Commission Implementing Decision (EU) 2018/2079 of 19 December 2018 on the approval of the engine idle coasting function as an innovative technology for reducing CO2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (Text with EEA relevance)

COMMISSION IMPLEMENTING DECISION (EU) 2018/2079

of 19 December 2018

on the approval of the engine idle coasting function 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 emission 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 manufacturers Audi AG, BMW AG, FCA Italy S.p.A., Ford Motor Company, Hyundai Motor Europe Technical Center GmbH, JLR Jaguar Land Rover LTD, Opel Automobile GmbH, PSA Peugeot Citroën, Groupe Renault, Robert Bosch GmbH, Toyota Motor Europe NV/SA, Volvo Cars Corporation and Volkswagen AG (the ‘applicants’) submitted a joint application for the approval of an engine idle coasting function as an eco-innovation on 21 March 2018.

(2) The application has been assessed in accordance with Article 12 of Regulation (EC) No 443/2009 and Commission Implementing Regulation (EU) No 725/2011[(2)].

(3) The application refers to the engine idle coasting function to be used in vehicles of category M_1 with a conventional powertrain (non-hybrid thermal engine). The basic principle of that innovative technology is to decouple the combustion engine from the drivetrain and prevent deceleration caused by engine braking. The function should be automatically activated in the predominant driving mode, which is the mode automatically selected when the vehicle is switched on. Thus coasting can be used to increase the rolling distance of the vehicle in situations where no propulsion or a slow reduction of speed is needed. When ‘coasting’, the kinetic and potential energy of the vehicle is directly used to overcome driving resistance and, as consequence, to decrease fuel consumption. To obtain less deceleration the engine is decoupled from the drivetrain by opening a clutch. This is done automatically by the control unit of the automatic transmission or by means of an automated clutch in case of a manual gearbox. During the coasting phases the engine is running at idle speed.

(4) By Implementing Decisions (EU) 2015/1132[(3)] and (EU) 2017/1402[(4)], the Commission approved applications by, respectively, Porsche AG concerning a coasting function intended for use exclusively in Porsche S-segment vehicles of category M_1 (sport coupé) and by BMW AG concerning an engine idle coasting function intended for use exclusively in BMW vehicles of category M_1 with a conventional powertrain and automatic transmission. The engine idle coasting function which is the subject of the current applications is intended for use in any vehicle of category M_1 with a conventional powertrain and an automatic or manual transmission.

(5) The applicants have provided a methodology for testing the CO_2 reductions from the use of the engine idle coasting function, which includes a modified NEDC test cycle to offer the possibility for the vehicle to coast. In order to determine the CO_2 savings achieved, the vehicle fitted with the engine idle coasting function should be compared with a baseline vehicle where the coasting function is not installed, not available in the predominant driving mode or disabled for testing purposes. In order to achieve a robust comparison the baseline vehicle should be tested on the standard NEDC under hot start conditions, while the modified conditions applicable for the vehicle equipped with the eco-innovation should be taken into account by a conversion factor being applied for the calculation of the CO_2 savings. It is considered appropriate to maintain the conversion factor at the value of 0,960 in line with the conversion factor set out in Implementing Decisions (EU) 2015/1132 and (EU) 2017/1402.

(6) A key element in determining the CO_2 savings is the proportion of the distance travelled by the vehicle over which the coasting function is activated, taking into account that the coasting function may be deactivated in other driving modes than the predominant driving mode. In order to take into account the diversity of the vehicles on the market, it is considered appropriate to establish a usage factor that is representative of the rate of activation of the technology for a wide range of vehicles in real world conditions. Based on data provided by the applicants, it is clear that the activation of the engine idle coasting technology is dependent of certain speed limits that may vary between different vehicles. Based on the database provided, it is appropriate to consider the coasting function to be active at speeds above 15 km/h.

(7) The information provided in the application demonstrates that the criteria referred to in Article 12 of Regulation (EC) No 443/2009 and the conditions referred to in Articles 2 and 4 of Implementing Regulation (EU) No 725/2011 have been met for a range of vehicles of category M_1 with a conventional powertrain equipped with automatic or manual transmissions. Moreover, the application is supported by verification reports established by independent and certified bodies in accordance with Article 7 of Implementing Regulation (EU) No 725/2011.

