

COMMISSION IMPLEMENTING DECISION (EU) 2022/716**of 6 May 2022****on the approval of a Smart Diesel Fuel Heater for use in conventional combustion engine and certain hybrid electric passenger cars and light commercial vehicles as an innovative technology pursuant to Regulation (EU) 2019/631 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 (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 ⁽¹⁾, and in particular Article 11(4) thereof,

Whereas:

- (1) On 7 July 2021 the manufacturer Stellantis submitted an application ('the application') for the approval as an innovative technology of a Smart Diesel Fuel Heater technology for use in passenger cars ('M₁ vehicles') and light commercial vehicles ('N₁ vehicles') with conventional internal combustion engines ('ICE') running on diesel and in not-off vehicle charging hybrid electric M₁ or N₁ vehicles (NOVC-HEVs) running on diesel for which uncorrected measured fuel consumption and CO₂ emission values may be used in accordance with paragraph 1.1.4 of Appendix 2 to Sub-annex 8 to Annex XXI to Commission Regulation (EU) 2017/1151 ⁽²⁾.
- (2) The application has been assessed in accordance with Article 11 of Regulation (EU) 2019/631, Commission Implementing Regulations (EU) No 725/2011 ⁽³⁾ and (EU) No 427/2014 ⁽⁴⁾ and the Technical Guidelines for the preparation of applications for the approval of innovative technologies pursuant to Regulation (EC) No 443/2009 and (EU) No 510/2011 (July 2018 version) ⁽⁵⁾. In accordance with Article 11(3) of Regulation (EU) 2019/631, the application was accompanied by a verification report undertaken by an independent and certified body.
- (3) For its use in vehicles, diesel fuel needs to be filtered in order to ensure a high-quality combustion process and proper vehicle operability. For diesel fuels, there is an intrinsic specific low temperature at which the heaviest paraffins they contain start to precipitate and form wax crystals, which in turn clog the filtration elements within the fuel system, leading to non-startability of the engine, misfire or loss of engine power while driving. Therefore, diesel vehicles are equipped with a fuel heater that is activated at low temperatures and prevents this clogging process.

⁽¹⁾ OJ L 111, 25.4.2019, p. 13.

⁽²⁾ Commission Regulation (EU) 2017/1151 of 1 June 2017 supplementing 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, amending Directive 2007/46/EC of the European Parliament and of the Council, Commission Regulation (EC) No 692/2008 and Commission Regulation (EU) No 1230/2012 and repealing Commission Regulation (EC) No 692/2008 (OJ L 175, 7.7.2017, p. 1).

⁽³⁾ Commission Implementing Regulation (EU) No 725/2011 of 25 July 2011 establishing a procedure for the approval and certification of innovative technologies for reducing CO₂ 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).

⁽⁴⁾ Commission Implementing Regulation (EU) No 427/2014 of 25 April 2014 establishing a procedure for the approval and certification of innovative technologies for reducing CO₂ emissions from light commercial vehicles pursuant to Regulation (EU) No 510/2011 of the European Parliament and of the Council (OJ L 125, 26.4.2014, p. 57).

⁽⁵⁾ <https://circabc.europa.eu/sd/a/a19b42c8-8e87-4b24-a78b-9b70760f82a9/july%202018%20Technical%20Guidelines.pdf>

