend to read:

- "1.4. The ~~same~~ two samples with the smallest and the largest CIL value in the tests according to paragraph 1.3. above shall be subsequently subjected to the following tests:
- 1.4.1. Measurement of the values of the CIL in respect of the observation and illumination angles referred to in paragraphs 7.3.1.1. and 7.3.1.2. of this Regulation according to the method described in paragraph 4 below. ~~The visual inspection as meant in paragraphs 7.3.1.3. and 7.3.1.4. of this Regulation can then also be performed.~~
- 1.4.2. Testing of the colour of the retro-reflected light according to paragraph 2.1. below on the sample ~~which, as a result of a visual inspection, seems to have the least favourable colorimetric characteristics; in other cases the sample with the highest CIL concerned shall be examined.~~"

Annex 5, paragraphs 1.5.3. to 1.8.3., renumber as paragraphs 1.4.3. to 1.7.3.

Annex 5, paragraph 2.1. and 2.1.1., amend to read:

- "2.1. Colour of retro-reflecting devices
- 2.1.1. The colour of the retro- reflecting devices to be tested ~~according to paragraph 7.2.1. of this Regulation may be ascertained visually by observers having normal colour response, by means of comparison with coloured lights the trichromatic co-ordinates of which is adequately within the colour limits~~

defined in paragraph 2.30 of Regulation No. 48 when illuminated by the CIE standard illuminant A with an angle of divergence of 1/3° and an illumination angle $V = H = 0^\circ$, or, if this produces a colourless surface reflection, an angle $V = \pm 5^\circ$, $H = 0^\circ$ shall be applied."

Annex 5, paragraph 2.1.2., shall be deleted.

Annex 5, paragraph 2.2 and 2.2.1., amend to read:

- "2.2. Colour of the fluorescent material
- 2.2.1. ~~The colour of the fluorescent material to be tested according to paragraph 7.2.2. of this Regulation may be ascertained visually by observers having normal colour response, by comparison with fluorescent materials the trichromatic co-ordinates of which is adequately within the colour limits defined in paragraph 7.2.2.2. of this Regulation. The illumination and observation of the samples shall be carried out in the measuring geometry 45°/0°, and illuminance shall be chosen so as to ensure photopic vision.~~

For testing the colour of the fluorescent material, the material shall be illuminated by the CIE Standard Illuminant D65 (ISO 11664-2:2007(E)/CIE S 014-2/E:2006) and measured with a spectrophotometer in accordance with the provisions of Publication CIE 15:2004, Recommendations on Colorimetry - Second Edition, either illuminated polychromatically or with a monochromator providing stepwise the CIE Standard Illuminant D 65 (ISO 11664-2:2007(E)/CIE S 014-2/E:2006) at an angle 45° to the normal and viewed along the normal (geometry 45/0). In the latter case, the stepwise resolution $\Delta\lambda$ shall be not larger than 10nm. Alternatively similar "Illuminants" are allowed, if verified that the colorimetric measuring procedure is of the same sufficient accuracy, meaning that the quality of the simulation of D65 shall be assessed by the method described in ISO 23603:2005(E)/CIE S 012/E:2004. The spectral distribution of the illuminant shall be in category BC (CIELAB) or better."

Annex 5, paragraph 2.2.2., shall be deleted.

Annex 5, paragraph 3.1. to 3.1.2., amend to read:

- "3.1. For the determination of the luminance factor the sample shall be **tested with the same method as described in paragraph 2.2.1 of this annex.** The luminance factor may be obtained:
- ...
- 3.1.2. When the colour of the fluorescent material has been colorimetrically determined in compliance with paragraph 2. 2. ~~1~~ above, from the ratio of the tristimulus value Y the sample and the tristimulus value of the perfect diffuser Y_0 ; in this case it is:

$$\beta = \frac{Y}{Y_0} "$$

Annex 5, paragraphs 10. to 10.5., amend to read:

