

Informal document GRE-85-05  
85<sup>th</sup> GRE, 26-29 October 2021  
Agenda item 4 (d)

This presentation supports the draft proposal for the  
new 01 series of amendments to UN Regulation No. 150  
(GRE/2021/15)

In the current version of Reg 150  
(based on former Reg 3) – no  
definition of the CIL value is given

NEW

"Coefficient of luminous intensity  $R_I$ " means the quotient of the luminous intensity  $I$  reflected by the retro-reflective device in the direction considered, divided by the normal illumination  $E_{\perp}$  of the retro-reflecting device for given angles of illumination, divergence and rotation.

$$R_I = \frac{I}{E_{\perp}} \quad \text{NOTE 1} \quad R_I \text{ is often referred to as CIL. The unit is cd/lx.}$$

Old definition of  $R'$

"Specific coefficient of retro-reflection (symbol  $R'$ )" means the quotient of the coefficient of luminous intensity  $R$  of a plane retro-reflecting surface and its area  $A$

$$\left( R' = \frac{R}{A} \right) \quad \left( R' = \frac{I}{E_{\perp} \cdot A} \right)$$

$R' \rightarrow R_A$

"Specific coefficient of retro-reflection (symbol  $R_A$ )" means the quotient of the coefficient of luminous intensity  $R$  of a plane retro-reflecting surface and its area  $A$

$$R_A = \frac{R_I}{A} = \frac{I}{E_{\perp} \cdot A}$$

The coefficient of retro-reflection  $R_A$  is expressed in candelas per m<sup>2</sup> per lx (cd·m<sup>-2</sup>·lx<sup>-1</sup>)

**Reference document:**

CIE Publication 54.2:2001 "Retroreflection: Definition and measurement"

## Luminance factor

(symbol  $\beta$ ) - means the ratio of the luminance of the body to the luminance of a perfect diffuser under identical conditions of illumination and observation;

(symbol  $\beta$ )  $\rightarrow$  (symbol  $R_F$ )

"Luminance factor (symbol  $R_F$ )" means the ratio of the luminance of the body to the luminance of a perfect diffuser under identical conditions of illumination and observation;

All definitions for angles are Greek symbols ( $\alpha$ ,  $\beta$ , ...) – to prevent mix-ups.

## Definition of the angles for the measuring geometry setup

### Consistently using $\beta_1$ and $\beta_2$

*In Reg. 150 there is a mix of the definitions for the observation angles.*

"Entrance angle (symbol  $\beta$ )" means the angle from the illumination axis to the reference axis. The entrance angle is usually not larger than  $90^\circ$  but, for completeness, its full range is defined as  $0^\circ < \beta < 180^\circ$ . In order to specify the orientation in full, this angle is characterised by two components,  $\beta_1$  and  $\beta_2$ ;

*E.g.  $\beta_V$ ,  $\beta_H$  or V, H or  $\beta_1$ ,  $\beta_2$*

"Observation angle (symbol  $\alpha$ )" means the angle between the illumination axis and the observation axis. The observation angle is always positive and, in the case of retro-reflection, is restricted to small angles;

Depending on Regulation 3 or 70, 104, ...

### Reference document:

*CIE Publication 54.2:2001 "Retroreflection: Definition and measurement"*

## Definition of the Luminance Factor

Current:  $\beta$

Proposal in GRE-83-26:  $R_F$

***luminance factor (at a surface of a non-self-radiating medium in a given direction, under specified conditions of illumination) [ $\beta_v$ ]***

***NOTE*** For photoluminescent media, the luminance factor consists of 2 components:

*the reflected luminance factor,  $\beta_{v,R}$ , and the luminescent luminance factor,  $\beta_{v,L}$ .*

*The sum of the reflected and luminescent luminance factors is the total luminance factor,  $\beta_{v,T}$ :  $\beta_{v,T} = \beta_{v,R} + \beta_{v,L}$ .*

*The subscript R is used here for the reflected luminance factor because it is more intuitive than the traditional S and avoids confusion with the use of S to denote a state of polarization.*

The luminance factor (symbol  $\beta_{v,R}$ ) of a retroreflective device means the ratio of the tristimulus value  $Y$  of the sample and the tristimulus value of the perfect diffuser  $Y_0$ .

$$\beta_{v,R} = \frac{Y}{Y_0}$$

New proposal:  $\beta_{v,R}$

### ***Reference document:***

*CIE Publication 54.2:2001 "Retroreflection: Definition and measurement"*

## Annexes 13, 21 and 22 (current)

- ▶ Weathering with xenon-arc weathering device
- ▶ Evaluation by reference materials blue wool – grey scale

Replaced by

## Annex 6 – Part 6 (new)

- ▶ Weathering with xenon-arc weathering device
- ▶ Defined time of 500 h
- ▶ Evaluation by set up minimum level for specific coefficient of retroreflection at 80% of required values
- ▶ Evaluation of colour as defined in R48