- (4) It has been demonstrated by the applicant that the market penetration of the eco-innovative technology did not exceed 3 % in the year 2019, which is a later date than the reference year provided for in Article 2(2)(a) of Implementing Regulations (EU) No 725/2011 and (EU) No 427/2014. The criterion of innovativeness is therefore fulfilled.
- (5) It has been confirmed that the benefits of the technology are not covered by the CO₂ type approval Type I test, since the Smart Diesel Fuel Heater is not activated at the temperature at which that test is performed.
- (6) The baseline technology against which the CO₂ savings from the Smart Diesel Fuel Heater should be assessed, is a conventional diesel fuel heater integrated in the filter assembly that turns on below +5 °C fuel temperature and turns off again above +8 °C fuel temperature, based on the signal coming from the temperature sensor inside the diesel filter assembly. The activation of that baseline diesel fuel heater is controlled only by a temperature threshold. The Smart Diesel Fuel Heater is activated based on the paraffin load situation of the filter cartridge, which is monitored by a filter pressure sensor in addition to the temperature sensor. This reduces the time during which the fuel heater is activated, thus providing a reduction in energy use and CO₂ emissions.
- (7) The applicant has provided a methodology for determining the CO₂ savings from the Smart Diesel Fuel Heater. In order to determine the power consumption of the baseline and eco-innovative technologies, a vehicle equipped with the eco-innovative technology is to be tested under the Worldwide Harmonised Light vehicle Test Cycle (WLTC) boundary conditions set out in Regulation (EU) 2017/1151, at – 20 °C and using a diesel arctic fuel. The vehicle is to be equipped with an open electronic control unit (ECU), which allows a read-out of the signals that would deactivate the fuel heater. A usage factor, reflecting the mean share of the innovative technology usage under real world conditions, has been determined, taking into account amongst others fuel quality, ambient temperature, technical component characteristics, traffic counting data and vehicle sales shares across the Member States.
- (8) Taking into account the above considerations, the testing methodology should be considered appropriate for determining the CO₂ savings from the innovative technology in question. By applying that testing methodology, the applicant has also demonstrated that the minimum CO₂ savings threshold of 0,5 g CO₂/km is verifiably exceeded and statistically significant.
- (9) Manufacturers should have the possibility to apply to a type-approval authority for the certification of CO₂ savings from the use of the innovative technology where the conditions laid down in this Decision are met. Manufacturers should for that purpose ensure that the application for certification is accompanied by a verification report from an independent and certified body confirming that the innovative technology complies with the conditions laid down in this Decision and that the savings have been determined in accordance with the testing methodology referred to in this Decision.
- (10) It is the responsibility of the type-approval authority to verify thoroughly that the conditions for certifying the CO₂ savings from the use of an innovative technology as specified in this Decision are met. Where the certification is issued, the responsible type-approval authority should ensure that all elements considered for the certification are recorded in a test report and kept together with the verification report and that this information is made available to the Commission on request.
- (11) For the purpose 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 Regulation (EU) 2018/858 of the European Parliament and of the Council ⁽⁶⁾, it is necessary to attribute an individual code to the innovative technology,

⁽⁶⁾ Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC (OJ L 151, 14.6.2018, p. 1).

HAS ADOPTED THIS DECISION:

Article 1

Innovative technology

The Smart Diesel Fuel Heater is approved as an innovative technology within the meaning of Article 11 of Regulation (EU) 2019/631, provided that it conforms to the following:

- (a) it is fitted in M₁ or N₁ internal combustion engine vehicles running on diesel or in not-off-vehicle charging hybrid electric vehicles of category M₁ or N₁ running on diesel and for which uncorrected measured fuel consumption and CO₂ emission values may be used in accordance with paragraph 1.1.4 of Appendix 2, Sub-annex 8 to Annex XXI to Regulation (EU) 2017/1151;
- (b) it activates itself at the earliest at the fuel specific cloud point temperature, when required to prevent clogging of filtration elements within the fuel system, by taking into account both a temperature threshold and the paraffin load of the filter cartridge.

Article 2

Application for certification of CO₂ savings

1. A manufacturer may apply to a type-approval authority for certification of the CO₂ savings from the use of the innovative technology referred to in Article 1 by reference to this Decision.
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 technology conforms to points (a) and (b) of Article 1.
3. Where CO₂ savings have been certified in accordance with Article 3, the manufacturer shall ensure that the certified CO₂ savings and the eco-innovation code referred to in Article 4 are recorded in the certificate of conformity of the vehicles concerned.

Article 3

Certification of CO₂ savings

1. The type-approval authority shall ensure that CO₂ savings achieved from the use of the innovative technology have been determined using the methodology set out in the Annex.
2. The type approval authority shall record the certified CO₂ savings calculated in accordance with point 7 of the Annex, and the eco-innovation code referred to in Article 4 in the relevant type-approval documentation.
3. 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.
4. The type-approval authority shall only certify CO₂ savings from the use of the innovative technology if it finds that the technology conforms with points (a) and (b) of Article 1, and if the CO₂ savings determined in accordance with point 7 of the Annex are 0,5 g CO₂/km or higher, as specified in Article 9(1)(b) of Implementing Regulation (EU) No 725/2011 in the case of M₁ vehicles, or in Article 9(1)(b) of Implementing Regulation (EU) No 427/2014 in the case of N₁ vehicles.