(8) Based on the information provided with the current joint application, and taking into account the experience gained from the assessment of the application on the approval of the Porsche AG coasting function in the framework of Implementing Decision (EU) 2015/1132, from the assessment of the application on the approval of the BMW AG engine idle coasting function in the framework of Implementing Decision (EU) 2017/1402, and from an internal study evaluating the relative coasting

distance, usage factors and CO_2 savings for the coasting technology[(5)], it has been satisfactorily demonstrated that the engine idle coasting function meets the criteria referred to in Article 12 of Regulation (EC) No 443/2009 and that it can provide a reduction in CO_2 emissions of at least 1 g CO_2/km in accordance with Article 9 of Implementing Regulation (EU) No 725/2011 for vehicles of category M_1 with a conventional powertrain. It is therefore for the type approval authority to verify that the 1 gCO_2/km threshold referred to in Article 9 of Implementing Regulation (EU) No 725/2011 is met and to certify the actual CO_2 savings for vehicle versions of category M_1 fitted with the engine idle coasting function.

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

(10) Any manufacturer should, in order to have the CO_2 savings from the engine idle coasting function certified, provide a verification report from an independent and certified body confirming the compliance of the fitted vehicle with the conditions specified in this Decision together with the application for certification to the type approval authority.

(11) If the type approval authority finds that the engine idle coasting function does not satisfy the conditions for certification, the application for certification of the savings should be rejected.

(12) This Decision should apply in relation to the test procedure referred to in Annex XII to Commission Regulation (EC) No 692/2008[(6)]. With effect from 1 January 2021, innovative technologies are to be assessed in relation to the test procedure laid down in Commission Implementing Regulation (EU) 2017/1151[(7)]. This decision shall apply for the calculation of the average specific emissions of a manufacturer until and including the 2020 calendar year.

(13) 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[(8)], the individual code to be used for the innovative technology should be specified,

HAS ADOPTED THIS DECISION:

Article 1

Approval

The engine idle coasting function is approved as an innovative technology within the meaning of Article 12 of Regulation (EC) No 443/2009 provided the following conditions are met:

(a) the innovative technology is fitted in conventional powertrain vehicles of category M_1 with an automatic transmission or a manual gearbox with an automated clutch;

(b) the engine idle coasting function is automatically activated in the driving mode that is always selected when the vehicle is switched on regardless of the operating mode selected when the vehicle was previously shut down ('predominant driving mode');

(c) the engine idle coasting function may not be deactivated in the predominant driving mode by the driver or by external interventions;

(d) the engine idle coasting function is active at least down to 15 km/h;

(e) for vehicles with the capacity to coast down to a speed lower than 15 km/h, the engine idle coasting function must be de-activated at 15 km/h for the purpose of the test set out in the Annex.

Article 2

Application for certification of CO_2 savings

Any manufacturer may in accordance with Article 11 of Implementing Regulation (EU) No 725/2011 apply to an approval authority for certification of the CO_2 savings from the engine idle coasting function by reference to this Decision.

The application for certification shall be accompanied by a verification report from an independent and certified body confirming the compliance of the fitted vehicle with the conditions set out in Article 1 and that the CO_2 savings threshold of 1 gCO_2/km specified in Article 9 of Implementing Regulation (EU) No 725/2011 is met.

Article 3

Certification of CO_2 savings

The reduction in CO_2 emissions from the use of the engine idle coasting function referred to in Article 1 shall be determined using the methodology set out in the Annex. The approval authority shall verify the reduction achieved, inter alia, by using the verification report referred to in Article 2 and shall certify that reduction level, provided that the threshold specified in Article 9 of Implementing Regulation (EU) No 725/2011 is met.

That reduction shall be taken into account for the calculation of the average specific emissions of a manufacturer until and including the 2020 calendar year.

Article 4

Eco-innovation code

The eco-innovation code No 25 shall be entered into the type approval documentation where reference is made to this Decision in accordance with Article 11(1) of Implementing Regulation (EU) No 725/2011.

Article 5

Applicability

This Decision shall apply until 31 December 2020.

Article 6

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, 19 December 2018.

