


**GTB**

**Upcoming Regulation 128 Changes related to  
LED Light Sources for Forward Lighting Applications**

In support of document GRE/2016/34

# Introduction

- Introduction into R128 of LED light source categories for forward lighting applications (front fog, low beam, high beam, AFS) is planned for **2017**
- R128 changes include performance-based requirements to address forward lighting application-specific parameters:
  - Photometric Performance
  - Temperature Dependency of LED Light Sources 
- Requirements in R128 have to match with the requirements in the forward lighting device regulations (R19, R98, R112, R113, R123)
- In order to avoid significant delay of introduction of this new technology we propose to implement the required adjustments to the **device regulations at GRE-76** before the “period of no change” due to the simplification of device regulations

# Timeline

## GRE-75:

- Informal document outlining the changes needed to close the technology gap → GRE-75-14

## GRE-76:

- Final proposal for amendments of R19, R98, R112, R113 and R123 → GRE/2016/34
- Informal document (for information only) with overview of:
  - Upcoming amendments of R128 relevant to the interface with the device (e.g. thermal grades)
  - Proposed category sheet (to be added to the Resolution R.E. [5])  
→ GRE-76-13

## GRE-77:

- Final proposal for amendments of R128 accompanied by a proposal to add a category sheet in the resolution R.E. [5]

# Document Package with 2 Parts

## Part 1

Announced at GRE-75

➤ GRE-75-14

Formal document GRE-76

➤ GRE/2016/34

Amend Device  
Regulations

***R19, R98, R112, R113, R123***

## Part 2

Announced GRE-75

➤ GRE-75-14

GRE-76 for information

➤ GRE-76-13

→ GRE-77 formal document

R128 body text

R.E. [5] Category  
Sheet "L1"

# Package Part 1: Amendments to Device Regulations

- Forward Lighting Regulations (R19, R98, R112, R113, R123) need to be amended to accept R128 light sources
  - Adding the option for R128 light sources:
  - Introduction of **Thermal Grades** from R128 into forward lighting regulations


→ GRE/2016/34



# Package Part 2: Amendments to R128 and Resolution

## Regulation 128 Amendments

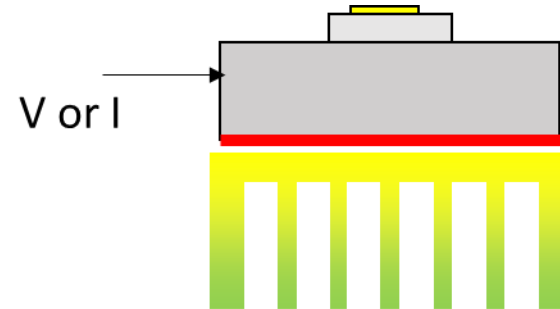
### Body Text & Annexes:

- Photometric Performance → *GRE-77*: GRE/2017/xx  
    ➤ To ensure adequate performance in devices with a cut-off  
    Light Source Specific
  - Thermal Behaviour:  → *GRE-76*: GRE-76-13  
    – Thermal Grades  
    Light Source & Device Specific
- Plus:  
Category Data Sheet "L1" (in the Resolution R.E. [5])  
→ *GRE-77*: GRE/2017/xx

# LED Light Sources According to R128 for Forward Lighting Application

LED light source, with:

- Photometric characteristics
  - near-field and far-field
  - Contrast, uniformity
- Mechanical interface
  - positioning tolerance (after replacement)
- Electrical interface (connector)
  - Either: operated at 13.2V
  - Or: using external control gear
- Thermal performance
  - Either: heat sink integrated
  - Or: thermal interface to heatsink



# Thermal Grades



## *What is Special for Forward Lighting LED Light Sources?*

The headlamp can be close to combustion engine, which would mean different levels of higher temperature conditions at the LED light source

- Introduce the concept of **Thermal Grades** to qualify the appropriate thermal operating environment of the LED light source

Example: all "L1" emit 350lm  $\pm$  20% at 25°C and ...

