31 December 2021

Agreement

Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations*

(Revision 3, including the amendments which entered into force on 14 September 2017)

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Addendum 153 – UN Regulation No. 154

Amendment 2

Supplement 1 to the original version of the Regulation – Date of entry into force: 30 September 2021

Uniform provisions concerning the approval of light duty passenger and commercial vehicles with regards to criteria emissions, emissions of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric range (WLTP)

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2021/56.

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UNITED NATIONS

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Paragraph 2.1., amend to read:

"…

SSV	Subsonic venturi
UBE	Usable Battery (REESS) Energy
USFM	Ultrasonic flow meter
V_H	Vehicle High
V_L	Vehicle Low
VPR	Volatile particle remover

…"

Paragraph 4.1.2.(a), amend to read:

"(a)　In the case of vehicles equipped with positive ignition engines, a declaration by the manufacturer of the minimum percentage of misfires out of a total number of firing events that would either result in emissions exceeding the OBD thresholds given in paragraph 6.8.2., if that percentage of misfire had been present from the start of a Type 1 test as described in Annexes Part B to this Regulation, or that could lead to an exhaust catalyst, or catalysts, overheating prior to causing irreversible damage;"

Paragraph 5.2.2., amend to read:

"5.2.2.　Example of an Approval Number to this Regulation:

E11*[XXX]R01/01/02*0123*01

The first extension of the Approval numbered 0123, issued by the United Kingdom to Series of Amendments 01, Supplement 01, which is a Level 2 Approval."

Paragraph 5.10.4., amend to read:

"5.10.4.　When tested with a defective component in accordance with Appendix 1 to Annex C5 to this Regulation, the OBD system malfunction indicator shall be activated. The OBD system malfunction indicator may also activate during this test at levels of emissions below the OBD thresholds specified in paragraph 6.8."

Paragraph 6.3.2.2.(b), amend to read:

"(b)　Type of traction REESS (type of cell, capacity, nominal voltage, nominal power, type of coolant (air, liquid));"

Paragraph 6.3.2.3.(b), amend to read:

"(b)　Type of traction REESS (type of cell, capacity, nominal voltage, nominal power, type of coolant (air, liquid));"

Paragraph 6.3.2.4.(c), amend to read:

"(c)　Type of traction REESS (type of cell, capacity, nominal voltage, nominal power, type of coolant (air, liquid));"

Add a new paragraph 6.3.11., to read:

"6.3.11.　For Level 1A only

K_{CO_2} correction factor family for OVC-HEVs and NOVC-HEVs

It is allowed to merge two or more interpolation families into the same K_{CO_2} correction factor family at which K_{CO_2} shall be determined with vehicle H of

one of the included interpolation families. The interpolation family that is used for the vehicle H selection shall be agreed by the Type Approval Authority.

At the request of the Type Approval Authority, the manufacturer shall provide evidence on the justification and technical criteria for merging these interpolation families for example in the following cases:

Two or more interpolation families are merged:

(a)   Which were split because the maximum interpolation range of 20 g/km CO_2 is exceeded (in case vehicle M measured: 30g/km);

(b)   Which were split due to different engine power ratings of the same physical combustion engine
(different power only related to software);

(c)   Which were split because the n/v ratios are just outside the tolerance of 8 per cent;

(d)   Which were split, but still fulfil all the family criteria of a single IP family;

(e)   Which were split because there is different number of powered axles.

Different electric energy converters between recharge-plug-in and traction REESS shall not be considered as a criterion in the context of the correction factor family."
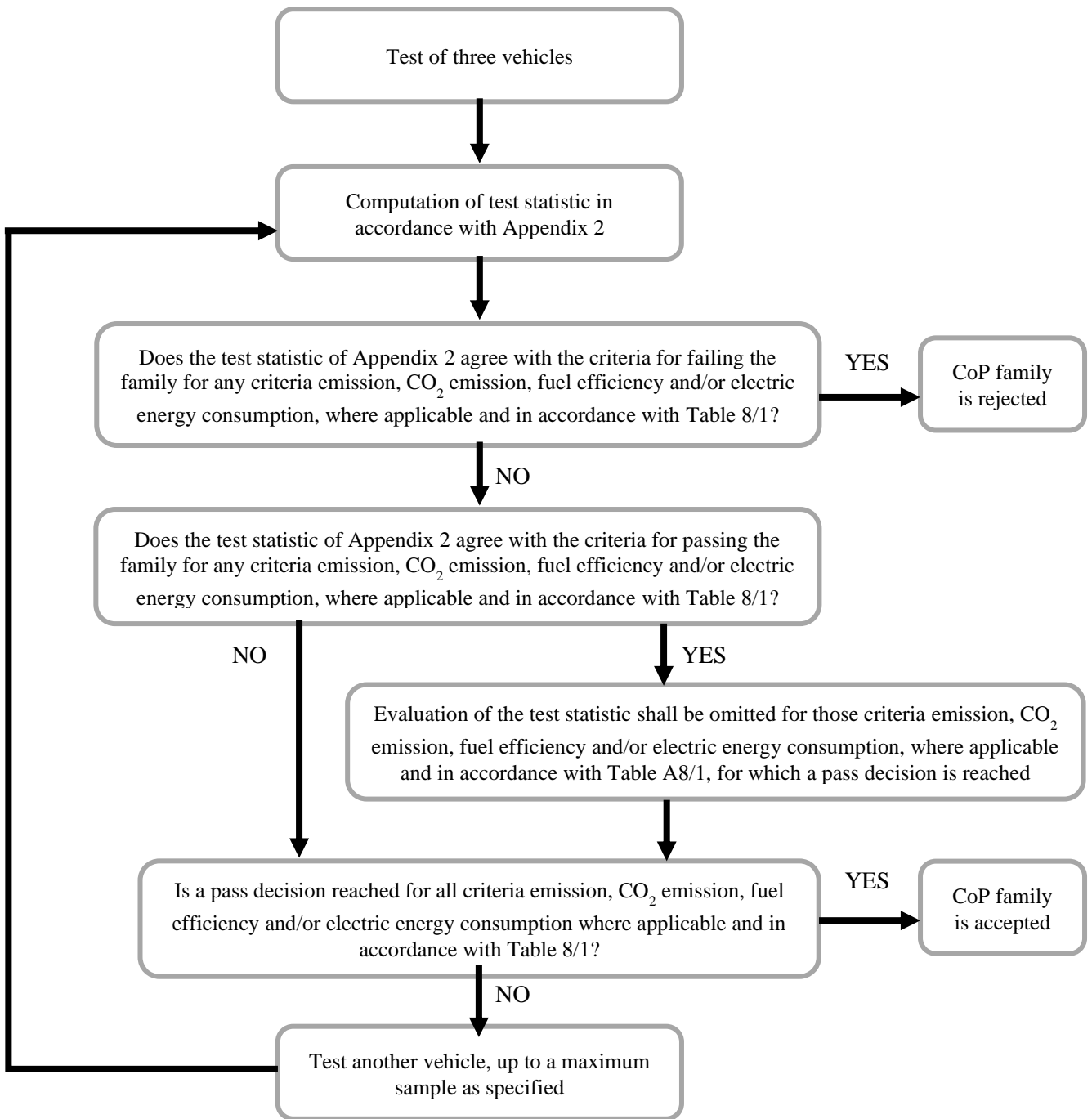
Paragraph 6.8.2., Table 4A, note 1, amend to read:

"[1]   Positive ignition particulate mass OBD thresholds apply only to vehicles with direct injection engines"

Paragraph 8.2.3.2., Figure 8/1, amend to read:

"Figure 8/1
Flowchart of the CoP test procedure for the Type 1 test

Test of three vehicles

Computation of test statistic in accordance with Appendix 2

Does the test statistic of Appendix 2 agree with the criteria for failing the family for any criteria emission, CO_2 emission, fuel efficiency and/or electric energy consumption, where applicable and in accordance with Table 8/1?

YES → CoP family is rejected

NO

Does the test statistic of Appendix 2 agree with the criteria for passing the family for any criteria emission, CO_2 emission, fuel efficiency and/or electric energy consumption, where applicable and in accordance with Table 8/1?

NO

YES

Evaluation of the test statistic shall be omitted for those criteria emission, CO_2 emission, fuel efficiency and/or electric energy consumption, where applicable and in accordance with Table A8/1, for which a pass decision is reached

Is a pass decision reached for all criteria emission, CO_2 emission, fuel efficiency and/or electric energy consumption where applicable and in accordance with Table 8/1?

YES → CoP family is accepted

NO

Test another vehicle, up to a maximum sample as specified

"

Paragraph 12.2., amend to read:

"12.2.   This paragraph is only applicable for Level 1A

For Approvals to Level 1A only, until 1 September 2022 in the case of category M and category N_1 class I vehicles, and 1 September 2023 in the case of category N_1 class II and III and category N_2 vehicles, Contracting Parties may accept Type Approvals to EU legislation as evidence of compliance with the provisions of this Regulation as detailed in (a) to (d) below:

(a)   Type 1/I tests performed in accordance with Annex 4a to UN Regulation No 83, 07 series of amendments before 1 September 2017 in the case of category M and category N_1 class I vehicles, and 1 September 2018 in the case of category N_1 class II and III and category N_2 vehicles shall be accepted by the Type Approval Authority for the purposes of producing deteriorated or defective components to simulate failures for assessing the requirements of Annex C5 to this Regulation;

(b)   With respect to vehicles of a WLTP interpolation family which fulfil the extension rules specified in paragraph 2 of Annex 13 of UN Regulation No. 83, 07 series of amendments, procedures performed in accordance with Section 3 of Annex 13 to UN Regulation No. 83,.07 series of amendments before 1 September 2017 in the case of category M and category N_1 class I vehicles, and 1 September 2018 in the case of category N_1 class II and III and category N_2 vehicles shall be accepted by the Type Approval Authority for the purposes of fulfilling the requirements of Appendix 1 to Annex B6 of this Regulation;

(c)   Durability demonstrations where the first type 1/I test was performed and completed in accordance with Annex 9 to UN Regulation No. 83, 07 series of amendments before 1 September 2017 in the case of category M and category N_1 class I vehicles, and 1 September 2018 in the case of category N_1 class II and III and category N_2 vehicles shall be accepted by the approval authorities for the purposes of fulfilling the requirements of Annex C4 to this Regulation.

(d)   Evaporative emissions tests conducted on the basis of the test procedure set out in Annex VI of Regulation (EC) No 692/2008 as amended by Regulation (EC) No 2016/646 which were used to approve evaporative emissions families in the European Union before 31 August 2019 shall be accepted by the approval authorities for the purposes of fulfilling the requirements of Annex C3 to this Regulation."

Appendix 1

Paragraph 2.3.1., amend to read:

"2.3.1. CO_2 mass emission values for CoP / Fuel efficiency values for CoP

For Level 1A:

In the case the interpolation method is not applied, the CO_2 mass emission value $M_{Co2,c,7}$ according to step 7 of Table A7/1 of Annex B7 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the CO_2 mass emission value $M_{CO2,c,ind}$ for the individual vehicle according to step 10 of Table A7/1 of Annex B7 shall be used for verifying the conformity of production.

For Level 1B:

In the case the interpolation method is not applied, the fuel efficiency value $FE_{c,8}$ according to step 8 of Table A7/1 of Annex B7 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the fuel efficiency value $FE_{c,ind}$ for the individual vehicle according to step 10 of Table A7/1 of Annex B7 shall be used for verifying the conformity of production."

Appendix 3

Paragraph 1.9., amend to read:

"1.9.   …

In the case that multiple vehicles have been tested, the C_{RI} shall be calculated for each vehicle, and the resulting values shall be averaged. The manufacturer will provide statistical evidence to the Type Aproval Authority that the fit is sufficiently statistically justified."

