

Proposal for amendments to ECE/TRANS/WP.29/GRPE/2016/3 (gtr 15 - WLTP)

Submitted by the experts from OICA and the Informal Working Group on Worldwide harmonized Light vehicles Test Procedure (WLTP)

This document is a proposal to amend and complete the GRPE working document ECE/TRANS/WP.29/GRPE/2016/3, submitted by the Informal Working Group on Worldwide harmonised Light vehicles Test Procedure (WLTP).

The proposal is a collection of editorial corrections and improvements that have been identified since the last Informal Working Group meeting (WLTP-12) held in Tokyo between 28/9/15 and 2/10/15.

Not all of the content of this paper originates from OICA members. Interested parties agreed that a consolidated paper would be beneficial to all participants. Sadly the Drafting Coordinator is currently not being funded by Contracting Parties and so OICE has by exception accepted the task of consolidation of the amendments.

I. Proposal for amending ECE/TRANS/WP.29/GRPE/2016/3 (text changes)

II. Text of the global technical regulation

Proposal:

Amend paragraph 3.2.19. to read:

“3.2.19. “Target road load” means the road load to be reproduced on the chassis dynamometer”

Justification:

Clarification

Proposal:

Amend the point “AC” in paragraph 4.1.to read:

AC	<u>Alternating</u> current
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Justification:

Correction

Proposal:

Amend the last sentence of paragraph 5.6.1.to read:

“

Vehicles may only be part of the same interpolation family if they belong to the same vehicle class as described in paragraph 2 of Annex 1.”

Justification:

As the terminology “vehicle class” occurs in a number of contexts, this amendment would improve clarity.

Proposal:

Amend the first sentence of paragraph 5.6.2. to read:

“5.6.2. ~~Without prejudice~~ **In addition** to the requirements of paragraph 5.6.1., only OVC-HEVs and NOVC-HEVs that are identical with respect to the following characteristics may be part of the same interpolation family.
.....”

Justification:

As the requirements of paragraph 5.6.1. apply only to ICE vehicles, the words “in addition” are more appropriate than “without prejudice”

Proposal:

Amend sub-paragraph 5.7. (b) to read:

(b) **n/v ratios** (engine rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to the transmission ratios of the most commonly installed transmission type is within 25 per cent;

Justification:

Consistency with preceding paragraphs

Annex 1

Proposal:

Amend paragraph 1.1. to read:

“1.1. The cycle to be driven depends on the **ratio of the** test vehicle’s rated power to mass in running order, W/kg, and its maximum velocity, v_{max} . ~~and its mass, kg~~
The cycle resulting from the requirements described in this annex shall be referred to in other parts of the GTR as the "applicable cycle".”

Justification:

Improved consistency and clarity.

Proposal:

Amend the first sentence of paragraph 8.2.1. to read:

“8.2.1. Downscaling procedure for Class 1 vehicles
Figure A1/14 shows ~~an example for~~ a downscaled medium speed phase of the Class 1 WLTC **as an example**.
.....”

Justification:

A slight improvement to the text with no change of meaning.

Annex 2

Proposal:

Renumber paragraph 1.5. as 1.6 and insert a new paragraph 1.5. to read:

“**1.5 The prescriptions for the clutch operation shall not be applied if the clutch is operated automatically without the need of an engagement or disengagement by the driver.**”

~~1.5.~~ **1.6.** This annex shall not apply to vehicles tested according to Annex 8.”

Justification:

Clarification

Proposal:

Amend Paragraph 2 indent (c) to read:

“(c) n_{idle} , idling speed, min^{-1} ;

n_{idle} shall be measured over a period of at least 1 minute at a sampling rate of at least 1 Hz with the engine running in warm condition, the gear lever placed in neutral, and the clutch engaged. The conditions for temperature, peripherals, ~~and auxiliaries~~ and auxiliary devices, etc shall be the same as described in ~~the Annex 6 or for~~ the Type 1 test.

The value to be used in this Annex shall be the arithmetic average over the measuring period, rounded or truncated to the nearest 10 min^{-1} .”

Justification:

The terms “peripheral device” and “auxiliary device” are defined in the gtr and should be used.

