DECISIONS

COMMISSION IMPLEMENTING DECISION (EU) 2016/1721

of 26 September 2016

on the approval of the Toyota efficient exterior lighting using light emitting diodes for the use in non-externally chargeable hybrid electrified vehicles as an innovative technology for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emissions performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles ([1]), and in particular Article 12(4) thereof,

Whereas:

(1) The manufacturer Toyota Motor Europe NV/SA (the 'Applicant') submitted an application for the approval of the Toyota light emitting diodes (LEDs) for the use in non-externally chargeable hybrid electrified M1 vehicles (NOVC-HEVs) as an innovative technology on 9 December 2015. The completeness of that application was assessed in accordance with Article 4 of Commission Implementing Regulation (EU) No 725/2011 ([2]). The application was found to be complete and the period for the Commission's assessment of the application started on the day following the date of official receipt of the complete information, i.e. 10 December 2015.

(2) The application has been assessed in accordance with Article 12 of Regulation (EC) No 443/2009, Implementing Regulation (EU) No 725/2011 and the Technical Guidelines for the preparation of applications for the approval of innovative technologies pursuant to Regulation (EC) No 443/2009 (the Technical Guidelines, version February 2013) ([3]).

(3) The application refers to the Toyota efficient LEDs for use in NOVC-HEV in the low beam headlamp, high beam headlamp, front position lamp, front fog lamp, rear fog lamp, front turn signal lamp, rear turn signal lamp, rear fog lamp, licence plate and reversing lamps.

(4) The Commission finds that the information provided in the application demonstrates that the conditions and criteria referred to in Article 12 of Regulation (EC) No 443/2009 and in Articles 2 and 4 of Implementing Regulation (EU) No 725/2011 have been met.

(5) The Applicant has demonstrated that the use of the Toyota LEDs in the relevant lamps did not exceed 3 % of the new passenger cars registered in the reference year 2009. In support of this the Applicant has referred to the Technical Guidelines, which provides for the summary of the CLEPA LIGHT Sight Safety report.

(6) The Applicant has in accordance with the simplified approach described in the Technical Guidelines used halogen lighting as baseline technology for demonstrating the CO_2 reducing capacity of the Toyota LEDs.

([1]) OJ L 140, 5.6.2009, p. 1.
([2]) Commission Implementing Regulation (EU) No 725/2011of 25 July 2011 establishing a procedure for the approval and certification of innovative technologies for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (OJ L 194, 26.7.2011, p. 19).
([3]) https://circabc.europa.eu/w/browse/42c4a33e-6fd7-44aa-adac-f28620bd436f

(7) In order to take into account the presence in a NOVC-HEV of two power sources (i.e. the internal combustion engine and the electric powertrain) a different approach is required for the conversion of power savings to CO_2 savings compared to the methodology set out in Commission Implementing Decision (EU) 2016/587 ([1]).

(8) The Applicant has provided a specific methodology for testing the CO_2 reductions from LEDs fitted in such vehicles. The Commission considers that the testing methodology is appropriate for addressing the issue and that it will provide testing results that are verifiable, repeatable and comparable and capable of demonstrating in a realistic manner the CO_2 emissions benefits of the innovative technology with strong statistical significance in accordance with Article 6 of Implementing Regulation (EU) No 725/2011.

(9) Against that background the Commission finds that the Applicant has demonstrated satisfactorily that the emission reduction achieved by the Toyota LED lightings for the use in NOVC-HEV in appropriate combinations of a low beam headlamp, high beam headlamp, front position lamp, front fog lamp, rear fog lamp and licence plate lamp is at least 1 g CO_2/km.

(10) Since the activation of the LED lightings for the lamps listed in the application is not required for the CO_2 emissions type-approval test referred to in Regulation (EC) No 715/2007 of the European Parliament and of the Council ([2]) and Commission Regulation (EC) No 692/2008 ([3]), the Commission is satisfied that the LED lighting functions in question are not covered by the standard test cycle.

(11) The activation of the lighting functions concerned is mandatory to ensure the safe operation of the vehicle and as a consequence not dependant on the choice of the driver. On that basis the Commission finds that the manufacturer should be considered accountable for the CO_2 emission reduction due to the use of the innovative technology.