Appendix 6

Paragraph 6.2., amend to read:

"6.2.   The manufacturer shall demonstrate that use of the sensors referred to in paragraph 6.1. and any other sensors on the vehicle, results in the activation of the driver warning system as referred to in paragraph 3., the display of a message indicating an appropriate warning (e.g. "emissions too high — check urea", "emissions too high — check AdBlue", "emissions too high — check reagent"), and the activation of the driver inducement system as referred to in paragraph 8.3., when the situations referred to in paragraphs 4.2., 5.4., or 5.5. occur.

For the purposes of this paragraph these situations are presumed to occur if the applicable NOx OBD threshold set out in Table 4 of paragraph 6.8.2. is exceeded.

NOx emissions during the test to demonstrate compliance with these requirements shall be no more than 20 per cent higher than the OBD thresholds."

Paragraphs 8.6. to 8.8., amend to read:

"8.6.   Detailed written information fully describing the functional operation characteristics of the driver inducement system shall be provided to the Type Approval Authority at the time of approval.

8.7.   As part of the application for type approval under this Regulation, the manufacturer shall demonstrate the operation of the driver warning and inducement systems."

Annexes Part A

Annex A2 Addendum

Paragraph 2.5.3.8., amend to read:

"2.5.3.8.   Electric energy consumption

2.5.3.8.1.   Electric Energy Consumption EC

EAC(Wh)	

…"

Annexes Part B

Annex B2

Add new paragraph 6., to read:

"6.   Calculation tools

Examples of gear shift calculating tools can be found in the same webpage as this Regulation.[1]

The following tools are provided:

(a)   ACCESS based tool;

(b)   Matlab code tool;

(c)   NET core tool.

These tools were validated by the comparison of calculation results between the ACCESS tool, the Matlab code and the .NET core code for 115 different vehicle configurations supplemented by additional calculations for 7 of them with additional options like "apply speed cap", "suppress downscaling", "choose other vehicle class cycle" and "choose individual n_{min_drive} values".

The 115 vehicle configurations cover extreme technical designs for transmission and engines and all vehicle classes.

All three tools deliver identical results with respect to gear use and clutch operation and although only the text in Annexes B1 and B2 is legally binding the tools have achieved a status that qualifies them as reference tools."

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[1] [link to be inserted after final notification]

Annex B4

Paragraph 4.2.2.1., Table A4/2, amend to read:

"Table A4/2

Energy efficiency classes according to rolling resistance coefficients (RRC) for C1, C2 and C3 tyres and the RRC values to be used for those energy efficiency classes in the interpolation, kg/tonne

Energy efficiency class	Range of RRC for C1 tyres	Range of RRC for C2 tyres	Range of RRC for C3 tyres
1	RRC ≤ 6.5	RRC ≤ 5.5	RRC ≤ 4.0
2	6.5 < RRC ≤ 7.7	5.5 < RRC ≤ 6.7	4.0 < RRC ≤ 5.0
3	7.7 < RRC ≤ 9.0	6.7 < RRC ≤ 8.0	5.0 < RRC ≤ 6.0
4	9.0 < RRC ≤ 10.5	8.0 < RRC ≤ 9.2	6.0 < RRC ≤ 7.0
5	10.5 < RRC ≤ 12.0	9.2 < RRC ≤ 10.5	7.0 < RRC ≤ 8.0
6	RRC > 12.0	RRC > 10.5	RRC > 8.0

Energy efficiency class	Value of RRC to be used for interpolation for C1 tyres	Value of RRC to be used for interpolation for C2 tyres	Value of RRC to be used for interpolation for C3 tyres
1	RRC = 5.9*	RRC = 4.9*	RRC = 3.5*
2	RRC = 7.1	RRC = 6.1	RRC = 4.5
3	RRC = 8.4	RRC = 7.4	RRC = 5.5
4	RRC = 9.8	RRC = 8.6	RRC = 6.5
5	RRC = 11.3	RRC = 9.9	RRC = 7.5
6	RRC = 12.9	RRC = 11.2	RRC = 8.5

* For Level 1A only: In case the actual RRC value is lower than this value, the actual rolling resistance value of the tyre or any higher value up to the RRC value indicated here shall be used for interpolation.
"

Paragraph 4.5.5.2.1., amend to read:

"4.5.5.2.1.   Correction to reference conditions

$$C^* = \left((c_0(1 - K_1) - w_2) + c_1v\right) \times \left(1 + K_0(T - 20)\right) + K_2 c_2 v^2$$

where:

…"

Annex B6

Paragraph 1.2.3.9., Table A6/1 column headings, amend to read:

"

| Powertrain	Level 1A only M_{CO2} [b] (g/km)	Level 1A: FC (kg/100 km)	Level 1B; FE (km/l or km/kg)	Electric energy consumption[c] (Wh/km)	All electric range / Pure Electric Range [c] (km)

…"

Paragraph 2.3.2.4., amend to read:

"2.3.2.4.   Vehicle M is a vehicle within the interpolation family between the vehicles L and H with a cycle energy demand which is preferably closest to the average of vehicles L and H.

The limits of the selection of vehicle M (see Figure A6/4) are such that neither the difference in CO_2 emission values between vehicles H and M nor the difference in CO_2 emission values between vehicles M and L is greater than the allowed CO_2 range in accordance with paragraph 2.3.2.2. of this annex. The defined road load coefficients and the defined test mass shall be recorded.