Clarification of the reference to the “Type 1 test annex”

Proposal:

Amend Paragraph 2. indent (g) to read:

“(g) n_{max}

$n_{max_{95}}$, the minimum engine speed where 95 per cent of rated power is reached, min^{-1} ;

if $n_{max_{95}}$ is less than 65 per cent of n_{rated} , $n_{max_{95}}$ shall be set to 65 per cent of n_{rated} ;

If 65 per cent of n_{rated} , $\times ndv_3 / ndv_2 < n_{idle} + 0.125 \times (n_{rated} - n_{idle})$, $n_{max_{95}}$ shall be set to

$1.1 \times (n_{idle} + 0.125 \times (n_{rated} - n_{idle})) \times ndv_2 / ndv_3$

$n_{max}(ng_{vmax}) = ndv(ng_{vmax}) \times v_{max,cycle}$

where:

ng_{vmax} is defined in paragraph 2.(i) of this annex;

$v_{max,cycle}$ is the maximum speed of the vehicle speed trace according to Annex 1, km/h;

n_{max} is the maximum of $n_{max_{95}}$ and $n_{max}(ng_{vmax})$, min^{-1} .”

Justification:

This requirement is necessary in order to avoid a situation where no gear will be determined because once $n_{max_{95}}$ is reached in a specific gear (especially gear 2) the engine speed in the next higher gear would drop below $n_{min,drive}$.

Proposal:

Amend Paragraph 2. indent (i) to read:

“(i) ng_{vmax}

ng_{vmax} , the gear in which the maximum vehicle speed is reached and shall be determined as follows:

If $v_{max}(ng) \geq v_{max}(ng-1)$, then,

$ng_{vmax} = ng$

otherwise, $ng_{vmax} = ng - 1$

where:

$v_{max}(ng)$ is the vehicle speed at which the required road load power equals the available power, P_{wot} , in gear ng (see Figure A2/1a).

$v_{max}(ng-1)$ is the vehicle speed at which the required road load power equals the available power, P_{wot} , in the next lower gear (see Figure A2/1b).

The required road load power, kW, shall be calculated using the following equation:

$$P_{\text{Required}} = \frac{f_0 \times v_{\text{max}} + f_1 \times v_{\text{max}}^2 + f_2 \times v_{\text{max}}^3}{3600}$$

where:

v_{max} is the vehicle speed, km/h.

The available power at vehicle speed v_{max} in gear n_g or gear $n_g - 1$ may be determined from the full load power curve, $P_{woi}(n)$, by using the following equation:

$$n_{ng} = n v_{ng} \times v_{max}(ng); n_{ng-1} = n v_{ng-1} \times v_{max}(ng-1)$$

and by reducing the power values of the full load power curve by 10%, analogous to the following sections.”

Justification:

References to figures should be prefixed with the Annex.

Proposal:

Amend Paragraph 2. indent (k) to read:

“(k) Definition of n_{min_drive}

n_{min_drive} is the minimum engine speed when the vehicle is in motion, min^{-1} ;

For $n_{gear} = 1$, $n_{min_drive} = n_{idle}$,

For $n_{gear} = 2$,

(a) for transitions from 1st to 2nd gear ~~during accelerations from standstill:~~

$$n_{min_drive} = 1.15 \times n_{idle},$$

(b) for decelerations to standstill:

$$n_{min_drive} = n_{idle}.$$

(c) for all other driving conditions:

$$n_{min_drive} = 0.9 \times n_{idle}.$$

For $n_{gear} > 2$, n_{min_drive} shall be determined by :

$$n_{min_drive} = n_{idle} + 0.125 \times (n_{rated} - n_{idle}).$$

The final result for n_{min_drive} is rounded to the nearest integer. Example: 1199.5 is 1200, 1199.4 is 1199.

Higher values may be used if requested by the manufacturer.”

Justification:

The text in sub indent (a) should apply to all transitions from 1st to 2nd gear

For clarity, the rounding rules for n_{min_drive} should be stated.

Proposal:

Amend the titles of the figures following paragraph 2. To read

“Figure A2/1a” and

“Figure A2/1b”

Justification:

References to figures should be prefixed with the Annex.