Article 4

Eco-innovation code

The innovative technology approved by this Decision is attributed with the eco-innovation code 37.

*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*.

Done at Brussels, 6 May 2022.

For the Commission
The President
Ursula VON DER LEYEN

ANNEX

METHODOLOGY TO DETERMINE THE CO₂ SAVINGS OF THE SMART DIESEL FUEL HEATER**1. INTRODUCTION**

This Annex sets out the methodology to determine the CO₂ emission savings to be attributed to the use of a Smart Diesel Fuel Heater in a vehicle fulfilling the conditions specified in Article 1.

In order to determine these savings, the following elements shall be determined:

- (1) the baseline technology power consumption;
- (2) the innovative technology power consumption;
- (3) the CO₂ savings;
- (4) the uncertainty of the CO₂ savings.

2. METHODOLOGY

The operation of the innovative technology is intended to be controlled by the vehicle electronic control unit (ECU) based on a temperature and pressure signal coming from the fuel filter.

The baseline fuel heater is controlled by the vehicle ECU based on a temperature signal only.

In order to simultaneously determine the power consumption of the baseline and eco-innovative technologies, a vehicle equipped with the innovative technology shall be tested as described in points 2.1 and 2.2 below. Diesel arctic fuel belonging to class 2 to class 4 of the EN 590 classification shall be used for those measurements.

2.1. Determination of P_{base} (power consumption of the baseline technology)

In order to determine the baseline heater power consumption, the diesel fuel heater shall be put into activated state during the entire power consumption test as specified in points (1) to (9) below, and its operation shall not be affected by the filter pressure sensor.

The tool to be used for the read-out of the ECU, as well as the most suitable software to be used for the identification of the pressure threshold calibration label, shall be agreed upon between the manufacturer and the type-approval authority.

The type-approval authority or its designated technical service shall ensure that the power consumption test consists of the following steps:

- (1) a calibration read-out of the production ECU installed on the eco-innovative vehicle;
- (2) the installation on the vehicle of an open ECU that enables to set the threshold for the heater filter pressure sensor;
- (3) a calibration read-out of the open ECU;
- (4) identification, using appropriate software, of the pressure threshold calibration label as specified by the manufacturer;
- (5) setting of the heater pressure threshold to 0 kPa to ensure that the fuel heater is activated during the entire test;
- (6) verification and confirmation, that the only difference between the production and the open ECUs settings is the diesel fuel heater pressure threshold calibration;
- (7) cool down the vehicle, filled to at least 50 % fuel tank volume, until the climatic chamber and fuel temperature are stabilized at – 20 °C;
- (8) at least 30 seconds prior to starting to drive the WLTC, check that the heater is in activated state and start measuring and recording the battery voltage and diesel fuel heater current with an acquisition frequency of at least 100 Hz in order to document the pre-WLTC vehicle status;
- (9) drive a complete WLTC, with the climatic chamber and fuel temperature stabilized at – 20 °C.

Steps (7) to (9) shall be repeated at least five times.

Before starting the first WLTC drive, the manufacturer shall provide to the type-approval authority the operating voltage (U_{PS}) and current intensity (I_{PS}) of the pressure sensor of the smart diesel fuel heater, based on its electrical property data or measurement data provided by the supplier of the sensor.