(12) The Commission finds that the verification report has been prepared by Vehicles Certification Agency which is an independent and certified body and that the report supports the findings set out in the application.

(13) Against that background, the Commission finds that no objections should be raised as regards the approval of the innovative technology in question.

(14) For the purposes of determining the general eco-innovation code to be used in the relevant type-approval documents in accordance with Annexes I, VIII and IX to Directive 2007/46/EC of the European Parliament and of the Council ([4]), the individual code to be used for the innovative technology approved through this Implementing Decision should be specified,

HAS ADOPTED THIS DECISION:

Article 1

1. The Toyota light emitting diodes (LEDs) for use in non-externally chargeable hybrid electrified M_1 vehicles (NOVC-HEV) in the low beam headlamp, high beam headlamp, front position lamp, front fog lamp, front turn signal lamp, rear turn signal lamp, rear fog lamp, licence plate lamp and reversing lamp is approved as an innovative technology within the meaning of Article 12 of Regulation (EC) No 443/2009.

([1]) Commission Implementing Decision (EU) 2016/587 of 14 April 2016 on the approval of the technology used in efficient vehicle exterior lighting using light emitting diodes as an innovative technology for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (OJ L 101, 16.4.2016, p. 17).

([2]) Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 171, 29.6.2007, p. 1).

([3]) Commission Regulation (EC) No 692/2008 of 18 July 2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 199, 28.7.2008, p. 1).

([4]) Directive 2007/46/EC of the European Parliament ad of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (Framework Directive) (OJ L 263, 9.10.2007, p. 1).

2. The CO_2 emissions reduction from the use of the Toyota LEDs in NOVC-HEV in all, or an appropriate combination of the lighting functions referred to in paragraph 1 shall be determined using the methodology set out in the Annex.

3. The individual eco-innovation code to be entered into type-approval documentation to be used for the innovative technology approved through this Implementing Decision shall be '20'.

Article 2

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

Done at Brussels, 26 September 2016.

For the Commission

The President

Jean-Claude JUNCKER

ANNEX

Methodology to determine the CO_2 savings of exterior vehicle lighting using light emitting diodes (LEDs) for the use in M_1 non-externally chargeable hybrid electrified vehicles (NOVC-HEV)

1. INTRODUCTION

In order to determine the CO_2 emission reductions that can be attributed to a package of efficient exterior LED lights consisting of an appropriate combination of vehicle lights referred to in Article 1 for the use in M_1 non-externally chargeable hybrid electrified vehicles (NOVC-HEVs), it is necessary to establish the following:

(1) Testing conditions;

(2) Test equipment;

(3) Determination of the power savings;

(4) Calculation of the CO_2 savings;

(5) Calculation of the statistical error.

2. SYMBOLS, PARAMETERS AND UNITS

Latin symbols

c — Correction factor for the nominal voltage of the High Voltage battery

C_{CO_2} — CO_2 savings [g CO_2/km]

CO_2 — Carbon dioxide

k_{CO_2} — CO_2 correction factor [gCO_2/km · Ah], as defined in Regulation UN/ECE No 101, Annex 8

m — Number of efficient exterior LED lights composing the package

n — Number of measurements of the sample

P — Power consumption of the vehicle light [W]

$S_{P_{EI}}$ — Standard deviation of the LED light power consumption [W]

$S_{\overline{P_{EI}}}$ — Standard deviation of the LED light power consumption mean [W]

$S_{C_{CO_2}}$ — Standard deviation of the total CO_2 savings [g CO_2/km]

t — Driving duration of the NEDC [s], which is 1 180 s

UF — Usage factor of the vehicle light [-] as defined in Table 2

V_{HVnom} — Nominal voltage of the High Voltage battery (traction battery) [V]

V_{HVop} — Operative voltage of the High Voltage battery (traction battery) [V]

$\frac{\partial C_{CO_2}}{\partial P_{EI}}$ — Sensitivity of calculated CO_2 savings related to the LED light power consumption

$\frac{\partial C_{CO_2}}{\partial k_{CO_2}}$ — Sensitivity of calculated CO_2 savings related to the CO_2 correction factor