For the Commission

The President

Jean-Claude JUNCKER

ANNEX

METHODOLOGY TO DETERMINE THE CO_2 SAVINGS OF THE USE OF THE ENGINE IDLE COASTING FUNCTION

1. INTRODUCTION

To determine the CO_2 savings that can be attributed to the use of the Engine Idle Coasting Function, it is necessary to specify the following:

(1) The test vehicles;

(2) The procedure to precondition the vehicle;

(3) The procedure to perform the dynamometer road load determination;

(4) The procedure to define the modified testing conditions;

(5) The procedure to determine the CO_2 emissions of the eco-innovative vehicle under modified testing conditions;

(6) The procedure to determine the CO_2 emissions of the baseline vehicle under Type 1 hot start conditions;

(7) The calculation of the CO_2 savings;

(8) The calculation of the uncertainty of the CO_2 savings.

2. SYMBOLS, PARAMETERS AND UNITS

Latin symbols

C_{CO_2} — CO_2 savings [g CO_2/km]
CO_2 — Carbon dioxide
c — Conversion parameter
B_{MC} — Arithmetic mean of the CO_2 emissions of the baseline vehicle under modified testing conditions [gCO_2/km]
E_{MC} — Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under modified testing conditions [gCO_2/km]
$B_{TA_{hot}}$ — Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval (NEDC) hot start conditions [gCO_2/km]
B_{TA} — Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval (NEDC) testing conditions [gCO_2/km]
E_{TA} — Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under type approval (NEDC) testing conditions [gCO_2/km]
RCD_{RW} — Relative coasting distance under real world conditions [%]
RCD_{mNEDC} — Relative coasting distance under modified testing conditions [%]
UF — Usage factor of the coasting technology
$s_{C_{CO_2}}$ — Statistical margin of the total CO_2 saving [g CO_2/km]
$s_{B_{TA_{hot}}}$ — Standard deviation of the arithmetic mean of the CO_2 emission of the baseline vehicle under type approval (NEDC) hot start conditions [gCO_2/km]
$s_{E_{MC}}$ — Standard deviation of the arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km]
s_{UF} — Standard deviation of the arithmetic mean of the usage factor

Subscripts

RW — Real-world conditions
TA — Type approval (NEDC) conditions
B — Baseline

3. TEST VEHICLES

The test vehicles shall fulfil the following requirements:

(a) Baseline vehicle: a vehicle with the innovative technology deactivated or not installed. For that vehicle, it shall be verified that the coasting function is not activated during the NEDC test (i.e. the test run to obtain

$$B_{MC} \left(= B_{TA_{hot}}\right)$$

);

(b) Eco-innovative vehicle: a vehicle with the innovative technology installed and active in default or predominant mode. The predominant driving mode is the driving mode that is always selected when the vehicle is switched on regardless of the operating mode selected when the vehicle was previously shut down. Engine-on coasting function may not be deactivated by the driver in the predominant driving mode;

4. VEHICLES PRECONDITIONING

In order to reach the hot testing conditions of the powertrain, one or more complete preconditioning NEDC or mNEDC driving cycles shall be performed.

5. ROAD LOAD DETERMINATION

The dynamometer road load determination shall be carried out on a chassis dynamometer as follows:

— Preconditioning the vehicle according to point 4;
— Performing the dynamometer road load determination, according to the procedures defined in the UN/ECE Regulation No 83 Annex 4a — Appendix 7.

6. DEFINITION OF THE MODIFIED TESTING CONDITIONS

6.1. **Definition of the Coast Down Curve**

The determination of the coast down curve in coasting mode shall be carried out on a chassis dynamometer and following these two compulsory steps:

— Bringing the vehicle to operating temperature using the preconditioning procedure;
— Executing a coast down in coasting mode from 125 km/h to either a standstill or to the lowest possible coasting speed.