For each WLTC drive completed, the energy consumed by the diesel fuel heater over the cycle (W_{base_i}) and the corresponding power consumption of the baseline diesel fuel heater (P_{base_i}) shall be calculated in accordance with Formula 1 and Formula 2, respectively:

Formula 1

$$W_{base_i} = \int_{t_s}^{t_e} U_{base}(t) \cdot I_{base}(t) dt$$

Formula 2

$$P_{base_i} = \frac{W_{base_i}}{t_e - t_s} \cdot 3600 - (U_{PS} \cdot I_{PS})$$

Where:

W_{base_i} :	Energy consumption of the diesel fuel heater during the i-th WLTC drive [Wh]
$U_{base}(t)$:	Battery voltage measured at time t [V]
$I_{base}(t)$:	Diesel fuel heater current intensity measured at time t [A]
t_s :	Starting point in time of WLTC drive, counted from the start of the voltage and current measurements [s]
t_e :	End point in time of WLTC drive, counted from the start of the voltage and current measurements [s]
P_{base_i} :	Power consumption of the baseline diesel fuel heater during the i-th WLTC drive [W]
U_{PS} :	Pressure sensor supply voltage [V]
I_{PS} :	Pressure sensor supply current intensity [A]

The arithmetic mean of the baseline diesel fuel heater power consumption ($\overline{P_{base}}$) over all complete WLTC drives performed shall be calculated in accordance with Formula 3.

Formula 3

$$\overline{P_{base}} = \frac{\sum_{i=1}^n P_{base_i}}{n}$$

2.2. Determination of P_{eco} (power consumption of the innovative technology)

Before starting the WLTC drive as set out in the steps (8) and (9) in point 2.1, the manufacturer shall provide to the type-approval authority the heater filter pressure signal(s) to the ECU that would trigger the deactivation of the smart diesel fuel heater during the WLTC test.

Using that ECU signal, for each WLTC drive performed as set out in points (8) and (9) of point 2.1, the type-approval authority or its designated technical service shall determine the earliest time X [s] after which the smart diesel fuel heater would be deactivated.

The power consumption of the innovative technology [P_{eco}] shall be determined in accordance with Formula 4:

Formula 4

$$P_{eco} = \frac{\bar{X}}{1800} \cdot \overline{P_{base}} + (U_{PS} \cdot I_{PS})$$

Where:

P_{eco} : Power consumption of the innovative technology [W]

$\overline{P_{base}}$: Arithmetic mean of the baseline technology power consumption as determined under point 2.1 [W]

\bar{X} : Average value, across all WLTC drives performed, of the earliest time after the start of the WLTC drive when the smart diesel fuel heater would be deactivated [s]

U_{PS} : Pressure sensor supply voltage [V]

I_{PS} : Pressure sensor supply current intensity [A]

In case the diesel fuel heater is turned off by default at the start of each WLTC drive, the value \bar{X} will be zero and Formula 4 becomes $P_{eco} = U_{PS} \cdot I_{PS}$

3. CALCULATION OF THE CO₂ SAVINGS

The CO₂ savings of the innovative technology shall be calculated in accordance with Formula 5:

Formula 5

$$C_{CO_2} = (\overline{P_{base}} - P_{eco}) \cdot \frac{V_{PeD} \cdot CF_D}{\eta_A \cdot v} \cdot UF$$

Where:

CF_D : Conversion factor, which is 2 640 for diesel [gCO₂/l]

$\overline{P_{base}}$: Power consumption of the baseline technology as determined in point 2.1 [W]

P_{eco} : Power consumption of the innovative technology as determined in point 2.2 [W]

UF: Usage Factor, which is 0,2

v: Mean driving speed of the WLTC, which is 46,5 [km/h]

V_{PeD} : Consumption of effective power, which is 0,220 for diesel [l/kWh]

η_A : Efficiency of the alternator, which is 0,67 ⁽¹⁾

4. CALCULATION OF THE UNCERTAINTY OF THE CO₂ SAVINGS

The uncertainty of the CO₂ savings shall be determined as follows.

The standard deviation of the baseline technology power consumption ($S_{\overline{P_{base}}}$) shall be calculated in accordance with Formula 6:

⁽¹⁾ In case an efficient 12V alternator, 12V motor-generator or 48V motor-generator plus 48V/12V DC/DC converter is applied, which has been approved as an eco-innovation in accordance with Commission Implementing Decision (EU) 2020/174, (EU) 2020/1232, (EU) 2020/1167 or (EU) 2021/488, the type-approval authority shall use the alternator efficiency determined in accordance with that Decision.

