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**COMMISSION 3DECISION (EU) 2020/1339**

**of 23 September 2020**

**on the approval pursuant to Regulation (EU) 2019/631 of the European Parliament and of the Council of efficient vehicle exterior lighting using light emitting diodes as an innovative technology for reducing CO<sub>2</sub> emissions from certain light commercial vehicles in relation to the Worldwide Harmonised Light Vehicle Test Procedure**

(Text with EEA relevance)

(OJ L 313, 28.9.2020, p. 4)

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**▼B****COMMISSION IMPLEMENTING DECISION (EU) 2020/1339****of 23 September 2020**

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**(Text with EEA relevance)***Article 1***Innovative technology**

The use of efficient light emitting diodes in vehicle exterior lighting ('efficient exterior LED light') is approved as an innovative technology within the meaning of Article 11 of Regulation (EU) 2019/631 for use in light commercial vehicles powered by an internal combustion engine that are capable of running on petrol, diesel, liquefied petroleum gas (LPG), compressed natural gas (CNG) or E85, or a combination of those fuels, as well as in not-off-vehicle charging hybrid electric vehicles (NOVC-HEVs) of category N<sub>1</sub> for which uncorrected measured fuel consumption and CO<sub>2</sub> emission values may be used in accordance with paragraph 1.1.4 of Appendix 2 to Sub-Annex 8 to Annex XXI to Regulation (EU) 2017/1151 and that are capable of running on those same fuels or a combination thereof, where the innovative technology is used in one or several of the following exterior vehicle lights:

- (a) low beam headlamp (including adaptive front lighting system);
- (b) high beam headlamp;
- (c) front position lamp;
- (d) front fog lamp;
- (e) rear fog lamp;
- (f) front turn signal lamp;
- (g) rear turn signal lamp;
- (h) licence plate lamp;
- (i) reversing lamp;
- (j) cornering lamp;
- (k) static bending light lamp;
- (l) end-outline marker light;
- (m) side marker light;

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- (n) rear position lamp.

**▼B***Article 2***Application for certification of CO<sub>2</sub> savings**

1. A manufacturer may apply to a type-approval authority for certification of the CO<sub>2</sub> savings from the use of one or several efficient exterior LED lights by reference to this Decision.

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2. The manufacturer shall ensure that the application for the certification is accompanied by a verification report from an independent and certified body confirming that the conditions set out in Article 1 have been met.

3. Where the savings have been certified in accordance with Article 3, the manufacturer shall ensure that the certified CO<sub>2</sub> savings and the eco-innovation code referred to in Article 4(1) are recorded in the certificate of conformity of the vehicles concerned.

*Article 3***Certification of CO<sub>2</sub> savings**

1. The type-approval authority shall ensure that the CO<sub>2</sub> savings achieved from the use of the innovative technology have been determined using the methodology set out in the Annex.

2. Where a manufacturer applies for the certification of the CO<sub>2</sub> savings from more than one efficient exterior LED light referred to in Article 1 in relation to one vehicle version, the type approval authority shall determine which of the efficient exterior LED lights tested delivers the lowest CO<sub>2</sub> savings, and record the lowest value in the relevant type approval documentation.

3. The type approval authority shall record the certified CO<sub>2</sub> savings determined in accordance with paragraphs 1 and 2 of this Article, and the eco-innovation code referred to in Article 4(1) in the relevant type-approval documentation.

4. Where the innovative technology is fitted in a bi-fuel or flex-fuel vehicle, the approval authority shall record the CO<sub>2</sub> savings as follows:

- (a) for bi-fuel vehicles using petrol and gaseous fuels, the CO<sub>2</sub> savings with regard to LPG or CNG fuels;
- (b) for flex-fuel vehicles using petrol and E85, the CO<sub>2</sub> savings with regard to petrol.

5. The type-approval authority shall record all the elements considered for the certification in a test report and keep that together with the verification report referred to in Article 2(2), and shall make that information available to the Commission on request.

6. The type-approval authority shall only certify CO<sub>2</sub> savings, if it finds that the innovative technology complies with the conditions set out in Article 1 of this Decision, and if the CO<sub>2</sub> savings achieved are 0,5 g CO<sub>2</sub>/km or higher, as specified in Article 9(1)(b) of Implementing Regulation (EU) No 427/2014.

*Article 4***Eco-innovation code**

1. The innovative technology approved by this Decision is attributed with the eco-innovation code 35.
2. The certified CO<sub>2</sub> savings recorded by reference to the eco-innovation code referred to in paragraph 1 may be taken into account for the calculation of the average specific emissions of manufacturers starting from the calendar year 2021.

*Article 5***Entry into force**

This Decision shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.



