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## Economic Commission for Europe

### Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

#### Working Party on Lighting and Light-Signalling

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Item 5 of the provisional agenda

**Regulations Nos. 37 (Filament lamps), 99 (Gas discharge light sources), 128 (Light emitting diodes light sources) and the Consolidated Resolution on the common specification of light source categories.**

### **Proposal for Supplement 7 to the original version of Regulation No. 128 (Light emitting diodes light sources)**

#### **Submitted by the expert from the International Automotive Lighting and Light Signalling Expert Group (GTB)\***

The text reproduced below was prepared by the expert from GTB to introduce requirements and test specifications for light emitting diodes (LED) substitute light sources. This proposal is an updated version of ECE/TRANS/WP.29/GRE/2017/2, originally considered by the Working Party on Lighting and Light-Signalling (GRE) at its seventy-seventh session, and takes into account comments received from several Contracting Parties. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), 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

*Insert a new paragraph 2.2.2.4., to read:*

- "2.2.2.4. Documents, in case of LED substitute light sources, showing:**
- (a) The information to be displayed on; and**
  - (b) The instructions to be contained by the packaging of LED substitute light sources for retail."**

*Insert a new paragraph 2.3.1.5., to read:*

- "2.3.1.5. In the case of LED substitute light sources, the following symbol<sup>1</sup>:**



*Insert a new paragraph 3.10., to read:*

- "3.10. LED substitute light sources - additional requirements**
- 3.10.1. The electrical current of the LED substitute light source shall be measured at ambient temperature of  $(23 \pm 2)$  °C in still air after 1 minute and after 30 minutes of operation at test voltage.**
- Measured values of the electrical current shall be within the limits as specified in the relevant data sheet of Annex 1.**
- 3.10.2. The LED substitute light source shall comply with the technical requirements to an electrical/electronic sub-assembly (ESA) as specified by Regulation No. 10 and its series of amendments in force at the time of application for type approval.**
- 3.10.3. The LED substitute light source shall not emit light when activated for 2 milliseconds or shorter.**
- 3.10.4. The correlated colour temperature<sup>2</sup> of LED substitute light sources emitting white light shall be no more than 3000 K."**

*Insert a new paragraph 4 and renumber old paragraphs 4 to 7 and its sub paragraphs including its references to paragraphs and sub paragraphs 5 to 8, to read:*

## **"4. Requirements to the packaging of LED substitute light sources**

- 4.1. Each package for retail shall display the following information:**
- 4.1.1. The trade name or mark of the manufacturer;**
  - 4.1.2. The rated voltage;**

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<sup>1</sup> ISO 7000, symbol 1641

<sup>2</sup> CIE S 017/E: 2011: ILV: International Lighting Vocabulary, or eILV; term 17-258

- 4.1.3. The designation of the LED substitute light source category;
- 4.1.4. The approval code;
- 4.1.5. The following symbol<sup>3</sup>:



- 4.2. Each package for retail shall contain instructions in an official language of the 1958 Agreement (i.e. English, French or Russian), supplemented by the corresponding text in the language of the country where it is sold:
  - 4.2.1. Stating that this LED substitute light source is suitable for fitment in lamps on vehicle models if both the lamp and the vehicle in which it is to be installed are approved for the use of this LED substitute light source;
  - 4.2.2. Referring to the lamp markings and instructions provided with the vehicle;
  - 4.2.3. Providing a web address of the LED light source manufacturer where this manufacturer shall publish listing(s) of light signalling functions installed on vehicle models approved for the use of the LED substitute light source;
  - 4.2.4. Warning, clearly legible, that if this LED substitute light source is not used in accordance with the instructions with its package and with the instructions provided with the vehicle, this LED substitute light source may cause a fault in the vehicle's electrical system and/or pose an operational and/or traffic safety risk.
  - 4.2.5. Referring to professional maintenance or repair shops, if the applicability of the LED substitute light source is unclear.
- 4.3. The manufacturer shall provide the instructions, as referred to in paragraph 4.2, for displaying purposes at the point of sales without opening the package."

*Old paragraph 4.1., renumbered as new paragraph 5.1., amend to read:*

- "4.5.1. LED light sources approved to this Regulation shall be so manufactured as to conform to the type approved by meeting the inscriptions and technical requirements set forth in paragraph 3. ~~above~~ and Annexes 1, 4 and 5 to this Regulation.