Figure A6/4
Limits for the selection of vehicle M
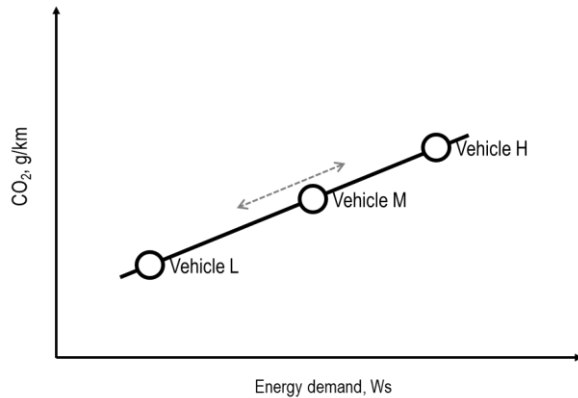
For Level 1A

The linearity of the corrected measured and averaged CO_2 mass emission for vehicle M, $M_{CO2,c,6,M}$ according to step 6 of Table A7/1 of Annex B7, shall be verified against the linearly interpolated CO_2 mass emission between vehicles L and H over the applicable cycle by using the corrected measured and averaged CO_2 mass emission $M_{CO2,c,6,H}$ of vehicle H and $M_{CO2,c,6,L}$ of vehicle L, according to step 6 of Table A7/1 of Annex B7, for the linear CO_2 mass emission interpolation.

For Level 1B

An additional averaging of tests using the CO_2-output of step 4a is necessary (not described in Table A7/1). The linearity of the corrected measured and averaged CO_2 mass emission for vehicle M, $M_{CO2,c,4a,M}$ according to step 4a of Table A7/1 of Annex B7, shall be verified against the linearly interpolated CO_2 mass emission between vehicles L and H over the applicable cycle by using the corrected measured and averaged CO_2 mass emission $M_{CO2,c,4a,H}$ values of vehicle H and $M_{CO2,c,4a,L}$ of vehicle L, according to step 4a used in of Table A7/1 of Annex B7, for the linear CO2 mass emission interpolation.

For Level 1A and Level 1B

The linearity criterion for vehicle M (see Figure A6/5) shall be considered fulfilled, if the CO_2 mass emission of the vehicle M over the applicable WLTC minus the CO_2 mass emission derived by interpolation is less than 2 g/km or 3 per cent of the interpolated value, whichever value is lower, but at least 1 g/km.

Figure A6/5

…"

Paragraph 2.8.1., amend to read:

"2.8.1.   The test cell temperature at the start of the test shall be within ±3 °C of the set point of 23 °C. The engine oil temperature and coolant temperature, if any, shall be within ±2 °C of the set point of 23 °C."

Paragraph 3.4.1., amend to read:

"3.4.1.   ...

E_{fuel} is the fuel energy according to the following equation:

$$E_{fuel} = 10 \times HV \times FC_{nb} \times d$$

Where

…"

Table A6.App2/3, amend to read:

"Table A6.App2/3
Willans factors (as applicable)

			Naturally aspirated	*Pressure-charged*
Positive ignition	Petrol (E0)	l/MJ	0.0733	0.0778
		gCO$_2$/MJ	175	186
	Petrol (E10)	l/MJ	0.0756	0.0803
		gCO$_2$/MJ	174	184
	CNG (G20)	m³/MJ	0.0719	0.0764
		gCO$_2$/MJ	129	137
	LPG	l/MJ	0.0950	0.101
		gCO$_2$/MJ	155	164
	E85	l/MJ	0.102	0.108
		gCO$_2$/MJ	169	179
Compression ignition	Diesel (B0)	l/MJ	0.0611	0.0611
		gCO$_2$/MJ	161	161
	Diesel (B7)	l/MJ	0.0611	0.0611
		gCO$_2$/MJ	161	161

"

Annex B7

Paragraph 1.4., Table A7/1, Step Nos. 4a to 4b, amend to read:

"

4a	Output step 2 Output step 3	$M_{i,c,2}$, g/km; $M_{CO2,c,3}$, g/km.	Emissions test procedure for all vehicles equipped with periodically regenerating systems, K_i. Annex B6, Appendix 1. $M_{i,c,4a} = K_i \times M_{i,c,2}$ or $M_{i,c,4a} = K_i + M_{i,c,2}$ and $M_{CO2,c,4a} = K_{CO2} \times M_{CO2,c,3}$ or $M_{CO2,c,4a} = K_{CO2} + M_{CO2,c,3}$ Additive offset or multiplicative factor to be used according to Ki determination. If K_i is not applicable: $M_{i,c,4a} = M_{i,c,2}$ $M_{CO2,c,4a} = M_{CO2,c,3}$	$M_{i,c,4a}$, g/km; $M_{CO2,c,4a}$, g/km.
4b	Output step 3 Output step 4a	$M_{CO2,p,3}$, g/km; $M_{CO2,c,3}$, g/km; $M_{CO2,c,4a}$, g/km.	If K_i is applicable, align CO_2 phase values to the combined cycle value: $$M_{CO2,p,4} = M_{CO2,p,3} \times AF_{Ki}$$ for every cycle phase p; where: $$AF_{Ki} = \frac{M_{CO2,c,4a}}{M_{CO2,c,3}}$$ If K_i is not applicable: $M_{CO2,p,4} = M_{CO2,p,3}$	$M_{CO2,p,4}$, g/km.

"

Paragraph 1.4., Table A7/1, Step No. 6, amend to read:

"

6	For Level 1A Output step 5	For every test: $M_{i,c,5}$, g/km; $M_{CO2,c,5}$, g/km; $M_{CO2,p,5}$, g/km.	Averaging of tests and declared value. Paragraphs 1.2. to 1.2.3. inclusive of Annex B6.	$M_{i,c,6}$, g/km; $M_{CO2,c,6}$, g/km; $M_{CO2,p,6}$, g/km. $M_{CO2,c,declared}$, g/km.
	For Level 1B Output step 5	$FE_{c,5}$, km/l;	Averaging of tests and declared value. Paragraphs 1.2. to 1.2.3. inclusive of Annex B6. The conversion from $FE_{c,declared}$ to $M_{CO2,c,declared}$ shall be performed for the applicable cycle according to paragraph 6. of Annex B7. For that purpose, the criteria emission over the applicable cycle shall be used.	$FE_{c,declared}$, km/l $FE_{c,6}$, km/l $M_{CO2,c,declared}$, g/km.