## ANNEX

### Methodology to determine the CO<sub>2</sub> savings of Efficient Exterior LED Lights for use in certain light commercial vehicles

#### 1. INTRODUCTION

This Annex sets out the methodology to determine the carbon dioxide (CO<sub>2</sub>) emission savings to be attributed to the use of efficient vehicle exterior LED lights in one or several of the exterior vehicle lights listed in Article 1, for use in the light commercial vehicles referred to in that Article.

#### 2. TESTING CONDITIONS

In the case of NOVC-HEVs, the maximum available voltage level on board shall not exceed 60 Volt.

The testing conditions shall fulfil the requirements of UN/ECE Regulations Nos 4 <sup>(1)</sup>, 6 <sup>(2)</sup>, 7 <sup>(3)</sup>, 19 <sup>(4)</sup>, 23 <sup>(5)</sup>, 38 <sup>(6)</sup>, 48 <sup>(7)</sup>, 91 <sup>(8)</sup>, 100 <sup>(9)</sup>, 112 <sup>(10)</sup>, 119 <sup>(11)</sup> and 123 <sup>(12)</sup>. The power consumption shall be determined in accordance with point 6.1.4 of UN/ECE Regulation No 112, and points 3.2.1 and 3.2.2 of Annex 10 to that Regulation.

For the low beam adaptive front lighting system (AFS) falling within at least two of the Classes C, E, V or W as defined in Table 1 of UN/ECE Regulation No 123, the power consumption measurements shall be done at the LED intensity of each class (P<sub>k</sub>), where k corresponds to each class specified at Table 1 as defined in UN/ECE Regulation No 123.

If it is agreed with the technical service that Class C is the representative/ average LED intensity for the vehicle application, power consumption measurements shall be done in the same way as for any other exterior LED light included in the combination.

*Table 1*  
**Classes of Low beam AFS**

Class	See point 1.3 and footnote 2 of UN/ECE Regulation No 123	% LED Intensity	Activation Mode (*)
C	Base Passing Beam (Country)	100	50 km/h < speed < 100 km/h Or when no mode of another passing beam class is activated (V, W, E)
V	Town	85	Speed < 50 km/h
E	Motorway	110	Speed > 100 km/h
W	Adverse Conditions	90	Windshield wiper active > 2 minutes

(\*) Activation speeds shall be checked for each vehicle application in accordance with UN/ECE Regulation No 48 Section 6, Chapter 6.22, paragraphs 6.22.7.4.1 (class C), 6.22.7.4.2 (class V), 6.22.7.4.3 (class E), 6.22.7.4.4 (class W).

<sup>(1)</sup> OJ L 4, 7.1.2012, p. 17.

<sup>(2)</sup> OJ L 213, 18.7.2014, p. 1.

<sup>(3)</sup> OJ L 285, 30.9.2014, p. 1.

<sup>(4)</sup> OJ L 250, 22.8.2014, p. 1.

<sup>(5)</sup> OJ L 237, 8.8.2014, p. 1.

<sup>(6)</sup> OJ L 148, 12.6.2010, p. 55.

<sup>(7)</sup> OJ L 323, 6.12.2011, p. 46.

<sup>(8)</sup> OJ L 164, 30.6.2010, p. 69.

<sup>(9)</sup> OJ L 302, 28.11.2018, p. 114.

<sup>(10)</sup> OJ L 250, 22.8.2014, p. 67.

<sup>(11)</sup> OJ L 89, 25.3.2014, p. 101.

<sup>(12)</sup> OJ L 222, 24.8.2010, p. 1.

**▼ B****2.1. Test equipment**

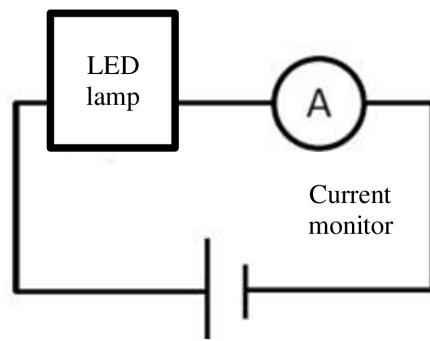
The following test equipment shall be used:

- (a) a power supply unit (i.e. variable voltage supplier);
- (b) two digital multimeters, one for measuring the DC-current, and the other for measuring the DC-voltage.

Figure 1 shows a possible test set-up, with the DC-voltage meter integrated in the power supply unit.

*Figure 1*

**Illustration of test set-up**



Variable voltage supplier

**2.2. Determination of the power savings****2.2.1. Measurement of the power consumption**

For each efficient exterior LED light included in a combination, the measurement of the current shall be performed at a voltage of 13,2 V. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.

The manufacturer may request that additional measurements of the current shall be performed at other voltages, where the necessity to do so can be demonstrated on the basis of verified documentation.

In any case the measurements (n) shall be performed for each voltage at least five times consecutively. The applied voltage and the measured current shall be recorded in four decimals.