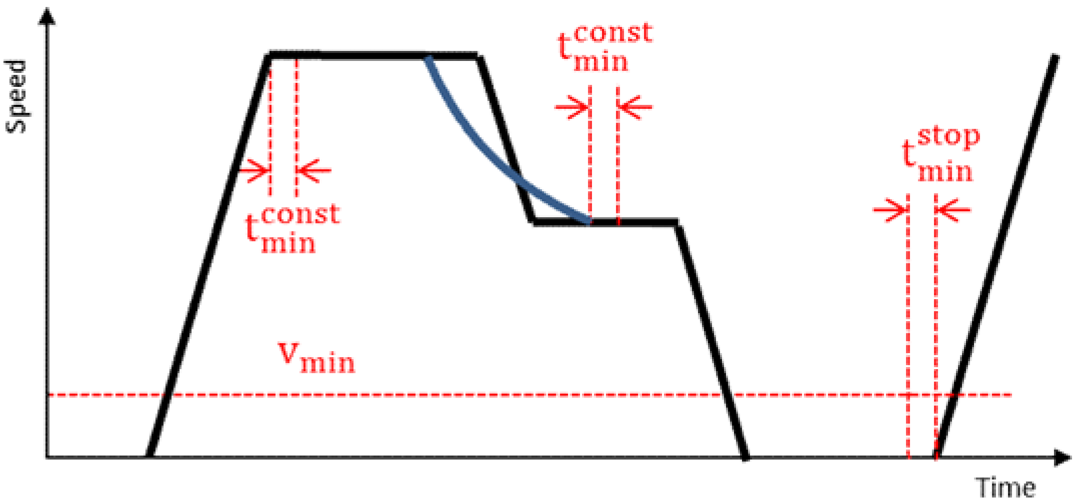
6.2. **Generation of the modified NEDC Speed Profile (mNEDC)**

The speed profile of the mNEDC shall be generated according to the following rules:

— The test sequence is composed of an urban cycle made of four elementary urban cycles and an extra-urban cycle;
— All acceleration ramps are identical to the NEDC-profile;
— All constant speed levels are identical to the NEDC-profile;
— The deceleration values when coasting function is deactivated are equal to the ones within the NEDC-profile;
— The speed and time tolerances shall be in accordance with paragraph 1.4 of Annex 7 to UN/ECE Regulation No 101.

— The deviation from the NEDC profile shall be minimised and the overall distance must comply with the NEDC specified tolerances;
— The distance at the end of each deceleration phase of the mNEDC-profile shall be equal to the distances at the end of each deceleration phase of the NEDC-profile;
— For all phases of acceleration, constant velocity and deceleration, standard NEDC tolerances shall be applied.
— During coasting phases the ICE is decoupled and no active correction of the vehicles velocity trajectory is permitted.
— Lower speed limit for coasting v_{min}: The coasting mode has to be disabled at the lower speed limit (15 km/h) for coasting by pressing the brake pedal.
— Minimal stop time: The minimum time after every coasting deceleration to a standstill or constant speed phase is 2 seconds (t_{stop}^{min} in Figure 1).
— Minimum duration for constant speed phases: The minimum duration for constant speed phases after acceleration or coasting deceleration shall be at least 2 seconds (t_{const}^{min} in Figure 1).
— During the deceleration phases, the coasting mode can be enabled if the speed is below v_{max}, v_{max} being the maximum speed of the test cycle.
— The coasting mode may be disabled for speeds higher than v_{min}.

Figure 1 **Illustration of parameters used to generate mNEDC**



Shift profile generation for vehicles with manual gearbox

For vehicles equipped with manual gearboxes, the gearshift table shall be adapted using the following assumptions:

1. The gearshift selection during vehicle acceleration remains as defined for the NEDC
2. the timing for the downshifts of the modified NEDC differ from the one of the NEDC in order to avoid downshifts during coasting phases (e.g. anticipated before deceleration phases)

The pre-defined shift points for the ECE portion of the NEDC cycle are modified as described in the following table:

Operation	Phase	Acceleration (m/s2)	Speed (km/h)	Duration of each Operation (s)	Duration of each Phase (s)	Cumulative time (s)	Gear to be used in the case of a manual gearbox
Idling	1	0	0	11	11	11	6 s PM + 5s K_1[1]
Acceleration	2	1.04	0-15	4	4	15	1
Steady speed	3	0	15	9	8	23	1
Deceleration	4	-0.69	15-10	2	5	25	1
Deceleration, clutch disengaged		-0.92	10-0	3		28	K_1[1]
Idling	5	0	0	21	21	49	16 s PM + 5s K_1[1]
Acceleration	6	0.83	0-15	5	12	54	1
Gear change			15	2		56	
Acceleration		0.94	15-32	5		61	2
Steady speed	7	0	32	t_{const1}	t_{const1}	$61+t_{const1}$	2
Deceleration	8	coastdown	$[32-dv_1]$	Δt_{cd1}	$\Delta t_{cd1}+8-\Delta t_1+3$	$61+t_{const1}+\Delta t_{cd1}$	2
Deceleration		-0.75	$[32-dv_1]-10$	$8-\Delta t_1$		$69+t_{const1}+\Delta t_{cd1}-\Delta t_1$	2
Deceleration, clutch disengaged		-0.92	10-0	3		$72+t_{const1}+\Delta t_{cd1}-\Delta t_1$	K_2[1]
Idling	9	0	0	$21-\Delta t_1$		117	16 s - Δt_1 PM + 5s K_1[1]
Acceleration	10	0.83	0-15	5	26	122	1
Gear change			15	2		124	
Acceleration		0.62	15-35	9		133	2
Gear change			35	2		135	
Acceleration		0.52	35-50	8		143	3
Steady speed	11	0	50	t_{const2}	t_{const2}	t_{const2}	3
Deceleration		coastdown	$[50-dv_2]$	Δt_{cd2}	Δt_{cd2}	$t_{const2}+\Delta t_{cd2}$	3
Deceleration	12	-0.52	$[50-dv_2]-35$	$8-\Delta t_2$	$8-\Delta t_2$	$t_{const2}+\Delta t_{cd2}+8-\Delta t_2$	3
Steady speed	13	0	35	t_{const3}	t_{const3}	$t_{const2}+\Delta t_{cd2}+8-\Delta t_2+t_{const3}$	3
Gear change	14		35	2	$12+\Delta t_{cd3}-\Delta t_3$	$t_{const2}+\Delta t_{cd2}+10-\Delta t_2+t_{const3}$	
Deceleration		coastdown	$[35-dv_3]$	Δt_{cd3}		$t_{const2}+\Delta t_{cd2}+10-\Delta t_2+t_{const3}+\Delta t_{cd3}$	2
Deceleration		-0.99	$[35-dv_3]-10$	$7-\Delta t_3$		$t_{const2}+\Delta t_{cd2}+17-\Delta t_2+t_{const3}+\Delta t_{cd3}-\Delta t_3$	2
Deceleration, clutch disengaged		-0.92	10-0	3		$t_{const2}+\Delta t_{cd2}+20-\Delta t_2+t_{const3}+\Delta t_{cd3}-\Delta t_3$	K_2[1]
Idling	15	0	0	$7-\Delta t_3$	$7-\Delta t_3$	$t_{const2}+\Delta t_{cd2}+27-\Delta t_2+t_{const3}+\Delta t_{cd3}-2*\Delta t_3$	7 s - Δt_3 PM[1]

1 PM = gearbox in neutral, clutch engaged. K1, K2 = first or second gear engaged, clutch disengaged.

	Operation	Phase	Acceleration (m/s2)	Speed (km/h)	Duration of each Operation (s)	Duration of each Phase (s)	Cumulative time (s)	Gear to be used in the case of a manual gearbox
1	Idling	1	0	0	20	20		K_1[1]
2	Acceleration	2	0.83	0-15	5	41		1
3	Gear change			15	2			-
4	Acceleration		0.62	15-35	9			2
5	Gear change			35	2			-
6	Acceleration		0.52	35-50	8			3
7	Gear change			50	2			-
8	Acceleration		0.43	50-70	13			4
9	Steady speed	3	0	70	t_{const4}	t_{const4}		5
9'	Deceleration	3'	coastdown	70-dv$_4$**	Δt_{cd4}	Δt_{cd4}		5
10	Deceleration	4	coastdown,*-0.69	dv$_4$**-50	$8-\Delta t_{cd4}$	$8-\Delta t_{cd4}$		4
11	Steady speed	5	0	50	69	69		4
12	Acceleration	6	0.43	50-70	13	13		4
13	Steady speed	7	0	70	50	50		5
14	Acceleration	8	0.24	70-100	35	35		5
15	Steady speed[2]	9	0	100	30	30		5[2]
16	Acceleration[2]	10	0.28	100-120	20	20		5[2]
17	Steady speed[2]	11	0	120	t_{const5}	t_{const5}		5[2]
17'	Deceleration[2]		coastdown	$[120-dv_5]$	Δt_{cd5}	Δt_{cd5}		5[2]
18-end								
	If dv5 >= 80							
	Deceleration[2]	12	-0.69	$[120-dv_5]-80$	$16-\Delta t_5$	$34-\Delta t_5$		5[2]
	Deceleration[2]		-1.04	80-50	8			5[2]
	Deceleration, clutch disengaged		1.39	50-0	10			K_5[1]
	Idling	13	0	0	$20-\Delta t_5$	$20-\Delta t_5$		PM[1]
	If 50 < dv5 < 80							
	Deceleration[2]		-1.04	$[120-dv_5]-50$	$8-\Delta t_5$	$18-\Delta t_5$		5[2]
	Deceleration, clutch disengaged		1.39	50-0	10			K_5[1]
	Idling	13	0	0	$20-\Delta t_5$	$20-\Delta t_5$		PM[1]
	If dv$_5$ <= 50							
	Deceleration, clutch disengaged		1.39	$[120-dv_5]-0$	$10-\Delta t_5$	$10-\Delta t_5$		K_5[1]
	Idling	13	0	0	$20-\Delta t_5$	$20-\Delta t_5$		PM[1]