Proposal:

Amend Paragraph 3.2. to read:

“3.2. Determination of engine speeds

For any $v_j \leq 1$ km/h, it shall be assumed that the vehicle is standing still and the engine speed shall be set to n_{idle} . The gear lever shall be placed in neutral with the clutch engaged except 1 second before beginning an acceleration from standstill where first gear shall be selected with the clutch disengaged.

For each $v_j \geq 1$ km/h of the cycle trace and each gear i , $i = 1$ to ng_{\max} , the engine speed, $n_{i,j}$, shall be calculated using the following equation:

$$n_{i,j} = ndv_i \times v_j$$

i.e. in the first sentence replace the “less than or equal to” symbol with a “less than” symbol.

Justification:

The incorrect symbol was included in the gtr

Proposal:

Amend Paragraph 3.3. to read:

“3.3. Selection of possible gears with respect to engine speed

The following gears may be selected for driving the speed trace at v_j :

(a) all gears $i < ng_{v_{\max}}$ where $n_{\min_drive} \leq n_{i,j} \leq n_{\max_95}$, **and**

(b) all gears $i \geq ng_{v_{\max}}$ where $n_{\min_drive} \leq n_{i,j} \leq n_{\max}(ng_{v_{\max}})$,

(c) gear 1, if $n_{i,j} < n_{\min_drive}$

If $a_j \leq 0$ and $n_{i,j} \leq$ ~~drops below~~ n_{idle} , $n_{i,j}$ shall be set to n_{idle} and the clutch shall be disengaged.

If $a_j > 0$ and $n_{i,j} \leq$ ~~drops below~~ $(1.15 \times n_{idle})$, $n_{i,j}$ shall be set to $(1.15 \times n_{idle})$ and the clutch shall be disengaged.”

i.e. after the sub indents, replace the words “drops below” symbol with a “less than” symbol.

Justification:

The word “and” in sub indent (a) is redundant

Sub indent (c) was missing from the gtr

The use of “less than” symbols is clearer than the words “drops below”.

Proposal:

Amend Paragraph 3.4. to read:

“3.4. Calculation of available power

The available power for each possible gear i and each vehicle speed value of the cycle trace, v_i , shall be calculated using the following equation:

$$P_{\text{available_ij}} = P_{\text{wot}}(n_{i,j}) \times (1 - (SM + ASM))$$

where:

P_{rated} is the rated power, kW;

P_{wot} is the power available at $n_{i,j}$ at full load condition from the full load power curve;

SM is a safety margin accounting for the difference between the stationary full load condition power curve and the power available during transition conditions. SM is set to 10 per cent;

ASM is an additional exponential power safety margin, which may be applied at the request of the manufacturer. ASM is fully effective between n_{idle} and n_{start} , and approaches zero exponentially at n_{end} as described by the following requirements:

If $n_{i,j} \leq n_{start}$, then $ASM = ASM_0$;

If $n_{i,j} > n_{start}$, then:

$$ASM = ASM_0 \times \exp(\ln(0.005/ASM_0) \times (n_{start} - n_{i,j}) / (n_{start} - n_{end}))$$

ASM₀, n_{start} and n_{end} shall be defined by the manufacturer but shall fulfil the following conditions:

$$n_{start} \geq n_{idle},$$

$$n_{end} > n_{start}.$$

If $a_i > 0$ and $i = 1$ or $i = 2$ and $P_{available_ij} < P_{required,j}$, $n_{i,j}$ shall be increased by increments of 1 min^{-1} until $P_{available_ij} = P_{required,j}$, and the clutch shall be disengaged.

i.e. after the clarification of the components of the formula, add the subscripts “i,j” to the letter n.

Justification:

The subscripts were missing from the gtr text.

The last sentence clarifies a situation that was previously not covered and needs a carriage return at the end before the paragraph number for 3.5..

Proposal:

Amend Paragraph 3.5. to read:

“3.5. Determination of possible gears to be used

The possible gears to be used shall be determined by the following conditions:

(a) The conditions of paragraph 3.3. are fulfilled, and

(b) $P_{available_ij} \geq P_{required,j}$

The initial gear to be used for each second j of the cycle trace is the highest final possible gear, ~~i_{max}~~ i_{max} . When starting from standstill, only the first gear shall be used.