The power consumption shall be determined by multiplying the voltage with the measured current. The average of the power consumption for each efficient exterior LED light ( $\overline{P_{EI_i}}$ ) [W] shall be calculated as set out in Formula 1 with four decimals to be taken into account in the calculations. When a stepper motor or electronic controller is used for the supply of the electricity to the LED lamps, then the electric load of this component is to be excluded from the measurement.

*Formula 1*

$$\overline{P_{EI_i}} = \frac{\sum_{j=1}^n (V_{EI_{ij}} \cdot I_{EI_{ij}})}{n}$$

where:

$V_{EI_{ij}}$  is the tested voltage of each LED vehicle light i [V]

$I_{EI_{ij}}$  is the measured current of each LED vehicle light i [A]

n is the number of measurements of the sample

j refers to an individual measurement of power consumption

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In case of low beam AFS, the power consumption ( $P_{\text{EIAFS}}$ ) [W] shall be calculated as the average of the LED power consumption for each class k, weighted according to the WLTP time share per speed range, in accordance with Formula 2.

Formula 2

$$P_{\text{EIAFS}} = \sum_{k=1}^K \text{WLTP\_share} \cdot \bar{P}_k$$

where:

$\bar{P}_k$  is the power consumption at the LED intensity for each class k as the average of n consecutive measurements [W]

K is the number of classes associated with the low beam AFS.

WLTP\_share is the WLTP time share per speed range in each class as defined in Table 2.

Table 2

**WLTP time share per speed range**

Speed range	WLTP_share
< 50 km/h	0,588
50 – 100 km/h	0,311
> 100 km/h	0,101

When the low beam AFS does not fall within all four classes specified in Table 1, the WLTP\_share of the missing classes shall be attributed to class C.

### 2.2.2. Calculation of the power savings

The power savings of each efficient exterior LED light ( $\Delta P_i$ ) [W] shall be calculated in accordance with Formula 3.

Formula 3

$$\Delta P_i = P_{B_i} - \bar{P}_{Ei_i}$$

where:

$P_{B_i}$  is the power consumption of the baseline vehicle light i [W]

$\bar{P}_{Ei_i}$  is the average power consumption of the eco-innovative vehicle light i [W].

The power consumption of the different baseline vehicle lights is defined in Table 3.

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Table 3

**Power consumption for different baseline vehicle lights**

Vehicle light	Power consumption $P_B$ [W]
Low beam headlamp	137
High beam headlamp	150
Front position	12
Licence plate	12
Front fog lamp	124
Rear fog lamp	26
Front turn signal lamp	13
Rear turn signal lamp	13
Reversing lamp	52
Cornering lamp	44
Static Bending lamp	44
End-outline marker lamp (vehicles width > 2,1 m)	12
Side marker lamp (vehicles length > 6 m)	24
Rear position lamp	12

**▼M1****▼B**3. CALCULATION OF THE CO<sub>2</sub> SAVINGS

The CO<sub>2</sub> savings shall be calculated in accordance with Formula 4.

Formula 4

$$C_{CO_2} = \left( \sum_{i=1}^m \Delta P_i \cdot UF_i \right) \cdot \frac{V_{Pe}}{\eta_A} \cdot \frac{CF}{v}$$

where:

$v$  is the mean driving speed of the WLTP, which is 46,6 km/h

$\eta_A$  is the efficiency of the alternator, which is 0,67

$UF_i$  is the usage factor of the vehicle light  $i$  as defined in Table 4

$V_{Pe}$  is the consumption of effective power for each fuel approved, as defined in Table 5

$CF$  is the fuel conversion factor as defined in Table 6.



**▼ B***Table 4***Usage factor for different vehicle lights**

Vehicle light	Usage factor (UF)
Low beam headlamp	0,33
High beam headlamp	0,03
Front position	0,36
Licence plate	0,36
Front fog lamp	0,01
Rear fog lamp	0,01
Front turn signal lamp	0,15
Rear turn signal lamp	0,15
Reversing lamp	0,01
Cornering lamp	0,019
Static Bending lamp	0,039
End-outline marker lamps (width > 2,1 m)	0,36
Side marker lamps (length > 6 m)	0,36
Rear position lamp	0,36

**▼ M1****▼ B***Table 5***Consumption of effective power**

Type of Engine	Consumption of effective power $V_{pe}$ [l/kWh]
Petrol/E85	0,264
Petrol/E85 Turbo	0,280
Diesel	0,220
LPG	0,342
LPG Turbo	0,363
	Consumption of effective power $V_{pe}$ [m <sup>3</sup> /kWh]
CNG (G20)	0,259
CNG (G20) Turbo	0,275

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*Table 6*  
**Fuel Conversion Factor**

Type of fuel	Conversion factor (CF) [g CO <sub>2</sub> /l]
Petrol/E85	2 330
Diesel	2 640
LPG	1 629
	Conversion factor (CF) [g CO <sub>2</sub> /m <sup>3</sup> ]
CNG (G20)	1 795

#### 4. CALCULATION OF THE UNCERTAINTY OF THE CO<sub>2</sub> SAVINGS

##### 4.1. General methodology

The uncertainty of the CO<sub>2</sub> savings ( $s_{\text{CO}_2}$ ) [W] shall be calculated in accordance with Formula 5 and shall not exceed 30 % of the CO<sub>2</sub> savings.