*achieved velocity after 4 seconds with an acceleration of -0.69 m/s2 is 60.064km/h. This velocity is also used as gear change indicator for modified NEDC cycle.
** dv$_4$ is >= 60.064 km/h

7. DETERMINATION OF THE CO_2 EMISSIONS OF THE ECO-INNOVATIVE VEHICLE UNDER MODIFIED TESTING CONDITIONS (E_{MC})

The emissions of CO_2 of the eco-innovative vehicles shall be measured in accordance with Annex 6 of UN/ECE Regulation No 101 (Method of measuring emissions of carbon dioxide and fuel consumption of vehicles powered by an internal combustion engine only). The following elements shall be modified:

— The preconditioning of the vehicle

— The speed profile

— The number of tests

Preconditioning of the vehicle

The preconditioning shall be conducted according to Section 4 of the present Annex.

Speed profile

The speed profile shall be generated according to Section 6 of the present Annex.

Number of tests

The complete test procedure on the test bench shall be repeated at least three times. The arithmetic mean of the CO_2 emission from the eco-innovation vehicle (E_{MC}) and the respective standard deviation of the arithmetic mean (
$s_{E_{MC}}$
) shall be calculated.

8. DETERMINATION OF THE CO_2 EMISSIONS OF THE BASELINE VEHICLE UNDER MODIFIED TYPE APPROVAL HOT START CONDITIONS (
$B_{TA_{hot}}$
)

The CO_2 emissions of the baseline vehicles have to be measured in accordance with Annex 6 of UN/ECE Regulation No 101 (Method of measuring emissions of carbon dioxide and fuel consumption of vehicles powered by an internal combustion engine only). The following elements shall be modified:

— The preconditioning of the vehicle
— The number of tests

Preconditioning of the vehicle

The preconditioning shall be done according to Section 4 of the present Annex.

Number of tests

The complete test procedure under type approval (NEDC) hot start conditions on the test bench shall be repeated at least three times. The arithmetic means of the CO_2 emission from the baseline vehicle (
$B_{TA_{hot}}$
) and the respective standard deviation of the arithmetic mean (
$s_{B_{TA_{hot}}}$
) shall be calculated.

9. CALCULATION OF THE CO_2 SAVINGS

The formula to calculate the CO_2 savings is the following:

Formula 1:

$$C_{CO_2} = (B_{MC} - E_{MC}) \times UF_{MC} - (B_{TA} - E_{TA}) \times UF_{TA}$$

Where

C_{CO_2}	:	CO_2 savings [gCO_2/km]
B_{MC}	:	Arithmetic mean of the CO_2 emissions of the baseline vehicle under modified testing conditions [gCO_2/km]
E_{MC}	:	Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under modified testing conditions [gCO_2/km]
B_{TA}	:	Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval (NEDC) testing conditions [gCO_2/km]
E_{TA}	:	Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under type approval (NEDC) testing conditions [gCO_2/km]

UF_{MC}	:	Usage factor of the coasting technology under modified conditions, which is 0,52 for vehicles equipped with a conventional powertrain and an automatic transmission and 0,48 for vehicles equipped with a conventional powertrain and a manual transmission with an automated clutch.
UF_{TA}	:	Usage factor of the coasting technology under type approval (NEDC) conditions

Since the innovative technology is not active under type approval (NEDC) conditions, the general equation for calculating the CO_2 savings can be simplified as follows:

Formula 2:

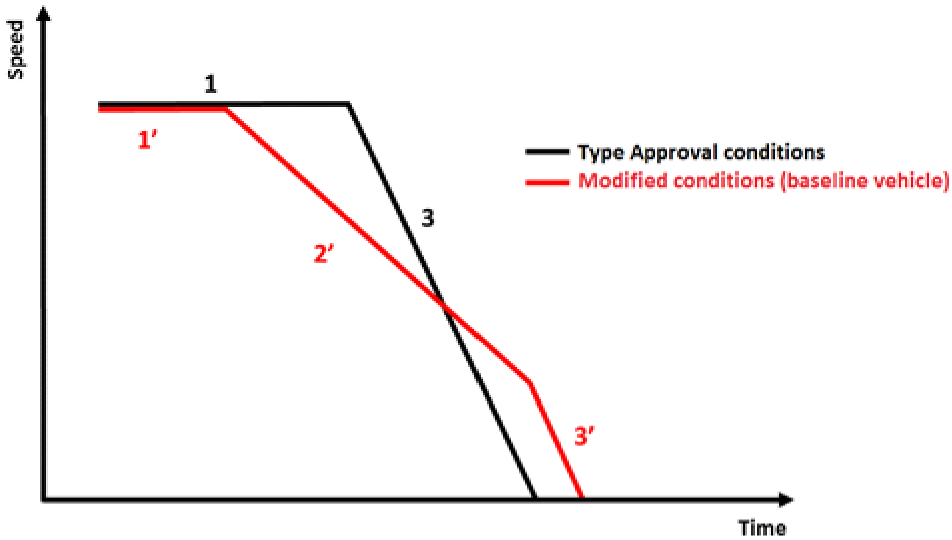
$$C_{CO_2} = (B_{MC} - E_{MC}) \times UF_{MC}$$

The term UF_{MC} of the Formula 2 will be hereafter simply written as 'UF' since it is the unique usage factor thanks to the previous simplification.

To determine B_{MC}, the same modified testing conditions should be followed by a vehicle which does not have the coasting function.

The assumption is that the baseline vehicle is able to perform a sailing curve (line 2′ in Figure 2) without disconnecting the engine from the wheels, although with lower efficiency than a coasting vehicle (able to disconnect the engine from the wheels). Sailing is intended as the hypothetical coasting behaviour of the baseline vehicle.

Figure 2 **Sailing curve for baseline vehicle**



A common characteristic of a baseline vehicle is that, during deceleration phases of the type approval (NEDC) (3) and modified (2′ + 3′) testing conditions, no fuel is used (cut-off).

The definition of the coasting curve (1′ + 2′ + 3′) for the baseline vehicle is a complex process since different parameters are involved (e.g. gear range, electric power demand, transmission temperature). Since it would therefore be difficult for the driver to follow this speed trace without exceeding the speed and time tolerances, it has therefore been proposed to use a conversion parameter (i.e. c-factor) to calculate the CO_2 emissions of the baseline vehicle under modified conditions (B_{MC}) from the CO_2 emissions of the baseline vehicle emissions under type approval (NEDC) hot start conditions (

$B_{TA_{hot}}$

).

The relation between

$B_{TA_{hot}}$

and B_{MC} is defined using the c-factor, shown on the following Formula 3

Formula 3:

$$c = \frac{B_{MC}}{B_{TA_{hot}}}$$

As consequence, Formula 2 becomes

Formula 4:

$$C_{CO_2} = \left(c \times B_{TA_{hot}} - E_{MC}\right) \times \mathrm{UF}$$

Where

c	:	Conversion parameter which is 0,960
$B_{TA_{hot}}$	:	Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval (NEDC) hot start conditions [gCO_2/km]
E_{MC}	:	Arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km]
UF	:	Usage factor of the coasting technology under modified conditions, which is 0,52 for vehicles equipped with a conventional powertrain and an automatic transmission and 0,48 for vehicles equipped with a conventional powertrain and a manual transmission with an automated clutch.

Determination of the Usage Factor

The usage factor has been defined by Formula 5.

Formula 5:

$$\mathrm{UF} = \frac{\mathrm{RCD_{RW}}}{\mathrm{RCD_{mNEDC}}}$$

With:

RCD_{RW}	:	Relative coasting distance under real world conditions [%];
RCD_{mNEDC}	:	Relative coasting distance under modified NEDC testing conditions [%].