Greek symbols

η_{DCDC} — Efficiency of the DC-DC converter

Subscripts

Index (i) refers to vehicle lights

Index (j) refers to measurement of the sample

B — Baseline

EI — Eco-innovative

3. TESTING CONDITIONS

The testing conditions shall fulfil the requirements of Regulation UN/ECE 112 ([1]) on Uniform provisions concerning the approval of motor vehicle headlamps emitting an asymmetrical passing beam or a driving beam or both and equipped with filament lamps and/or light-emitting diode (LED) modules. The power consumption shall be determined in accordance with point 6.1.4 of Regulation UN/ECE No 112 and points 3.2.1 and 3.2.2 of Annex 10 to that Regulation.

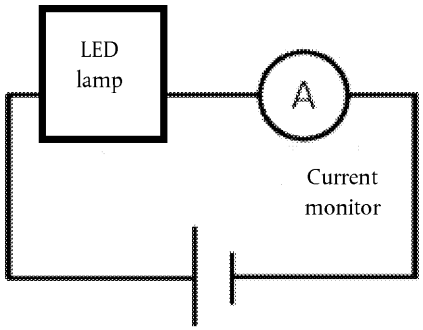
4. TEST EQUIPMENT

The following equipment is to be used, as shown in the figure:

— A power supply unit (i.e. variable voltage supplier);

— Two Digital Multi Meters, one for measuring the DC-current, and the other for measuring the DC-voltage. In the figure a possible test set-up is shown, when the DC-voltage meter is integrated in the power supply unit.

Test set-up



5. MEASUREMENTS AND DETERMINATION OF THE POWER SAVINGS

For each efficient exterior LED light included in the package the measurement of the current shall be performed as shown in the figure 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 other measurements of the current shall be done at other additional voltages. In that case, the manufacturer must hand over verified documentation on the necessity to perform these other measurements to the type-approval authority. The measurements of the currents at each of those additional voltages are to be performed consecutively at least five (5) times. The exact installed voltages and the measured current is to be recorded in four decimals.

The power consumption has to be determined by multiplying the installed voltage with the measured current. The average of the power consumption for each efficient exterior LED light ($\overline{P_{EI_i}}$) has to be calculated. Each value must be expressed in 4 decimals. 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 part is to be excluded from the measurement.

([1]) E/ECE/324/Rev.2/Add.111/Rev.3 — E/ECE/TRANS/505/Rev.2/Add.111/Rev.3, 9 January 2013

The resulting power savings of each efficient exterior LED light (ΔP_i) are to be calculated with the following formula:

Formula 1

$$\Delta P_i = P_{B_i} - \overline{P_{EI_i}}$$

where the power consumption of the corresponding baseline vehicle light is defined by Table 1.

Table 1

Power requirements for different baseline vehicle lights

Vehicle light	Total electric power (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

6. CALCULATION OF THE CO_2 SAVINGS

The total CO_2 savings of the lighting package are to be calculated by Formula 2.

Formula 2

$$C_{CO_2} = \left(\sum_{i=1}^{m} \Delta P_i \cdot UF_i \right) \cdot \frac{t \cdot k_{CO_2}}{V_{HV_{op}} \cdot \eta_{DCDC}}$$

where

UF: Usage factor of the vehicle light [-] as defined in Table 2.

t: Driving duration of the NEDC [s], which is 1 180 s

k_{CO_2}: CO_2 correction factor [$gCO_2/km \cdot Ah$], as defined in Regulation UN/ECE No 101, Annex 8

η_{DCDC}: Efficiency of the DC-DC converter [-]

V_{HVop}: Operative voltage of the High Voltage battery (traction battery) [V], defined by Formula 3

Formula 3

$$V_{HVop} = \frac{V_{HVnom}}{c}$$

where

V_{HVnom}: Nominal voltage of the High Voltage battery (traction battery) [V]

c: Correction factor for the nominal voltage of the High Voltage battery, which is 0,90 for nickel-metal hydride (NiMH) high voltage batteries [-]

The efficiency of the DC-DC converter (η_{DCDC}) shall be the highest value resulting from the efficiency tests performed in the operative electric current range. The measuring interval shall be equal or lower than 10 % of the operative electric current range.