"

Paragraph 1.4., Table A7/1, Step No. 9, amend to read:

"

| 9

Interpolation family result.

For Level 1A
Final criteria emission result | Output step 8 | For each of the test vehicles H and L:
$M_{i,c,8}$, g/km;
$M_{CO2,c,8}$, g/km;
$M_{CO2,p,8}$, g/km;
$FC_{c,8}$, l/100 km;
$FC_{p,8}$, l/100 km;
$FE_{c,8}$, km/l.
$FE_{p,8}$, km/l | For Level 1A;
If in addition to a test vehicle H a test vehicle L and, if applicable vehicle M was also tested, the resulting criteria emission value shall be the highest of the two or, if applicable, three values and referred to as Mi,c.
In the case of the combined THC + NOx emissions, the highest value of the sum referring to either the vehicle H or vehicle L or, if applicable, vehicle M is to be taken as the type approval value.

Otherwise, if no vehicle L was tested, $M_{i,c} = M_{i,c,8}$
Level 1A and Level 1B
For CO_2, FE and FC, the values derived in step 8 shall be used, and CO_2 values shall be rounded according to paragraph 6.1.8. of this Regulation to two places of decimal, and FE and FC values shall be rounded according to paragraph 6.1.8. of this Regulation to three places of decimal. | $M_{i,c}$, g/km;
$M_{CO2,c,H}$, g/km;
$M_{CO2,p,H}$, g/km;
$FC_{c,H}$, l/100 km;
$FC_{p,H}$, l/100 km;
$FE_{c,H}$, km/l;
$FE_{p,H}$, km/l;

and if a vehicle L was tested:
$M_{CO2,c,L}$, g/km;
$M_{CO2,p,L}$, g/km;
$FC_{c,L}$, l/100 km;
$FC_{p,L}$, l/100 km;
$FE_{c,L}$, km/l;
$FE_{p,L}$, km/l. |

"

Annex B8

Paragraph 3.1.2., amend to read:

"3.1.2.   Forced cooling as described in paragraph 2.7.2. of Annex B6 is only permitted for the charge-sustaining Type 1 test for OVC-HEVs according to paragraph 3.2. of this annex and for testing NOVC-HEVs according to paragraph 3.3. of this annex."
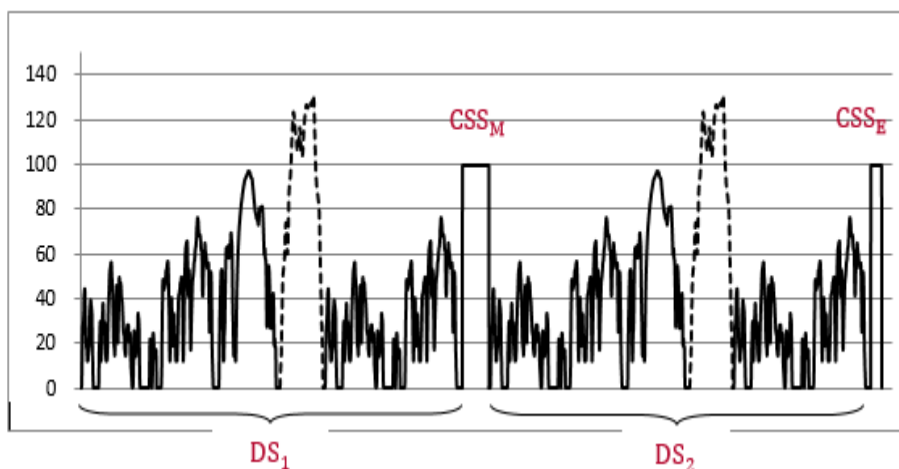
Paragraph 3.4.4.2.1., amend to read:

"3.4.4.2.1.   Speed trace

The shortened Type 1 test procedure consists of two dynamic segments (DS_1 and DS_2) combined with two constant speed segments (CSS_M and CSS_E) as shown in Figure A8/2.

Figure A8/2

Shortened Type 1 test procedure speed trace

"

Paragraph 4.1.1.1., Table A8/5, Step Nos. 4b to 8 amend to read:

"

4b	Output step 3	$M_{CO2,CS,p,3}$, g/km; $M_{CO2,CS,c,3}$, g/km;	If K_i is applicable, align CO_2 phase values to combined cycle value: $$M_{CO2,CS,p,4} = M_{CO2,CS,p,3} \times AF_{Ki}$$ for every cycle phase p; where: $$AF_{Ki} = \frac{M_{CO2,CS,c,4a}}{M_{CO2,CS,c,3}}$$ If K_i is not applicable: $$M_{CO2,CS,p,4} = M_{CO2,CS,p,3}$$	$M_{CO2,CS,p,4}$, g/km.
	Output step 4a	$M_{CO2,CS,c,4a}$, g/km.		
4c	Output step 4a	$M_{i,CS,c,4a}$, g/km; $M_{CO2,CS,c,4a}$, g/km.	In the case these values are used for the purpose of conformity of production, the criteria emission values and CO_2 mass emission values shall be multiplied with the run-in factor RI determined according to paragraph 8.2.4. of this Regulation: $M_{i,CS,c4c} = RI_C (j) \times M_{i,CS,c,4a}$ $M_{CO2,CS,c,4c} = RI_{CO2} (j) \times M_{CO2,CS,c,4a}$ In the case these values are not used for the purpose of conformity of production: $M_{i,c,4c} = M_{i,c,4a}$ $M_{CO2,c,4c} = M_{CO2,c,4a}$	$M_{i,CS,c,4c};$ $M_{CO2,CS,c,4c}$
			Calculate fuel efficiency ($FE_{c,4c\_temp}$) according to paragraph 6.14.1. of Annex B7.	$FE_{c,4c}$, km/l;