<b>L1 65C</b> means a Thermal Grade 65 °C	<b>L1 85C</b> means a Thermal Grade 85 °C
350 lm $\pm$ 20% up to 65 °C	350 lm $\pm$ 20% up to 85 °C

*Note: Thermal grades have downward compatible keying*



# Thermal Grades Amendment to Resolution

## New definition 2.5.

### *"2.5. Thermal characteristics*

*2.5.1. Thermal point  $T_b$  means an optional point on the base of an LED light source of which the temperature is stabilised during photometric measurements.*

*2.5.2. **Thermal grade** means the temperature level specified in the relevant data sheet of the LED light source, if any, indicating the maximum elevated test temperature up to which additional photometric requirements apply."*

# Thermal Grades

## Amendments to Regulation 128

### Testing

#### New paragraph 3.10. + amendments to Annex 4

##### *"3.10. Thermal grade*

*In case one or more thermal grades are specified in the relevant data sheet of Annex 1, the following requirements shall apply:*

*3.10.1 When measured according to the conditions specified in Annex 4, paragraph 5: ..."*

#### **Testing of Photometric Performance:**

- Over Temperature range (in steps) up to Thermal Grade Temperature;
- Initial and after 1000 h operation

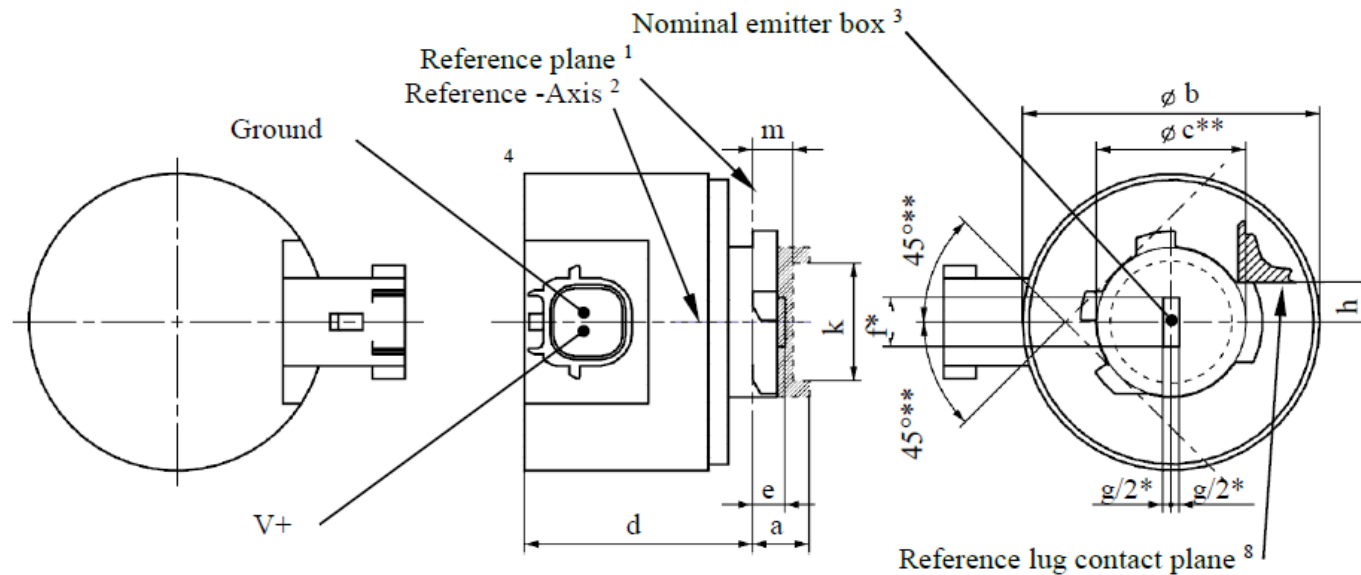
# Amendment to Resolution Category L1 Sheet

For inclusion in Resolution [R.E.5]

➤ L1A shown:

Figure 1\*\*\*

Main Drawing, L1A



# Amendment to Resolution Category L1 Sheet

## Table 1

### Introduction of Thermal Grade

Table 1  
Essential electrical and photometric characteristics of the LED light source