The lowest final possible gear is i_{min} .”

Justification:

The subscript “max” was not correctly transposed in the gtr text.

The last sentence clarifies a situation that was previously not covered.

Proposal:

Amend Paragraph 4. indent (e) to read:

“(e) If the deceleration phase is the last part of a short trip shortly before a stop phase and the 2nd gear would only be used for up to two seconds, ~~the gear shall be set to 0 and~~ the clutch may be either disengaged or the gear lever placed in neutral and the clutch left engaged.

A downshift to first gear is not permitted during those deceleration phases.”

Justification:

The wording “the gear shall be set to 0” has the same meaning as ”the gear lever placed in neutral” and this duplication is therefore deleted.

Proposal:

Amend Paragraph 4. indent (f) to read:

“(f) If gear i is used for a time sequence of 1 to 5 seconds and the gear prior to this sequence is lower and the gear after this sequence is the same as or lower than the gear before this sequence, the gear for the sequence shall be corrected to the gear before the sequence.

Examples:

(i) gear sequence $i - 1, i, i - 1$ shall be replaced by $i - 1, i - 1, i - 1$;

(ii) gear sequence $i - 1, i, i, i - 1$ shall be replaced by $i - 1, i - 1, i - 1, i - 1$;

(iii) gear sequence $i - 1, i, i, i, i - 1$ shall be replaced by $i - 1, i - 1, i - 1, i - 1, i - 1$;

- (iv) gear sequence $i - 1, i, i, i, i, i - 1$ shall be replaced by $i - 1, i - 1$;
- (v) gear sequence $i - 1, i, i, i, i, i, i - 1$ shall be replaced by $i - 1, i - 1$.

In all cases (i) to (v), $g_{min} \leq i - 1 > i_{min}$ shall be fulfilled;”

Justification:

The term g_{min} was erroneous as it was not defined in the gtr.

Annex 3

Proposal:

Amend the content of the row “water content” and add a new row “appearance at -7°C” below it with the content “clear and bright”, to read:

“3.6. Gasoline/petrol (nominal 95 RON, E10)

Table A3/6

Gasoline/petrol (nominal 95 RON, E10)

Parameter	Unit	Limits ⁽¹⁾		Test method ⁽²⁾
		Minimum	Maximum	
Research octane number, RON ⁽³⁾		95.0	98.0	EN ISO 5164
Motor octane number, MON ⁽³⁾		85.0	89.0	EN ISO 5163
Density at 15 °C	kg/m ³	743.0	756.0	EN ISO 12185
Vapour pressure	kPa	56.0	60.0	EN 13016-1
Water content	% v/v		0.05	EN 12937
<u>Appearance at -7 °C</u>		<u>clear and bright</u>		
Distillation:				
.....				

Justification:

The maximum water content should appear in the “max.” column and appearance is a separate parameter, related to but not an answer to “water content”

Proposal:

Renumber paragraph 4.2.6. as paragraph 6. And move to the end of the annex. All further table numbers of this annex will also need revision:

Justification:

Fuel cells are not positive ignition engines and therefore a new section must be created.

Annex 4

Proposal:

Amend paragraph 4.2.1.4. to read:

“4.2.1.4. Application of the road load matrix family

A vehicle that fulfils the criteria of paragraph 5.8. of this gtr that is:

- (a) representative ~~of the intended series~~ of the intended series of complete vehicles to be covered by the road load matrix family in terms of estimated worst C_D value and body shape; and
- (b) representative of the intended series of vehicles to be covered by the road load matrix family in terms of estimated ~~arithmetic~~ average of the mass of optional equipment shall be used to determine the road load.

In the case that no representative body shape for a complete vehicle can be determined, the test vehicle shall be equipped with a square box with rounded corners with radii of maximum of 25 mm and a width equal to the maximum width of the vehicles covered by the road load matrix family, and a total height of the test vehicle of $3.0 \text{ m} \pm 0.1 \text{ m}$, including the box.

The manufacturer and the responsible authority shall agree which vehicle test model is representative.