### Justification

State-of-the-art test, defined parameters in referenced ISO 4892-2:2013

- ▶ Method applicable for retro-reflective sheeting material used for
  - ▶ Retro-reflective markings of
  - ▶ Classes C, D, E, F
  - ▶ Classes 1, 2, 3, 4, 5
  - ▶ and SMV Class 1 and 2
  
- ▶ Method NOT applicable for retro-reflectors of
  - ▶ Classes IA, IB, IIIA, IIIB and IVA
  - ▶ Advance Warning Triangle of Type 1 and 2

# Arrangement of approval markings

## Adjustment of the sizes of the approval marks

In Table 1, to reduce the number of minimum sizes of “a”:

- the value “4 mm” will become “5 mm”
- the value “12 mm” will become “8 mm”

## Changes in the examples of the approval markings arrangement

- Space removed for class IIIA
- Size aligned
- “104R” removed
- “27R” replaced by WT

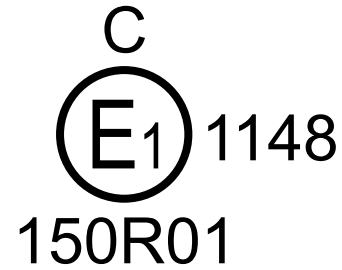
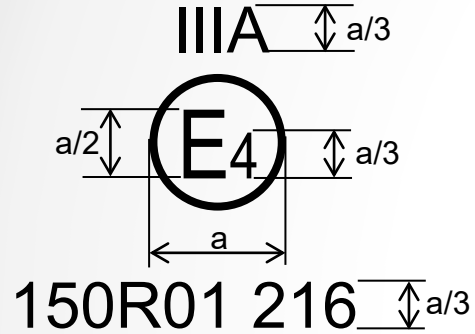
Table 1

**List of retro-reflective devices and their symbols**

<b>Retro-reflective devices</b>	<b>Symbol</b>	<b>Minimum "a" in Annex 10 (in mm)</b>	<b>Paragraph</b>
Retro-reflector for motor vehicles (independent)	IA	5	5.1.
Retro-reflector for motor vehicles (combined with other signal lamps which are not watertight)	IB	5	5.1.
Retro-reflector for trailers (independent)	IIIA	5	5.1.
Retro-reflector for trailers (combined with other signal lamps which are not watertight)	IIIB	5	5.1.
Wide-angle retro reflector	IVA	5	5.1.
Conspicuity marking (material for contour/strip marking)	C	8	5.2.
Conspicuity marking (material for distinctive markings/graphics intended for a limited area)	D	8	5.2.
Conspicuity marking (material for distinctive markings/graphics intended for an extended area)	E	8	5.2.
Conspicuity marking (materials for distinctive markings or graphics as base or background in printing process for fully coloured logos and markings of class "E" in use which fulfil the requirements of class "D" materials)	D/E	8	5.2.
Retro-reflective materials for extremities marking of class F	F	8	5.2.
Retro-reflective marking for long or heavy vehicles (retro-reflective and fluorescent materials) Marking plate of class 1 or class 2	RF	5	5.2.
Retro-reflective marking for long or heavy vehicles (retro-reflective only materials) Marking plate of class 3, class 4 or class 5	RR	5	5.2.
Marking for slow moving vehicles (retro-reflective and fluorescent materials) Marking plate of class 1	RF	5	5.2.
Marking for slow moving vehicles (retro-reflective only materials) Marking plate of class 2	RR	5	5.2.
Advance Warning Triangle (Type 1)	T1 → WT1	8	5.3.
Advance Warning Triangle (Type 2)	T2 → WT2	8	5.3.

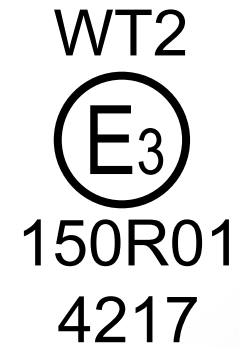
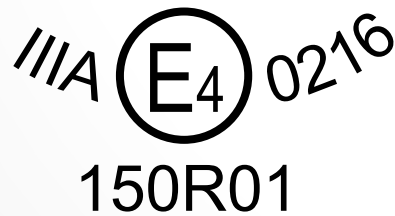