Formula 6

$$S_{\overline{P_{base}}} = \frac{\sqrt{\sum_{i=1}^n (P_{base_i} - \overline{P_{base}})^2}}{n(n-1)}$$

Where:

- $\overline{P_{base}}$: Power consumption of the baseline technology as determined in point 2.1 [W]
 P_{base_i} : Power consumption of the baseline technology during the i-th WLTC drive as determined in point 2.1 [W]
 $S_{\overline{P_{base}}}$: Standard deviation of the power consumption of the baseline technology [W]
 n: number of WLTC drives performed for determining the power consumption of the baseline technology [-]

The uncertainty of the CO₂ savings (S_{CO_2}) is then calculated in accordance with Formula 7. This uncertainty shall not exceed 30 % of the CO₂ savings.

Formula 7

$$S_{CO_2} = \frac{V_{Pe_D} \cdot CF_D}{\eta_A \cdot v} \cdot UF \cdot S_{\overline{P_{base}}}$$

Where:

- CF_D : Conversion factor, which is 2 640 [g CO₂/l]
 S_{CO_2} : Uncertainty of the CO₂ savings [g CO₂/km]
 $S_{\overline{P_{base}}}$: Standard deviation of the power consumption of the baseline technology as determined in accordance with Formula 6 [W]
 UF: Usage Factor, which is 0,2
 v: Mean driving speed of the WLTC [km/h], which is 46,5 km/h
 V_{Pe_D} : Consumption of effective power which is 0,220 for diesel [l/kWh]
 η_A : Efficiency of the alternator, which is 0,67 ⁽²⁾

5. ROUNDING

The CO₂ savings (C_{CO_2}) calculated in accordance with Formula 5 and the uncertainty of CO₂ savings (S_{CO_2}) calculated in accordance with Formula 7 shall be rounded to a maximum of two decimal places.

Each value used in the calculation of the CO₂ savings can be applied unrounded or must 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 gCO₂/km.

⁽²⁾ In case an efficient 12V alternator, 12V motor-generator or 48V motor-generator plus 48V/12V DC/DC converter is applied, which has been approved as an eco-innovation in accordance with Commission Implementing Decision (EU) 2020/174, (EU) 2020/1232, (EU) 2020/1167 or (EU) 2021/488, the type-approval authority shall use the efficiency determined in accordance with that Decision.

6. CHECK AGAINST THE MINIMUM CO₂ SAVINGS THRESHOLD

The type-approval authority shall ensure for each vehicle version fitted with the innovative technology that the minimum threshold criterion as specified in Article 9(1)(b) of Implementing Regulation (EU) No 725/2011 and 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 8, the CO₂ savings as determined in point 3 and the uncertainty as determined in point 4 .

Formula 8

$$(C_{\text{CO}_2} - s_{\text{CO}_2}) \geq \text{MT}$$

Where:

C_{CO_2} : is the CO₂ savings as determined in point 3 (Formula 5) [g CO₂/km]

MT: is 0,5 g CO₂/km as specified in Article 9(1)(b) of Implementing Regulation (EU) No 725/2011 and Commission Implementing Regulation (EU) No 427/2014

s_{CO_2} : is the uncertainty of the CO₂ savings as determined in point 4 (Formula 7) [g CO₂/km].

7. CERTIFICATION OF THE CO₂ SAVINGS

The CO₂ savings to be certified by the type-approval authority in accordance with Article 11 of Implementing Regulation (EU) No 725/2011 and Implementing Regulation (EU) No 427/2014 (CS_{CO_2} [g CO₂/km]) are those calculated in accordance with Formula 9.

The CO₂ savings shall be recorded in the type approval certificate for each vehicle version fitted with the Smart Diesel Fuel Heater.

Formula 9

$$CS_{\text{CO}_2} = C_{\text{CO}_2} - s_{\text{CO}_2}$$

Where:

CS_{CO_2} : is the CO₂ savings to be certified by the type-approval authority [g CO₂/km]

C_{CO_2} : is the CO₂ savings as determined in point 3 (Formula 5) [g CO₂/km]

s_{CO_2} : is the uncertainty of the CO₂ savings as determined in point 4 (Formula 7) [g CO₂/km]