			In the case this value is used for the purpose of conformity of production, the fuel efficiency value shall be multiplied with the run in factor determined according to paragraph 8.2.4. of this Regulation: $FE_{c,4c} = RI_{FE}(j) \times FE_{c,4c\_temp}$ In the case these values are not used for the purpose of conformity of production: $FE_{c,4c} = FE_{c,4c\_temp}$	
5 Result of a single test.	Output step 4b and 4c	$M_{CO2,CS,p,4}$, g/km; $M_{CO2,CS,c,4c}$, g/km;	For Level 1A: ATCT correction of $M_{CO2,CS,c,4c}$ and $M_{CO2,CS,p,4}$ in accordance with paragraph 3.8.2. of Annex B6a. For Level 1B: $M_{CO2,c,5} = M_{CO2,c,4c}$ $M_{CO2,p,5} = M_{CO2,p,4}$	$M_{CO2,CS,c,5}$, g/km; $M_{CO2,CS,p,5}$, g/km.
		$M_{i,CS,c,4c}$, g/km; $FE_{c,4c}$, km/l;	Apply deterioration factors calculated in accordance with Annex C4 to the criteria emissions values. In the case these values are used for the purpose of conformity of production, the further steps (6 to 9) are not required and the output of this step is the final result.	$M_{i,CS,c,5}$, g/km; $FE_{c,5}$, km/l;
6 $M_{i,CS}$ results of a Type 1 test for a test vehicle.	For Level 1A Output step 5	For every test: $M_{i,CS,c,5}$, g/km; $M_{CO2,CS,c,5}$, g/km; $M_{CO2,CS,p,5}$, g/km.	Averaging of tests and declared value according to paragraphs 1.2. to 1.2.3. inclusive of Annex B6.	$M_{i,CS,c,6}$, g/km; $M_{CO2,CS,c,6}$, g/km; $M_{CO2,CS,p,6}$, g/km; $M_{CO2,CS,c,declared}$, g/km.
	For Level 1B Output step 5	$FE_{c,5}$, km/l;	Averaging of tests and declared value. Paragraphs 1.2. to 1.2.3. inclusive of Annex B6. The conversion from $FE_{c,declared}$ to $M_{CO2,c,declared}$ shall be performed for the applicable cycle. For that purpose, the criteria emission over the complete cycle shall be used.	$FE_{c,declared}$, km/l $M_{CO2,c,declared}$, g/km.
7 $M_{CO2,CS}$ results of a Type 1 test for a test vehicle.	For Level 1A: Output step 6	$M_{CO2,CS,c,6}$, g/km; $M_{CO2,CS,p,6}$, g/km; $M_{CO2,CS,c,declared}$, g/km.	Alignment of phase values. Paragraph 1.2.4. of Annex B6, and: $M_{CO2,CS,c,7} = M_{CO2,CS,c,declared}$	$M_{CO2,CS,c,7}$, g/km; $M_{CO2,CS,p,7}$, g/km.
	For Level 1B: Output step 5 Output step 6	$M_{CO2,CS,c,5}$, g/km; $M_{CO2,CS,p,5}$, g/km; $M_{CO2,CS,c,declared}$, g/km.	Alignment of phase values. Paragraph 1.2.4. of Annex B6.	$M_{CO2,CS,p,7}$, g/km.

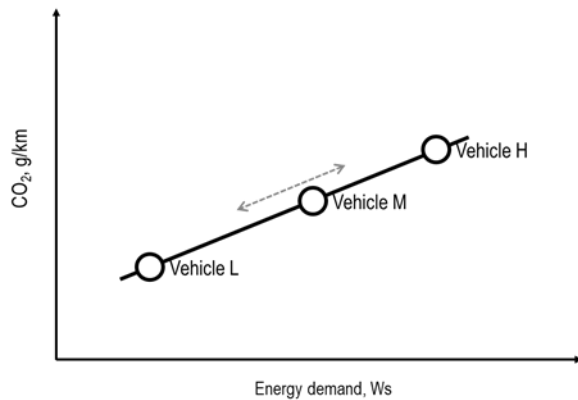| For Level 1A only

8

Interpolation family result.

Final criteria emission result.

If the interpolation method is not applied, step No. 9 is not required and the output of this step is the final CO_2 result. | Output step 6 | For each of the test vehicles H and L and, if applicable, vehicle M:

$M_{i,CS,c,6}$, g/km; | If in addition to a test vehicle H a test vehicle L and, if applicable vehicle M was also tested, the resulting criteria emission value shall be the highest of the two or, if applicable, three values and referred to as $M_{i,CS,c}$

In the case of the combined THC+NO$_x$ emissions, the highest value of the sum referring to either the vehicle H or vehicle L or, if applicable, vehicle M is to be taken as the type approval value. | $M_{i,CS,c}$, g/km;
$M_{CO2,CS,c}$, g/km;
$M_{CO2,CS,p}$, g/km; |
| | Output step 7 | For each of the test vehicles H and L and, if applicable, vehicle M:
$M_{CO2,CS,c,7}$, g/km;
$M_{CO2,CS,p,7}$, g/km. | Otherwise, if no vehicle L or if applicable vehicle M was tested, $M_{i,CS,c} = M_{i,CS,c,6}$

In the case that the interpolation method is applied, intermediate rounding shall be applied according to paragraph 6.1.8. of this Regulation:

CO_2 values derived in step 7 of this table shall be rounded to two places of decimal. Also, the output for CO_2 is available for vehicles H and vehicle L and, if applicable, for vehicle M.

In the case that the interpolation method is not applied, final rounding shall be applied according to paragraph 6.1.8. of this Regulation:

CO_2 values derived in step 7 of this table shall be rounded to the nearest whole number. | |

"

Paragraph 4.5.1.1.5., amend to read:

"4.5.1.1.5. Vehicle M

Vehicle M is a vehicle within the interpolation family between vehicles L and H with a cycle energy demand which is preferably closest to the average of vehicles L and H.