**In addition, the information on the packages and the instructions of LED substitute light sources contained by the packages for retail shall conform to the requirements as set forth in paragraph 4."**

*Insert a new paragraph 5.3.7. in the renumbered paragraph 5, to read:*

- "5.3.7. **Keep record of the listings, including the modifications and modification dates, published on its web pages as described in paragraph 4.2.3."**

<sup>3</sup> ISO 7000, symbol 1641

Annex 1, the footnote, amend to read:

"<sup>1</sup> ... onwards, the sheets for ~~gas discharge~~ **LED** light sources, the list..."

Annex 4, introductory part, amend to read:

"Light sources of all categories with integrated ~~heatsink~~ **heat sink** shall be measured **in still air** at ambient temperature of  $(23 \pm 2)$  °C ~~in still air~~, **and at an additional ambient temperature if indicated in the relevant data sheet of Annex 1**. For these measurements the minimum free space as defined in the data sheets shall be maintained.

Light sources of all categories with definition of a temperature  $T_b$  shall be measured by stabilising the  $T_b$ -point at the specific temperature defined on the category data sheet..."

Annex 5, paragraph 1., amend to read:

"1. General

The conformity requirements shall be considered satisfied from a photometric, geometrical, visual and electrical standpoint if the specified tolerances for production LED light sources in the relevant data sheet of Annex 1, ~~and the relevant data sheet for the caps~~ **and in the case of LED substitute light sources the additional requirements to LED substitute light sources in paragraph 3.10.** are met."

Annex 6, table 1, insert an additional row at the bottom, to read:

"Table 1  
**Characteristics**

<i>Grouping of characteristics</i>	<i>Grouping* of test records between LED light source types</i>	<i>Minimum 12 monthly sample per grouping*</i>	<i>Acceptable level of non-compliance per grouping of characteristics (%)</i>
Marking, legibility and durability	All types with the same external dimensions	315	1
External LED light source dimensions (excluding cap/base)	All types of the same category	200	1
Dimensions of caps and bases	All types of the same category	200	6.5
Dimensions related to light emitting surface and internal elements**	All LED light sources of one type	200	6.5
Initial readings, power, colour and luminous flux**	All LED light sources of one type	200	1
Normalised luminous intensity or cumulative luminous flux distribution	All LED light sources of one type	20	6.5
<b>Electrical current***</b>	<b>All LED light sources of one type</b>	20	<b>1</b>

\* The assessment shall in general cover series production LED light sources from individual factories. A manufacturer may group together records concerning the same type from several factories, provided these operate under the same quality system and quality management.

\*\* In **case** a LED light source has more than one light output function the grouping of characteristics (dimensions, power, colour and luminous flux) applies to each element separately.

\*\* **LED substitute light sources only"**

## II. Justification

1. An increasing number of LED retrofit light sources is present in the market and sold as replacements for approved light sources. The public is stimulated by governments to use energy efficient lighting like LEDs and is already getting used to LED retrofits in general lighting applications. However, the public is not aware that automotive LED retrofits in vehicles exterior lamps may bear a safety risk. The public is also not aware that these LED retrofits are not allowed by many jurisdictions.
2. GTB conducted a feasibility study of LED retrofit light sources. The outcome was that, while photometry aspects can be positively matched, electrical and software configurations of vehicles in use are not standardised. Moreover, the installation is subject to national law. Progress on this feasibility study was reported to GRE (GRE-69-41, GRE-70-47, GRE-72-27 and GRE-73-24).
3. As a consequence, GTB no longer pursued LED retrofit light sources intended for installation in lamps on vehicles originally not approved for these light sources. Instead, GTB worked on LED substitute light sources, intended for use in lamps installed on vehicles approved for using such light sources.
4. A proposal was developed where lamps may be approved with a filament light source and its corresponding LED substitute light source, fitting in the same holder, and providing equivalent photometric performance. Lamps equipped with these LED substitute light sources shall be tested with both the filament lamp and the LED substitute light source. Vehicles equipped with these lamps shall be declared ready for installation of such lamps, in particular in view of failure detection systems.
5. This proposal comprises of:
  - (a) A proposal to introduce provisions into Regulation No. 128;
  - (b) A proposal to introduce new category sheets C5W/LED, PY21W/LED and R5W/LED based on LED technology into the Consolidated Resolution (R.E.5);
  - (c) Equivalence criteria as guidance for specifying sheets for LED substitute light source categories (GRE-77-02). These guidelines are intended for publication, with the agreement of GRE, on the GRE website under "reference documents", similar to criteria for new filament light sources for head lighting (GRE-77-04). In addition, these criteria are being prepared for insertion in publication of the International Electrotechnical Commission (IEC) 60810;
  - (d) Equivalence reports for the new categories C5W/LED, PY21W/LED and R5W/LED in LED technology (GRE-77-03).
6. Technical explanations:
  - (a) In an earlier version of the proposal a distinction was made in types of a correlated colour temperature above or below 3000 K. The higher colour temperature light sources offer better colour matching options with front lighting light sources. The lower colour temperature light sources shall be used in lamps with colour filters, such as direction indicator lamps or stop lamps, to maintain colour quality and luminous intensity of the lamps. That earlier version of the proposal required G-marking of an LED substitute light source of a correlated colour temperature up to 3000 K for use in a lamp with a colour filter;