The relative coasting distance RCD under real world conditions is defined as the distance travelled with coasting active divided by total driving distance per trip.

10. CALCULATION OF THE UNCERTAINTY

The uncertainty of the total CO_2 saving should not exceed 0,5 g CO_2/km (Formula 6).

Formula 6:

$$s_{C_{CO_2}} \leq 0{,}5\ \mathrm{gCO_2\,/\,km}$$

$s_{C_{CO_2}}$	:	Statistical margin of the total CO_2 saving [g CO_2/km],

The formula to calculate the statistical margin is

Formula 7:

$$s_{C_{CO_2}} = \sqrt{\left(c \times \mathrm{UF} \times s_{B_{TA_{hot}}}\right)^2 + \left(-\mathrm{UF} \times s_{E_{MC}}\right)^2 + \left[\left(c \times B_{TA_{hot}} - E_{MC}\right) \times s_{UF}\right]^2}$$

Where

$s_{C_{CO_2}}$	:	Statistical margin of the total CO_2 saving [g CO_2/km],
c	:	Conversion parameter which is 0,960

$B_{TA_{hot}}$	:	Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval (NEDC) hot start conditions [gCO_2/km]
$s_{B_{TA_{hot}}}$	:	Standard deviation of the arithmetic mean of the CO_2 emission of the baseline vehicle under modified testing conditions [gCO_2/km]
E_{MC}	:	Arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km]
$s_{E_{MC}}$	:	Standard deviation of the arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km]
UF	:	Usage factor of the coasting technology, which is 0,52 for vehicles equipped with a conventional powertrain and an automatic transmission and 0,48 for vehicles equipped with a conventional powertrain and a manual transmission with an automated clutch.
s_{UF}	:	Standard deviation of the arithmetic mean of the usage factor, which is 0,027;

11. ROUNDING

The calculated CO_2 savings value (
C_{CO_2}
) and the statistical margin of the CO_2 saving (
$s_{C_{CO_2}}$
) must be rounded up and expressed to a maximum of two decimal places.

Each value used in the calculation of the CO_2 savings (i.e.
$B_{TA_{hot}}$
and E_{MC}) can be applied unrounded or must be rounded up and expressed to a minimum number of decimals which allows the maximum total impact (i.e. combined impact of all rounded values) on the savings to be lower than 0,25 gCO_2/km.

12. DEMONSTRATION THAT THE MINIMUM THRESHOLD IS EXCEEDED IN A STATISTICALLY SIGNIFICANT WAY

In order to demonstrate that the 1 gCO_2/km threshold is exceeded in a statistically significant way, the following Formula shall be used:

$$MT = 1\ g\ CO_2\ /\ km \leq C_{CO_2} - s_{C_{CO_2}}$$

Where

MT	:	Minimum threshold [gCO_2/km]
C_{CO_2}	:	CO_2 savings [gCO_2/km]
$s_{C_{CO_2}}$	:	Statistical margin of the total CO_2 saving [g CO_2/km],

Where the CO_2 emission savings, as a result of the calculation using Formula 4 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.

(**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**) Commission Implementing Decision (EU) 2015/1132 of 10 July 2015 on the approval of the Porsche AG coasting function 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 184, 11.7.2015, p. 22).

(**4**) Commission Implementing Decision (EU) 2017/1402 of 28 July 2017 on the approval of the BMW AG engine idle coasting function 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 199, 29.7.2017, p. 14).

(**5**) 'Evaluation of the relative coasting distance, usage factors and CO_2 savings for the coasting technology', a study by Directorate-General for Climate Action of the European Commission, https://publications.europa.eu/en/publication-detail/-/publication/9673ca61-9abc-11e8-a408-01aa75ed71a1/language-en
The report is based on specific real driving testing conditions and vehicles without the coasting function installed. The results are only representative of the coasting technology potential under specific conditions and can only be considered as a supporting document.

(**6**) 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).

(**7**) 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).

(**8**) Directive 2007/46/EC of the European Parliament and 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).

Status:
Point in time view as at 19/12/2018.

Changes to legislation:
There are currently no known outstanding effects for the Commission Implementing Decision (EU) 2018/2079.