*Formula 5*

$$s_{\text{CO}_2} = \frac{V_{\text{Pe}} \cdot \text{CF}}{\eta_{\text{A}} \cdot v} \cdot \sqrt{\sum_{i=1}^m \left( \text{UF}_i \cdot s_{\overline{\text{PE}}_i} \right)^2}$$

where:

$m$  is the number of exterior LED lights in the combination tested.

$s_{\overline{\text{PE}}_i}$  is the statistical margin of the power consumption of each  $i$ -th LED light fitted in the eco-innovative vehicle which shall be calculated in accordance with Formula 6.

*Formula 6*

$$s_{\overline{\text{PE}}_i} = \sqrt{\frac{\sum_{j=1}^n \left( \text{PE}_{i,j} - \overline{\text{PE}}_i \right)^2}{n(n-1)}}$$

In case of a low beam AFS the statistical margin of the power consumption ( $s_{\overline{\text{PE}}_{\text{AFS}}}$ ) [W] shall instead be calculated in accordance with Formulas 7 and 8.

*Formula 7*

$$s_{\overline{\text{P}}_k} = \sqrt{\frac{\sum_{j=1}^n \left( \text{P}_{c,j} - \overline{\text{P}}_k \right)^2}{n(n-1)}}$$

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Formula 8

$$s_{\overline{P_{EIAFS}}} = \sqrt{\sum_{k=1}^K (WLTP\_share \cdot s_{\overline{P_k}})^2}$$

where:

n is the number of power consumption measurements, which is at least 5 as indicated in Section 2.2.1

i corresponds to each vehicle light

j refers to an individual measurement of power consumption

$\overline{P_k}$  is the average of the n values of  $P_k$

K is the number of classes associated with the low beam AFS.

#### 5. ROUNDING

The CO<sub>2</sub> savings ( $C_{CO_2}$ ) and the uncertainty of the CO<sub>2</sub> savings ( $s_{C_{CO_2}}$ ) shall be rounded to two decimal places.

Each value used in the calculation of the CO<sub>2</sub> savings shall either be applied unrounded or be rounded to the minimum number of decimal places which allows the maximum total impact (i.e. combined impact of all rounded values) on the savings to be lower than 0,25 g CO<sub>2</sub>/km.

#### 6. CHECK AGAINST THE MINIMUM CO<sub>2</sub> SAVINGS THRESHOLD

The type-approval authority shall ensure for each version of a vehicle fitted with the efficient exterior LED lights that the minimum threshold criterion as specified in Article 9(1)(b) of Implementing Regulation (EU) No 427/2014 is met.

When verifying whether the minimum threshold criterion is met, the type-approval authority shall take into account, in accordance with Formula 9, the CO<sub>2</sub> savings determined in point 3 and the uncertainty determined in point 4.

Formula 9

$$C_{CO_2} - s_{C_{CO_2}} \geq MT$$

where:

MT is the minimum threshold equal to 1 g CO<sub>2</sub>/km

$C_{CO_2}$  is the CO<sub>2</sub> savings [g CO<sub>2</sub>/km] as defined in point 3

$s_{C_{CO_2}}$  is the uncertainty of the CO<sub>2</sub> savings calculated in accordance with point 4 [g CO<sub>2</sub>/km].

**▼B**7. CERTIFICATION OF THE CO<sub>2</sub> SAVINGS

The CO<sub>2</sub> savings to be certified by the type-approval authority in accordance with Article 11 of Implementing Regulation (EU) No 427/2014 ( $CS_{CO_2}$ ) [g CO<sub>2</sub>/km] are those calculated in accordance with Formula 10.

The CO<sub>2</sub> savings shall be recorded in the type approval certificate for each vehicle version fitted with the efficient exterior LED lights.

*Formula 10*

$$CS_{CO_2} = (C_{CO_2} - s_{C_{CO_2}})$$

where:

$C_{CO_2}$  is the CO<sub>2</sub> savings as determined in point 3 [g CO<sub>2</sub>/km]

$s_{C_{CO_2}}$  is the uncertainty of the CO<sub>2</sub> savings calculated in accordance with point 4 [g CO<sub>2</sub>/km].