The limits of the selection of vehicle M (see Figure A8/5) are such that neither the difference in CO_2 mass emission between vehicles H and M nor the difference in charge-sustaining CO_2 mass emission between vehicles M and L is higher than the allowed charge-sustaining CO_2 range according to paragraph 4.5.1.1.2. of this annex. The defined road load coefficients and the defined test mass shall be recorded.

Figure A8/5
Limits for the selection of vehicle M

For Level 1A

The linearity of the corrected measured and averaged charge-sustaining CO_2 mass emission for vehicle M, $M_{CO2,c,6,M}$ according to step 6 of Table A8/5 of Annex B8, shall be verified against the linearly interpolated charge-sustaining CO_2 mass emission between vehicles L and H over the applicable cycle by using the corrected measured and averaged charge-sustaining CO_2 mass emission $M_{CO2,c,6,H}$ of vehicle H and $M_{CO2,c,6,L}$ of vehicle L, according to step 6 of Table A8/5 of Annex B8, for the linear CO_2 mass emission interpolation.

For Level 1B

An additional averaging of tests using the charge-sustaining CO_2-output of step 4a is necessary (not described in Table A8/5). The linearity of the corrected measured and averaged charge-sustaining CO_2 mass emission for vehicle M, $M_{CO2,c,4a,M}$ according to step 4a of Table A8/5 of Annex B8, shall be verified against the linearly interpolated CO_2 mass emission between vehicles L and H over the applicable cycle by using the corrected measured and averaged charge-sustaining CO_2 mass emission $M_{CO2,c,4a,H}$ of vehicle H and $M_{CO2,c,4a,L}$ of vehicle L, according to step 4a used in of Table A8/5 of Annex B8, for the linear CO_2 mass emission interpolation.

For Level 1A and Level 1B

The linearity criterion for vehicle M shall be considered fulfilled if the charge-sustaining CO_2 mass emission of vehicle M over the applicable WLTC minus the charge-sustaining CO_2 mass emission derived by interpolation is less than 2 g/km or 3 per cent of the interpolated value, whichever value is less, but at least 1 g/km. See Figure A8/6.

Figure A8/6

…"

Paragraph 4.6.1., Table A8/8, Step No. 16, amend to read:

"

16	Output step 15	If applicable: $EC_{DC,CD,COP}$, Wh/km;	In the case that the interpolation method is applied, intermediate rounding shall be performed according to paragraph 6.1.8. of this Regulation:	If applicable: $EC_{DC,CD,COP,final}$, Wh/km;
Interpolation family result.	Output step 14	$EC_{AC,CD,declared}$, Wh/km; $EC_{AC,weighted}$, Wh/km; $FE_{CD,declared}$, km/l; $M_{CO2,CD,declared}$, g/km.	$M_{CO2,CD}$ shall be rounded to the second place of decimal.	For Level 1A, $EC_{AC,CD,final}$, Wh/km; $M_{CO2,CD,final}$, g/km; $EC_{AC,weighted,final}$, Wh/km; $FC_{CD,final}$, l/100 km;
If the interpola-tion method is not applied, step No. 17 is not required and the output of this step is the final result.	Output step 13	$FC_{CD,ave}$, l/100 km;	$EC_{AC,CD,final}$ and $EC_{AC,weighted,final}$ shall be rounded to the first place of decimal. If applicable: $EC_{DC,CD,COP}$ shall be rounded to the first place of decimal. FC_{CD} and FE_{CD} shall be rounded to the third place of decimal. Output is available for vehicles H and for vehicle L and, if applicable, for vehicle M. In case that the interpolation method is not applied, final rounding shall be applied according to paragraph 6.1.8. of this Regulation: $EC_{AC,CD}$, $EC_{AC,weighted}$ and $M_{CO2,CD}$ shall be rounded to the nearest whole number. If applicable: $EC_{DC,CD,COP}$ shall be rounded to the nearest whole number. FC_{CD} and FE_{CD} shall be rounded to the first place of decimal.	For Level 1B, $FE_{CD,final}$, km/l;

"

Paragraph 4.6.2., Table A8/9, Step No. 7, amend to read:

"

7	Output step 1	E_{AC}, Wh;	Calculation of the electric energy consumption based on EAER according to paragraphs 4.3.3.1. and 4.3.3.2. of this annex. Output is available for each CD test. In the case that the interpolation method is applied, the output is available for each vehicle H, vehicle L and, if applicable, vehicle M.	EC, Wh/km; EC_p, Wh/km;
	Output step 3	EAER, km; $EAER_p$, km;		

"

Paragraph 4.6.3.2., Table A8/9b, Step No. 6, amend to read:

"

6	Output step 1	E_{AC}, Wh;	Calculation of the electric energy consumption based on EAER according to paragraphs 4.3.3.1. and 4.3.3.2. of this annex.
	Output step 2	EAER, km; $EAER_p$, km;	
			Output is available for each CD test.
			In the case that the interpolation method is applied, the output is available for each vehicle H, vehicle L and, if applicable, vehicle M.

"

Annex B8, Appendix 2

Paragraph 2.1., amend to read:

"2.1.   The CO_2 mass emission correction coefficient K_{CO2}, the fuel consumption correction coefficients $K_{fuel,FCHV}$, as well as, if required by the manufacturer, the phase-specific correction coefficients $K_{CO2,p}$ and $K_{fuel,FCHV,p}$ shall be developed based on the applicable charge-sustaining Type 1 test cycles.

In the case that vehicle H was tested for the development of the correction coefficient for CO_2 mass emission for NOVC-HEVs and OVC-HEVs, the coefficient may be applied to vehicles that fulfil the same interpolation family criteria. For interpolation families which fulfil the criteria of the K_{CO2} correction family, defined in paragraph 6.3.11. of this Regulation, the same K_{CO2} value may be applied."