The vehicle parameters test mass, tyre rolling resistance and frontal area of both a vehicle H_M and L_M shall be determined in such a way that vehicle H_M produces the highest cycle energy demand and vehicle L_M the lowest cycle energy from the road load matrix family. The manufacturer and the responsible authority shall agree on the vehicle parameters for vehicle H_M and L_M .

The road load of all individual vehicles of the road load **matrix** family, including H_M and L_M , shall be calculated according to paragraph 5.1. of this annex.”

Justification:

“of the intended series” was repeated

The word “arithmetic” was deleted in the text adopted in Tokyo

“road load matrix family” is the terminology that was agreed upon.

Proposal:

Amend paragraph 4.2.3. to read:

“4.2.3. Instrumentation

Any instruments shall be installed in such a manner as to minimise their effects on the aerodynamic characteristics of the vehicle.

If the effect of the installed instrument on $(C_D \times A_f)$ is expected to be greater than 0.015 m^2 , the vehicle with and without the instrument shall be measured in a wind tunnel fulfilling the criterion in paragraph 3.2. of this annex. The corresponding difference shall be subtracted from f_2 . At the request of the manufacturer, and with approval of the responsible authority, the determined value may be used for similar vehicles where the influence of the equipment is expected to be the same.”

Justification:

In the abbreviation for the coefficient of drag, the D is subscript i.e. C_D

Proposal:

Amend paragraph 4.4.4. to read:

“4.4.4. Running resistance curve determination

The arithmetic average speed and arithmetic average torque at each reference speed point shall be calculated using the following equations:

$$V_{jm} = \frac{1}{2} \times (v_{jma} + v_{jmb})$$

$$C_{jm} = \frac{1}{2} \times (C_{jma} + C_{jmb})$$

The following least squares regression curve of arithmetic average running resistance shall be fitted to all the data pairs (v_{jm}, C_{jm}) at all reference speeds described in paragraph 4.4.2.1. of this annex to determine the coefficients c_0 , c_1 and c_2 .

The coefficients, c_0 , c_1 and c_2 , as well as the coastdown times measured on the chassis dynamometer (see paragraph ~~8.2.3.3~~ **8.2.4**, of this annex) shall be recorded.

In the case that the tested vehicle is the representative vehicle of a road load matrix family, the coefficient c_1 shall be set to zero and the coefficients c_0 and c_2 shall be recalculated with a least squares regression analysis.”

Justification:

The paragraph reference appears incorrect.

Proposal:

In the explanation of the terms of the formula in paragraph 5.1.1.1., amend the last four terms to read:

“

- A_r is the frontal area of the individual vehicle of the road load **matrix** family, m²,
- A_{fr} is the frontal area of the representative vehicle of the road load matrix family, m²;
- RR is the tyre rolling resistance of the individual vehicle of the road load **matrix** family, kg/tonne;
- RR_r is the tyre rolling resistance of the representative vehicle of the road load matrix family, kg/tonne.”

Justification:

“road load matrix family” is the terminology that was agreed upon.

Proposal:

In the explanation of the terms of the formula in paragraph 5.1.2.1., amend the last four items to read:

“

- RR is the tyre rolling resistance of the individual vehicle of the road load **matrix** family, kg/tonne;
- RR_r is the tyre rolling resistance of the representative vehicle of the road load matrix family, kg/tonne;
- r’ is the dynamic radius of the tyre on the chassis dynamometer obtained at 80 km/h, m;
- 1.02 is **an approximate** coefficient compensating for drivetrain losses.”

Justification:

“road load matrix family” is the terminology that was agreed upon.

The addition of the word “approximate” makes the text consistent with paragraph 8.2.4.1.1.

Proposal:

Amend paragraph 6.7.3. to read:

“6.7.3. Calculation of road load values

The total road load as a sum of the results of paragraphs 6.7.1 and 6.7.2. of this annex shall be calculated using the following equation:

$$F_j^* = F_{Dj} + F_{Aj}$$

For all applicable reference speed points j, N;

For all calculated F_j^{*}, the coefficients f₀, f₁ and f₂ in the road load equation shall be calculated with a least squares regression analysis and shall be used as the target coefficients in paragraph 8.1.1. of this annex.