- "10. Test of stability against wind**

- 10.1. The advance-warning triangle shall be set up in a wind tunnel, on a base measuring about 1.50 m by 1.20 m with a surface formed of abrasive material of the type P36 corresponding to the FEPA¹ specification 43-1-2006. This surface shall be characterised by its geometric roughness, HS = 0.5 mm ± 0.05 mm, which shall be defined and determined by the so-called "sandy beach" method according to Annex 4 of this Regulation.
- To avoid a laminar boundary layer of the incident flow over the surface of the base, this base shall have a splitter plate and shall be set up in such a way, that the flow is completely around the plate.
- 10.2. For the air flow the following conditions shall apply:
- (a) The air stream shall reach a dynamic pressure of 180 Pa; and shall have a flow field which shall be homogeneous and free of turbulence;
 - (b) The dimension of the flow field shall be such, that horizontally to each corner and vertical to the top of the advance-warning triangle a clearance of at least 150mm to the border line of this flow field shall exist;
 - (c) The air stream (flow field) shall be parallel to the supporting surface, in a direction which seems to be most unfavourable for the stability;
 - (d) In the case of a closed wind tunnel, the area of the advance-warning triangle shall be not larger than 5 per cent of the area cross-section of the closed wind tunnel.
- 10.3. When set up in this manner, the advance-warning triangle shall be subjected for 3 minutes to this open air stream.
- 10.4. The advance-warning triangle shall neither overturn nor shift. Slight shifting of the points of contact with the road surface by not more than 5 cm, however, shall be allowed.
- 10.5. The retro-reflecting triangular part of the device shall not rotate through more than 10° round a horizontal axis or a vertical axis from its initial position. The rotation around the horizontal axis or the vertical axis shall be determined by the aid of a virtual plane at the initial position of the retro-reflecting triangular part of the device, which is orthogonal to the base and orthogonal to the air stream."

Annex 5, paragraph 12.1., amend to read:

- "12.1. One of the samples of the fluorescent material submitted according to paragraph 3.5 of this Regulation shall be subjected to a temperature and irradiation test described in ~~ISO 105 of 1978~~ **Annex 9 to this Regulation** until the contrast No. 4 of the grey scale has been reached for the reference sample No. 5 **or the light exposure equivalents for blue wool light fastness references sample No. 5 to fade to the grey scale 4 for exposure by a Xenon-arc lamp has been reached.**"

¹ FEPA: Federation of European Producers of Abrasives, 20 Avenue Reille, 75014 Paris, France.

Insert a new Annex 9, to read:

"Annex 9

Colour fastness to artificial light Xenon-arc lamp test

1. Scope

This Annex specifies a method intended for determining the resistance of the colour of test samples of all kinds and in all forms to the action of an artificial light source representative of natural daylight (D65).

2. Principle

A specimen of the test samples to be tested is exposed to artificial light under prescribed conditions, along with a blue wool reference as specified.

3. Reference materials

The colour fastness ratings mentioned in this Annex are obtained by comparison unexposed with exposed specified blue wool references for verification of the radiation dose as a required maximum contrast in this Regulation.

- 3.1. Blue wool references developed and produced in Europe are identified by the numerical designation 1 to 8. These references are blue wool cloths dyed with the dyes listed in table 1. For the test procedure of this Regulation described by this Annex only the blue wool references 5 and 7 will be applied as described in Table 1 below.

Table 1
Dyes for blue wool references 5 and 7

Reference	Dye (Colour Index designation) ¹
5	CI Acid Blue 47
7	CI Solubilised Vat Blue 5

¹ The Colour Index (third edition) is published by The Society of Dyers and Colourists, P.O. Box 244, Perkin House, 82 Grattan Road, Bradford BD1 2JB, UK, and by The American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215, USA.

4. Grey scale

The grey scale for determining changes in colour of test samples in colour fastness tests. A precise colorimetric specification of the scale is given in Appendix 1 to this annex.

- 4.1. The use of the scale is described in paragraph 2 of Appendix 1 to this annex.

5. Xenon-arc lamp apparatus

The apparatus shall be either an air-cooled or water-cooled Xenon-arc weathering device capable of exposing samples in accordance with EN ISO 4892-2.

- 5.1. The Exposure conditions shall comply with the specifications in the Table 2 below.

Table 2
Artificial weathering test parameters

<i>Exposure parameters</i>	<i>Air-cooled lamp</i>	<i>Water-cooled lamp</i>
Light/dark/water spray cycle	Continuous light without water spray	Continuous light without water spray
Black standard temperature during light only periods	(47 ± 3) °C using a black standard thermometer	(47 ± 3) °C using a black standard thermometer
Relative humidity	Approximately 40 %	Approximately 40 %
Filters	Window glass filters Specifications see paragraph 5.2 below	Window glass filters Specifications see paragraph 5.2 below
<i>Irradiance (W/m²) controlled at:</i>		
Over 300nm to 400nm range	42±2	42±2
Over 300nm to 800nm range	550	630

Note 1: Water used for the specimen spray should contain no more than 1 ppm silica. Higher levels of silica can produce spotting on samples and variability in results. Water of the required purity can be obtained by distillation or by a combination of deionization and reverse osmosis.

Note 2: While irradiance levels should be set at the above levels, variations in filter ages and transmissivity, and in calibration variations, will generally mean that irradiance error will be in the order of ± 10 per cent.