In response to the considerations at the seventy-seventh session of GRE, GTB deleted the G-marking for LED substitute light sources below 3000 K, which were intended for use behind coloured lenses. Instead, a requirement was inserted that the correlated colour temperature of white light emitted by LED substitute light sources shall be no more than 3000 K.

- (b) For failure detection and on-board diagnostics (OBD) systems, the electrical current of filament light sources can be calculated within some margins from the applied voltage and wattage of the filament light source. For LED substitute light sources this is not the case. This is why the electrical current of LED substitute light sources is specified and also subject to Conformity of Production (COP);
- (c) LED substitute light sources contain electronics and such electronics should not unintentionally influence or be influenced by the board net. This is a reason to test LED substitute light sources as electrical/electronic sub-assembly (ESA), as specified by Regulation No. 10. Approval according to Regulation No. 10 is not possible. This is to avoid that light sources are only tested according to Regulation No. 10 and not as a light source, which has occurred in the past;
- (d) LED substitute light sources shall not emit light within 2 ms after activation to avoid visible signals on vehicles doing life testing of light sources;
- (e) LED technology is temperature sensitive. The performance of filament light sources does not depend on the ambient temperature. Because LED substitute light sources are intended to replace filament light sources, additional higher ambient temperatures are defined for testing of LED substitutes.

7. As is the case for other light sources, additional tests on voluntary basis are described in standards, such as from the International Electrotechnical Commission (IEC) or Society of Automotive Engineers (SAE).

8. The use of LED substitute light sources in lamps and on vehicles, for which such light sources were not foreseen during the original design of the lamp/vehicle, needs to be verified to guarantee the correct operation of both the lamp and the vehicle.

9. In response to the considerations at the seventy-seventh session of GRE, where several contracting parties called for developing a set of preventive measures including raising public awareness and giving warnings to consumers, GTB inserted a new paragraph on packaging requirements similar to what is specified in Regulation No. 90. These requirements consist of several parts:

- (a) Information displayed on the package;
- (b) Instructions contained by the package;
- (c) This information and these instructions without opening the package for displaying purpose at the point of sales;
- (d) A list vehicles and the signaling functions installed on these vehicles, approved for the use of LED substitute light sources, published on a web site.

10. For these reasons, in parallel to the introduction of the LED substitute light sources in Regulation No. 128 and in the Consolidated Resolution (R.E.5), the following amendments to the Regulation for the type approval of the lamps and for the type approval of vehicles for their lamp installation are necessary:

- (a) Provisions in lamp Regulations to allow type approval with both the filament light source category as the prime light source and its LED substitute, whereby for COP lamp testing only the use of a filament light source is required;
  - (b) Provisions in installation Regulations to avoid that lamp(s), originally or by extension approved for LED substitute light sources, are installed on a vehicle while this vehicle failure detection and on-board diagnostics systems are not prepared for LED substitute light sources;
  - (c) Proposals for amendments to Regulation No. 48 concern also 03, 04 and 05 series of amendments to offer the possibility to upgrade vehicles with lamps using LED substitute light sources by extension of approval.
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