# UPDATED DRAWINGS IN ANNEX 10



	3333 ⓔ <sub>4</sub> 148R01 150R01	IA	2b	R2
		F2	AR	S2

IA 2b R2 F2 AR S2 3333 ⓔ <sub>4</sub> 148R01 150R01			



# Current structure of the Annexes in R150

- 1 Communication
- 2 Minimum requirements for conformity of production control procedures
- 3 Minimum requirements for sampling by an inspector
- 4 Photometric measurements of retro-reflective devices and marking materials
- 5 Specifications of shape and dimensions
- 6 Resistance to heat
- 7 Resistance to water penetration for retro-reflective devices
- 8 Alternative test procedures of resistance to water penetration for retro-reflective devices of the Classes IB and IIIB
- 9 Resistance to fuels
- 10 Resistance to lubricating oils
- 11 Resistance to corrosion
- 12 Resistance of the accessible rear face of mirror-backed retro-reflective devices
- 13 Resistance to weathering
- 14 Stability of photometric properties
- 15 Resistance to cleaning in the case of a sample unit of retro-reflective marking devices
- 16 Bonding strength in the case of adhesive materials
- 17 Flexing - Retro-reflecting Markings
- 18 Resistance to impact
- 19 Rigidity of plates
- 20 Further test procedure for Advance Warning Triangles of Type 1 and 2
- 21 Arrangement of approval markings
- 22 Guidelines for installation of rear marking plates on slow-moving vehicles (by construction) and their trailers
- 23 Description of the measurement geometry for measurement of the daytime colour and the luminance factor of retro-reflective material

	Annex	Type of testing	Administrativ	Photom. measurement	Drawin g	Chemical Test	Mechanical Test	Ad. Warning Triangle only	Environment al Test
1	Communication		●						
2	Minimum requirements for conformity of production control procedures		●						
3	Minimum requirements for sampling by an inspector		●						
4	Photometric measurements of retro-reflective devices and marking materials			●					
5	Specifications of shape and dimensions				●				
6	Resistance to heat								●
7	Resistance to water penetration for retro-reflective devices								●
8	Alternative test procedures of resistance to water penetration for retro-reflective devices of the Classes IB and IIIB								●
9	Resistance to fuels					●			
10	Resistance to lubricating oils					●			
11	Resistance to corrosion								●
12	Resistance of the accessible rear face of mirror-backed retro-reflective devices								●
13	Resistance to weathering								●
14	Stability of photometric properties			●					
15	Resistance to cleaning in the case of a sample unit of retro-reflective marking devices						●		
16	Bonding strength in the case of adhesive materials						●		
17	Flexing - Retro-reflecting Markings						●		
18	Resistance to impact						●		
19	Rigidity of plates						●		
20	Further test procedure for Advance Warning Triangles of Type 1 and 2							●	
21	Arrangement of approval markings		●		●				
22	Guidelines for installation of rear marking plates on slow-moving vehicles (by construction) and their trailers		●						
23	Description of the measurement geometry for measurement of the daytime colour and the luminance factor of retro-reflective material			●					

- 1 Communication**
- 2 Minimum requirements for conformity of production control procedures**
- 3 Minimum requirements for sampling by an inspector**
- 4 Photometric and colorimetric measurements**
  - 4.1 Photometric measurements of retro-reflective devices and marking materials
  - 4.2. Description of the measurement geometry for measurement of the daytime colour and the luminance factor of retro-reflective material
  - 4.3 Stability of photometric properties
- 5 Specifications of shape and dimensions**
- 6 Environmental Testing**
  - 6.1 Resistance to heat
  - 6.2 Resistance to water penetration for retro-reflective devices
  - 6.3 Alternative test procedures of resistance to water penetration for retro-reflective devices of the Classes IB and IIIB
  - 6.4 Resistance to corrosion
  - 6.5 Resistance of the accessible rear face of mirror-backed retro-reflective devices
  - 6.6 Resistance to weathering
- 7 Chemical Testing**
  - 7.1 Resistance to fuels
  - 7.2 Resistance to lubricating oils
- 8 Mechanical testing**
  - 8.1 Resistance to cleaning in the case of a sample unit of retro-reflective marking devices
  - 8.2 Bonding strength in the case of adhesive materials
  - 8.3 Flexing - Retro-reflecting Markings
  - 8.4 Resistance to impact
  - 8.5 Rigidity of plates
- 9 Further test procedure for Advance Warning Triangles of Type 1 and 2**
- 10 Arrangement of approval markings**
- 11 Guidelines for installation of rear marking plates on slow-moving vehicles (by construction) and their trailers**

# Summary of the main changes in Stage II, Step 1

- **Update of definitions - Correction of the Photometric Definitions**  
 $R_V, R_A, \beta_1, \beta_2, b_{v,R}$
- **Resistance to weathering**  
500 h xenon - retroreflection at 80% of required values
- **Arrangement of approval markings**  
Adjustment of the sizes of the approval marks  
and changes in the examples of the approval markings arrangement
- **Updated drawings of Approval Markings**  
Corrected and updated drawings
- **New arrangement of Annexes with grouped structure**  
23 Annexes re-arranged and grouped into 11 Annexes
- **Introduction of scientific notation**  
In order to assure that not more than 3 significant digits are shown for the required values