5.2 Light source

The light source shall consist of a xenon arc lamp of correlated colour temperature 5500 K to 6500 K, the size of which will depend on the type of apparatus used. The xenon-arc lamp shall use filters that provide a reasonable simulation of solar radiation filtered by typical window glass. Table 3 gives the relative spectral irradiance requirements for the filtered xenon-arc. It is the responsibility of the supplier of the exposure device to provide necessary certification that the filters that they supply for use in the exposure tests described in this standard meets the requirements of Table 3.

Table 3
Relative spectral irradiance requirements for window glass filters^{a, b} used for the Xenon-arc devices used in this standard.

<i>Spectral Bandpass Wavelength λ in nm</i>	<i>Minimum %^c</i>	<i>CIE No.85, Table 4 plus window glass %^{d, e}</i>	<i>Maximum %^c</i>
1 < 300			0,29
300 $\leq \lambda \leq$ 320	0,1	≤ 1	2,8
320 < $\lambda \leq$ 360	23,8	33,1	35,5
360 < $\lambda \leq$ 400	62,4	66,0	76,2

^a Data in Table 3 is the irradiance in the given bandpass expressed as a percentage of the total irradiance from 290 nm to 400 nm. To determine whether a specific filter or set of filters for a xenon-arc meets the requirements of Table 3, the spectral irradiance from 250 nm to 400 nm must be measured. The total irradiance in each wavelength bandpass is then summed and divided by the total irradiance from 290 nm to 400 nm.

^b The minimum and maximum data in Table 3 are based on more than 30 spectral irradiance measurements for water and air cooled xenon-arcs with window glass filters of various lots and ages. Spectral irradiance data is for filters and xenon-burners within the ageing recommendations of the device manufacturer. As more spectral irradiance data become available, minor changes in the limits are possible. The minimum and maximum data are at least the three sigma limits from the mean for all measurements.

^c The minimum and maximum columns will not necessarily sum to 100 per cent because they represent the minimum and maximum for the data used. For any individual spectral irradiance, the calculated percentage for the bandpasses in Table 3 will sum to 100 per cent. For any individual xenon-arc lamp with window glass filters, the calculated percentage in each bandpass must fall within the minimum and maximum limits of Table 2. Test results can be expected to differ between exposures using xenon-arc devices in which the spectral irradiance differ by as much as that allowed by the tolerances. Contact the manufacturer of the xenon-arc devices for specific spectral irradiance data for the xenon-arc and filters used.

^d The data from Table 4 in CIE No. 85 [1] plus window glass was determined by multiplying the CIE No. 85, Table 4 data by the spectral transmittance of 3 mm thick window glass (see ISO 11341 [2]). These data are target values for xenon-arc with window glass filters.

^e For the CIE 85 Table 4 plus window glass, the UV irradiance from 300 nm to 400 nm is typically about 9 per cent and the visible irradiance (400 nm to 800 nm) is typically about 91 per cent when expressed as a percentage of the total irradiance from 300 nm to 800 nm. The percentages of UV and visible irradiances on samples exposed in xenon arc devices may vary due to the number and reflectance properties of specimens being exposed.

5.3. Light exposure equivalents for blue wool light fastness references for exposure by a Xenon-arc lamp

Table 4
Blue wool reference

<i>Blue wool reference</i>		<i>420nm</i>	<i>300 nm–400 nm</i>
No.		kJ/m²	kJ/m²
5	L6	340	13824
7	L8	1360	55296
For colour change of step 4 on the grey scale			

6. Procedure (blue wool references)

- 6.1 Place the test samples mounted on the holders in the apparatus and expose them continuously to weathering following method.
- 6.2 At the same time expose the blue wool references mounted on cardboard, cover one-third of each.
- 6.3 Only one side of the test samples shall be exposed to weathering and light.
- 6.4 Whilst the specimens are drying, the air in the test chamber shall not be moistened.
Note: The actual conditions of the weathering test depend on the kind of test apparatus used.
- 6.5 Before mounting the tested specimens for assessment, dry them in air at a temperature not exceeding 60°C.
- 6.6 Trim and mount the exposed blue wool reference so that they measure at least 15 mm x 30 mm, one on each side of a portion of the original which has been trimmed to the same size and shape as the specimens.
- 6.7 Unexposed samples of original fabric identical to those being tested are required as references for comparison with the specimens during weathering.

Annex 9 - Appendix 1

Definition of the Grey Scale

This section describes the grey scale for determining changes in colour of test samples in colour fastness tests, and its use. A precise colorimetric specification of the scale is given as a permanent record against which newly prepared working standards and standards that may have changed can be compared.