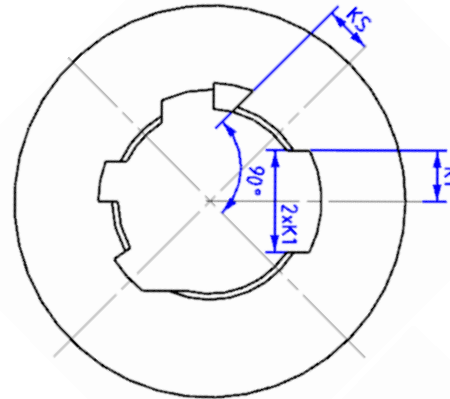
<i>Dimensions</i>		<i>Production LED light sources</i>	<i>Standard LED light sources</i>
a	mm	6.0 max.	
b	mm	c + 10.0 min. 38.0 max.	
c	mm	18.60	
d	mm	28.0 max.	
e	mm	3.00 ± 0.30	3.00 ± 0.10
h <sup>8</sup>	mm	4.88	
k <sup>9</sup>	mm	7 min.	
m <sup>9</sup>	mm	4.5 max.	
Cap [PGJ18.5d-29a] for <b>thermal grade</b> [65] in accordance with IEC Publication 60061 (sheet 7004-185-[2])			
Cap [PGJ18.5d-29b] for <b>thermal grade</b> [85] in accordance with IEC Publication 60061 (sheet 7004-185-[2])			
<i>Electrical and photometric characteristics<sup>5</sup></i>			
Rated Values	Voltage (in Volts)	12	
	Power (in Watts)	L1A, L1B	4.0
Objective values <sup>6</sup>	Power (in Watts) at 13.2V DC	L1A, L1B	6.0 max
	Luminous Flux (in lumen) at 13.2V DC	L1A, L1B	350 ± 20%      350 ± 10% <sup>7</sup>
	Luminous Flux (in lumen) at 9V DC	L1A, L1B	[70] min.
	<b>Thermal grade</b> (in degree Celsius)	L1A [65], L1B [65] L1A [85], L1B [85]	[65]°C [85]°C

# Amendment to Resolution Category L1 Sheet

L1  
Light Source

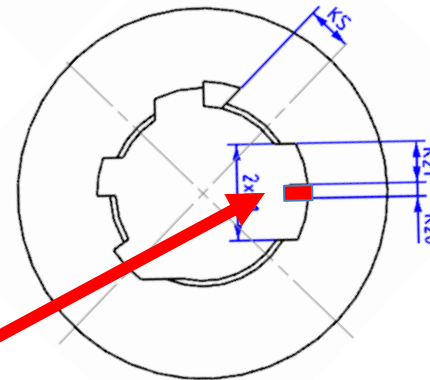
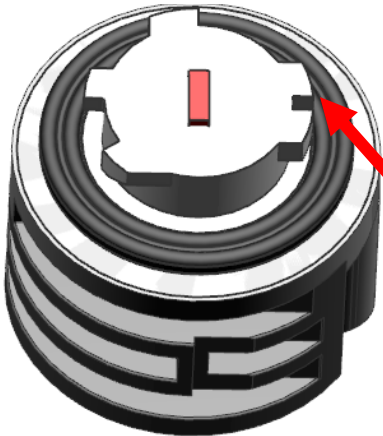
L1 Holder  
(top view)

TG65



Interchangeability is guaranteed through established IEC Cap/Holder specification process, assigning unique keys to each Thermal Grade



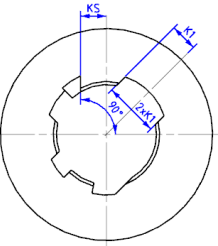
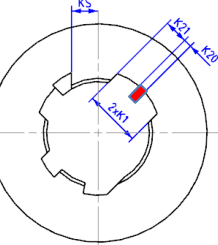
TG85



# Amendment to Resolution Category L1 Sheet

Thermal Grade is  
upwards compatible:

*a light a source with a higher  
thermal grade is allowed to be  
inserted and fits in a holder for  
a lower thermal grade*

		<b>Light Source</b>	
		<b>TG65</b> 	<b>TG85</b> 
<b>Holder</b>	<b>Top View</b> <b>TG65</b> 	<b>FIT OK</b>	<b>FIT OK</b>
	<b>Top View</b> <b>TG85</b> 	<b>NO FIT</b>	<b>FIT OK</b>

# GRE/2016/34

## Summary of Editorial & Technical Changes

### Editorial changes

### Changes related to:

- Mixing of light sources
- "Thermal Grades"
- the "luminous flux limits for the light source" for principle passing beam
- Type-Approval Testing
- Conformity of Production (COP) testing