Table 2

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

7. CALCULATION OF THE STATISTICAL ERROR

The statistical errors in the outcomes of the testing methodology caused by the measurements are to be quantified. For each efficient exterior LED light included in the package the standard deviation is calculated as defined by Formula 4.

Formula 4

$$S_{\overline{P_{EI_i}}} = \frac{S_{P_{EI_i}}}{\sqrt{n}} = \sqrt{\frac{\sum_{j=1}^{n}\left(P_{EI_{ij}} - \overline{P_{EI_i}}\right)^2}{n(n-1)}}$$

where:

n: Number of measurements of the sample, which is at least 5

The CO_2-emission correction coefficient k_{CO_2} shall be determined from a set of T measurements performed by the manufacturer, as defined in Regulation UN/ECE No 101, Annex 8. For each measurement, the electricity balance during the test and the measured CO_2-emissions shall be recorded.

In order to evaluate the statistical error of k_{CO_2}, all T combinations without repetitions of T-1 measurements has to be used to extrapolate T different values of k_{CO_2} (i.e. $k_{CO_{2_t}}$). The extrapolation shall be performed according to the method defined in Regulation UN/ECE No 101, Annex 8.

The standard deviation of k_{CO_2} ($S_{\overline{k_{CO_2}}}$) is thus calculated as defined by Formula 5.

Formula 5

$$S_{\overline{k_{CO_2}}} = \frac{S_{k_{CO_2}}}{\sqrt{T}} = \sqrt{\frac{\sum_{t=1}^{T}\left(k_{CO_{2_t}} - \overline{k_{CO_2}}\right)^2}{T(T-1)}}$$

where:

T: Number of measurements performed by the manufacturer for the extrapolation of the k_{CO_2} as defined in Regulation UN/ECE No 101, Annex 8

$\overline{k_{CO_2}}$: mean of the T values of $k_{CO_{2_t}}$

The standard deviation of the power consumption of each efficient exterior LED light ($S_{\overline{P_{El_i}}}$) and the standard deviation of the k_{CO_2} ($S_{\overline{k_{CO_2}}}$) lead to an error in the CO_2 savings ($S_{C_{CO_2}}$). This error is to be calculated by means of Formula 6.

Formula 6

$$s_{C_{CO_2}} = \sqrt{\sum_{i=1}^{m}\left(\frac{\partial C_{CO_2}}{\partial P_{El_i}} \cdot s_{\overline{P_{El_i}}}\right)^2 + \left(\frac{\partial C_{CO_2}}{\partial k_{CO_2}} \cdot s_{\overline{k_{CO_2}}}\right)^2} = \sqrt{\left(\frac{t \cdot k_{CO_2}}{V_{HV_{op}} \cdot \eta_{DCDC}}\right)^2 \cdot \sum_{i=1}^{m}\left(UF_i \cdot s_{\overline{P_{El_i}}}\right)^2 + \left(\sum_{i=1}^{m} \Delta P_i \cdot UF_i\right)^2 \cdot \left(\frac{t \cdot s_{\overline{k_{CO_2}}}}{V_{HV_{op}} \cdot \eta_{DCDC}}\right)^2}$$

Statistical significance

It has to be demonstrated for each type, variant and version of a vehicle fitted with the package of the efficient exterior LED lights that the error in the CO_2 savings calculated with Formula 6 is not greater than the difference between the total CO_2 savings and the minimum savings threshold specified in Article 9(1) of Implementing Regulation (EU) No 725/2011 (see Formula 7).

Formula 7

$$MT \leq C_{CO_2} - S_{C_{CO_2}}$$

where:

MT: Minimum threshold [gCO_2/km], which is 1 gCO_2/km

Where the total CO_2 emission savings of the package of the efficient exterior LED lights, as a result of the calculation using Formula 2, and the error in the CO_2 savings calculated with Formula 6, are below the threshold specified in Article 9(1) of Implementing Regulation (EU) No 725/2011, the second subparagraph of Article 11(2) of that Regulation shall apply.