1. The essential, or 5-step, scale consists of five pairs of non-glossy grey colour chips (or swatches of grey cloth), which illustrate the perceived colour differences corresponding to fastness ratings 5, 4, 3, 2 and 1. This essential scale may be augmented by the provision of similar chips or swatches illustrating the perceived colour differences corresponding to the half-step fastness ratings 4-5, 3-4, 2-3 and 1-2, such scales being termed 9-step scales. The first member of each pair is neutral grey in colour and the second member of the pair illustrating fastness rating 5 is identical with the first member. The second members of the remaining pairs are increasingly lighter in colour so that each pair illustrates increasing contrasts or perceived colour differences which are defined colorimetrically. The full colorimetric specification is given below:
 - 1.1. The chips or swatches shall be neutral grey in colour and shall be measured with a spectrophotometer with the specular component included. The colorimetric data shall be calculated using CIE standard colorimetric system for Illuminant D65;
 - 1.2. The Y tristimulus value of the first member of each pair shall be 12 ± 1 ;
 - 1.3. The second member of each pair shall be such that the colour difference between it and the adjacent first member is as follows.

Table 1
CIELab difference in relation to the Fastness grade

<i>Fastness grade</i>	<i>CIELab difference</i>	<i>Tolerance</i>
5	0	0,2
(4-5)	0,8	±0,2
4	1,7	±0,3
(3-4)	2,5	± 0,35
3	3,4	±0,4
(2-3)	4,8	±0,5
2	6,8	±0,6
(1-2)	9,6	±0,7
1	13,6	±1,0

Note 1: Bracketed values apply only to the 9-step scale.)

Note 2: Use of the scale:

Place a piece of the original blue reference and the exposed specimen of it side by side in the same plane and oriented in the same direction. Place the grey scale nearby in the same plane. The surrounding field should be neutral grey colour approximately midway between that illustrating grade 1 and that illustrating grade 2 of the grey scale for assessing change in colour (this is approximately Munsell N5). Illuminate the surfaces with north sky light in the Northern hemisphere, south sky light in the Southern hemisphere, or an equivalent source with an illumination of 600 lx or more. The light should be incident upon the surfaces at approximately 45°, and the direction of viewing approximately perpendicular to the plane of the surfaces. Compare the visual difference between original and exposed blue standard with the differences represented by the grey scale.

If the 5-step scale is used, the fairness rating of the specimen is that number of the grey scale which has a perceived colour difference equal in magnitude to the perceived colour difference between the original and the treated specimens; if the latter is judged to be nearer the imaginary contrast lying midway between two adjacent pairs than it is to either, the specimen is given an intermediate assessment, for example 4-5 or 2-3. A rating of 5 is given only when there is no perceived difference between the tested specimen and the original material.

If the 9-step scale is used, the fastness rating of the specimen is that number of the grey scale which has a perceived colour difference nearest in magnitude to the perceived colour difference between the original and the tested specimens. A rating of 5 is given only when there is no perceived difference between the tested specimen and the original material."

II. Justification

1. This amendment to Regulation No. 27 includes the following changes:
 - (a) For the colour measurement of fluorescent materials, the old test procedure using the Illuminant C is replaced by the Illuminant D65, as it is in the Regulation Nos. 69 and 70. The result is that the relevant UN Regulations now have a uniform procedure for carrying out the same measurements.
 - (b) For the instrumental measurement of the fluorescent colour, alternative methods are now introduced and allowed.
 - (c) The usage and the reference to the ISO 105 are replaced by an annex in the Regulation, which concisely describes the necessary aspects of the weathering procedures for the fluorescent materials.

2. The new annex is aligned with ISO 105-B02: 1994/Amendment. 2, 2000, para. 7.2.4.-Method 4, which represents the current legal status. It can also be used to amend Regulations Nos. 69 and 70.
 3. The description for the wind test (see paragraph 10. of Annex 5) was redrafted because the current specifications are not clear, and, in the past, different interpretations of the test procedure, producing totally different results have occurred. Therefore there is an urgent need to update the procedure in a clear way.
 4. The test surface, which in principle represents the road, is now standardised by a surface of abrasive material of the type P36 corresponding to the FEPA specification No. 43-1-2006. With this amendment all laboratories will use the same surface to ensure comparable results. The roughness of this new defined surface is the same as previously required but as the roughness is now defined by the specification of the abrasive material, the content of Annex 4 "Determination of the roughness of the road surface 'sandy beach' method" is, in principle, no longer necessary and could be replaced by the new Annex 9.
 5. Finally, the test device for clearance to the ground in Annex 3 is simplified and only one dimension (300mm) will be applied.
 6. A transitional period of 36 months has been introduced into a new paragraph 14. to allow time for manufacturers and laboratories to adapt to the new measurement methods.
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