### II. Justification

<p>1. This collective amendment extends the usage of LED light sources of Regulation No. 128 to the Regulations for front lighting, namely Regulations Nos. 19, 98, 112, 113 and 123. This intention was outlined by the expert from GTB during the seventy-fifth session of GRE (Informal document GRE-75-14).</p> <p>2. It is proposed to allow for the use of regulated replaceable LED light sources according to Regulation No. 128 in all applications where the use of LED modules is already allowed by the current Regulations. Several editorial and technical changes are introduced as follows.</p>	
<p><i>Editorial changes</i></p> <p>3. In several places the term "LED module(s)" is replaced by "LED module(s) and/or LED light source(s)", following the philosophy that Regulation No. 128 LED light sources are allowed in all functions where LED modules are allowed today.</p> <p>4. In several places a reference to LED light sources and Regulation No. 128 is inserted.</p> <p>5. In several places "filament lamp" is replaced by "filament light source" (comment: this change is not related to Regulation No. 128 but is implemented in this step to align with the recent changes to Regulation No. 37).</p>	
<p><i>Changes related to mixing of light sources</i></p> <p>6. The use of more than one Regulation No. 128 LED light source per function is allowed (comment: the use of more than one LED mod</p> <p>7. Mixing of LED modules and Regulation No. function is allowed.</p> <p>8. No "hybrid" solutions, e.g. mixing of filament light source technology is not allowed in the same function as LED modules is already allowed).</p>	<p>source (e.g. 105°C) can be inserted in a lower Thermal Grade headlamp (e.g. 85°C); however not vice-versa.</p> <p><i>Changes related to the "luminous flux limits for the light source" for principle passing beam</i></p> <p>15. The luminous flux limits for the light sources (e.g. minimum 1,000 lm for Regulation No. 112 principal passing beam) apply to the total luminous flux value of all LEDs (LED modules and Regulation No. 128 LED light sources) added together.</p>
<p><i>Changes related to "Thermal Grades"</i></p> <p>9. The Thermal Grade is a characteristic of the R<sub>f</sub> for forward lighting to ensure safe replaceability.</p> <p>10. "Thermal Grade" means that the technical parameters of filament light source (e.g. luminous flux) are specified up to 1 grade.</p> <p>11. Due to the thermal behaviour of LED technology, the use of LED light source interface for replaceable Regulation No. 128 LED light source is not allowed in the same function as filament light source technology is already allowed).</p> <p>12. Thermal Grade testing is defined in Regulation 76-xx, the informal to show the Regulation No. 128 performed at LED light source level.</p> <p>13. The minimum applicable Thermal Grade of source must be specified and mentioned in the communication for approval.</p> <p>14. Incorrect insertion of Regulation No. 128 I mechanical keying. Downward compatibility is ensured.</p>	<p><i>Changes related to the type-approval testing</i></p> <p>16. For type approval of the headlamp an etalon (standard) Regulation No. 128 LED light source is used, and the luminous flux is corrected to the objective value (comment: the use of etalon light source for type approval is the same like for filament and high-intensity discharge (HID) light sources today).</p> <p>17. If more than one Regulation No. 128 LED light source is used in the same function, then a mean value of the correction factors is applied, and each individual correction factor shall not deviate by more than 5% from the mean value (comment: the same procedure is used in Regulation No. 7, Annex 4, paragraph 3.2. for multiple light-source testing).</p> <p><i>Changes related to the Conformity of Production (COP) testing</i></p> <p>18. Etalon or serial (mass) production Regulation No. 128 LED light source(s) are allowed for COP testing (comment: the same procedure is foreseen in Regulation No. 98, Annex 8, paragraph 1.2.).</p> <p>19. In case of etalon light source(s), a correction of intensity values up to 10 per cent is allowed.</p> <p>20. In case of serial production light source(s), a correction of intensity values up to 20 per cent is allowed (comment: the same procedure is foreseen in Regulation No. 98, Annex 8, paragraph 1.2.).</p>

# Amendments to Device Regulations

## Example I

### R112

- 6.1.1. Headlamps shall be so made that they give adequate illumination without dazzle when emitting the passing-beam, and good illumination when emitting the driving-beam. Bend lighting may be produced by activating one additional filament light source, *one or more LED light source(s)* or one or more LED module(s) being part of the passing-beam headlamp.



# Amendments to Device Regulations

## Example II

### R112

- 1.6. References made in this Regulation to standard (étalon) filament *lamp(s) light source(s)* and to Regulation No. 37 shall refer to Regulation No. 37 and its series of amendments in force at the time of application for type approval.

*References made in this Regulation to standard (étalon) LED light source(s) and to Regulation No. 128, including the thermal grade of the LED light source(s), shall refer to Regulation No. 128 and its series of amendments in force at the time of application for type approval.*

# Summary

- A proposal for amendments to introduce LED light source categories for forward lighting applications (front fog, low beam, high beam, AFS) into R128 is upcoming
- R128 Body text amendments include Requirements on Photometric Performance and Thermal Behavior
- Resolution amendments include Thermal Grade definition and Proposal for Category sheet

END