Add a new paragraph 4., to read:

"4.   As an option for the manufacturer, it is allowed to apply $\Delta M_{CO2,j}$ defined in paragraph 4.5. of Appendix 2 to Annex B6 with the following modification:

$\eta_{alternator}$ is the efficiency of the alternator

0.67 in case $\Delta E_{REESS,p}$ is negative (corresponds to a discharge)

1.00 in case $\Delta E_{REESS,p}$ is positive (corresponds to a charge)

4.1.   In this case, the corrected charge-sustaining CO_2 mass emission defined in paragraphs 4.1.1.3., 4.1.1.4. and 4.1.1.5. of this annex shall be replaced by $\Delta M_{CO2,j}$ instead of $K_{CO2,j} \times EC_{DC,CS,j}$. "

Annex B8, Appendix 3

Paragraph 3., amend to read:

"3.   REESS voltage

3.1.   External REESS voltage measurement

During the tests described in paragraph 3. of this annex, the REESS voltage shall be measured with the equipment and accuracy requirements specified in paragraph 1.1. of this annex. To measure the REESS voltage using external measuring equipment, the manufacturers shall support the Type Approval Authority by providing REESS voltage measurement points and safety instructions.

3.2.   Nominal REESS voltage

For NOVC-HEVs, NOVC-FCHVs, OVC-HEVs and OVC-FCHVs, instead of using the measured REESS voltage according to paragraph 3.1. of this appendix, the nominal voltage of the REESS determined according to IEC 60050-482 may be used.

3.3. Vehicle on-board REESS voltage data

As an alternative to paragraphs 3.1. and 3.2. of this appendix, the manufacturer may use the on-board voltage measurement data. The accuracy of these data shall be demonstrated to the Type Approval Authority.

Table A8 App3/1

Test events	Para. 3.1.	Para. 3.2.		Para. 3.3.
		60V or more	Less than 60V	
NOVC-HEV	shall not to be used	shall be used		shall not to be used
OVC-HEV CS condition				
NOVC-FCHV				
OVC-FCHV CS condition				
REESS energy change-based correction procedure (Appendix 2)				
OVC-HEV CD condition	shall be used	shall not to be used	allowed to use	allowed to use
OVC-FCHV CD condition				
PEV				

"

Annex B8, Appendix 6

Paragraph 1.3., amend to read:

"1.3. On the basis of technical evidence provided by the manufacturer and with the agreement of the Type Approval Authority, the dedicated driver-selectable modes, such as "mountain mode" or "maintenance mode" which are not intended for normal daily operation but only for special limited purposes, shall not be considered. Irrespective of the driver-selectable mode selected for the Type 1 test according to paragraph 2. and 3. of this appendix, the vehicle shall comply with the criteria emissions limits in all remaining driver-selectable modes used for forward driving."

Paragraph 3.2., amend to read:

"3.2. If there is no predominant mode or if there is a predominant mode but this mode does not enable the vehicle to follow the reference test cycle under charge-sustaining operating condition, the mode for the test shall be selected according to the following conditions:

(a) If there is only one mode which allows the vehicle to follow the reference test cycle under charge-sustaining operating conditions, this mode shall be selected;

(b) If several modes are capable of following the reference test cycle under charge-sustaining operating conditions and none of those modes is a configurable start mode, the vehicle shall be tested for criteria emissions, CO_2 emissions in the best case mode and worst case mode. Best and worst case modes shall be identified by the evidence provided on the CO_2 emissions in all modes. CO_2 emissions shall be the arithmetic average of the test results in both modes. Test results for both modes shall be recorded.

At the request of the manufacturer, the vehicle may alternatively be tested with the driver-selectable mode in the worst case position for CO_2 emissions.

(c)   If several modes are capable of following the reference test cycle under charge-sustaining operating conditions and at least two or more of those modes are a configurable start mode, the worst case mode for CO_2 emissions and fuel consumption shall be selected from these configurable start modes."

Annex C4

Paragraph 1.5., amend to read:

"1.5.   This paragraph is applicable for Level 1A only

At the request of the manufacturer, the Technical Service may carry out the Type 1 test before the whole vehicle or bench ageing durability test has been completed using the assigned deterioration factors in Table 3A in paragraph 6.7.2. of this Regulation. On completion of the whole vehicle or bench ageing durability test, the Technical Service may then amend the type approval results recorded in Annex A2 to this Regulation by replacing the assigned deterioration factors in the above table with those measured in the whole vehicle or bench ageing durability test."

Annex C5

Paragraph 3.3.5., amend to read:

"3.3.5.   Manufacturers may demonstrate to the Type Approval Authority that certain components or systems need not be monitored if, in the event of their total failure or removal, emissions do not exceed the OBD thresholds set out in paragraph 6.8.2. of this Regulation.

3.3.5.1.   For Level 1A only

The following devices should however be monitored for total failure or removal (if removal would cause the applicable emission limits in paragraph 6.3.10. of this Regulation to be exceeded):

(a)   A particulate trap fitted to compression ignition engines as a separate unit or integrated into a combined emission control device;

(b)   A NO_x after treatment system fitted to compression ignition engines as a separate unit or integrated into a combined emission control device;

(c)   A Diesel Oxidation Catalyst (DOC) fitted to compression ignition engines as a separate unit or integrated into a combined emission control device.

3.3.5.2.   For Level 1A only

The devices referred to in paragraph 3.3.5.1. of this annex shall also be monitored for any failure that would result in exceeding the applicable OBD thresholds set out in in paragraph 6.8.2. of this Regulation. "

Paragraph 4.2.2., amend to read:

"4.2.2.   For Level 1A

The Type Approval Authority will not accept any deficiency request that does not respect the OBD thresholds set out in paragraph 6.8.2. of this Regulation.

For Level 1B

The Type Approval Authority shall reject any deficiency request that does not respect the OBD thresholds set out in regional legislation multiplied by a factor required by regional legislation up to a maximum factor of two."