In the case that the vehicle(s) tested according the wind tunnel method is (are) representative of a road load matrix family vehicle, the coefficient f1 shall be set to zero and the coefficients f0 and f2 shall be recalculated with a least squares regression analysis.”

Justification:

The text is included in other road load determination methods but was not included when the wind tunnel method was added.

Proposal:

Amend paragraph 8.1.3.4. and 8.1.3.4.1. to read:

“8.1.3.4. For dynamometer load setting, two different methods may be used. If the vehicle is accelerated by the dynamometer, the methods described in paragraph 8.1.3.4.1. of

this annex shall be used. If the vehicle is accelerated under its own power, the methods in paragraphs 8.1.3.4.1. or 8.1.3.4.2. of this annex shall be used. The minimum acceleration multiplied by speed shall be ~~approximately 6 m²/sec³ or with the approval of the responsible authority up to approximately 10 or 15 m²/sec³.~~ **Vehicles which are unable to achieve 6 m²/s³ shall be driven with the acceleration control fully applied.**

8.1.3.4.1. Fixed run method”

Justification:

The 6 m²/m³ is very demanding in terms of distance and time (costs).

Therefore it is proposed to accelerate that process, with approval by the authority.

It saves 1 minute and approximately 1.8 km at each run (having at least 3 runs at each chassis dyno setting!).

It is recognised, that due to the new requirement in WLTP to accelerate by the vehicle (iterative method), this acceleration has to be feasible for any kind of vehicles.

The carriage return was missed between these two paragraphs.

Proposal:

Amend paragraph 8.1.3.4.1.1. to read:

“8.1.3.4.1.1. The dynamometer software shall ~~run~~ **perform four coastdowns in total: From the first coastdown, the dynamometer setting coefficients for the second subsequent run coastdowns according to paragraph 8.1.4. of this annex are calculated. The Following the first coastdown, the software shall run perform three additional runs coastdowns with either the fixed dynamometer setting coefficients determined after the first coastdown first run or the adjusted dynamometer setting coefficients according to paragraph 8.1.4. of this annex.**”

Justification:

The previous text was open to misinterpretation and could be understood to demand 4 or 5 runs. The intent was 4 runs and the text has therefore been modified without amending the meaning as discussed in the Informal Working Group.

Proposal:

Amend paragraph 8.2. to read:

“8.2. Chassis dynamometer load setting using the torque meter method

This method is applicable when the running resistance is determined using the torque meter method described in paragraph 4.4. of this annex.

In the case of a road load matrix family, this method shall be applied when the running resistance of the representative vehicle is determined using the torque meter method as specified in paragraph 4.4. of this annex. The target ~~road load~~ **running resistance** values are the values calculated using the method specified in paragraph 5.1. of this annex.”

Justification:

“running resistance” is the terminology used in the rest of the gtr.

Annex 5

Proposal:

Amend paragraph 1.1.2. (b) to read:

“(b) For fans with circular ~~fan~~ **outlets**, the outlet shall be divided into 8 equal sectors by vertical, horizontal and 45° lines. The measurement points shall lie on the radial centre line of each arc sector (22.5°) at two-thirds of the outlet radius (as shown in Figure A5/2).”

Justification:

Correction of editorial failure

Proposal:

Amend paragraph 4.1.4.10. to read:

“4.1.4.10. Nitrous oxide (N₂O) analysis with IR-absorption spectrometry (if applicable)

The analyser shall be a laser infrared spectrometer defined as modulated high resolution narrow band infrared analyser (**e.g. OCL**). An NDIR or FTIR may also be used but water, CO and CO₂ interference shall be taken into consideration.”

Justification:

Establishes link to previous paragraph

Proposal:

Amend paragraphs 4.2.2. and 4.2.2.1. to read:

“4.2.2. Weighing chamber (**or room**) and analytical balance specifications

4.2.2.1. Weighing chamber (**or room**) conditions

- (a) The temperature of the weighing chamber (or room) in which the particulate sampling filters are conditioned and weighed shall be maintained to within 22 °C ± 2 °C (22 °C ± 1 °C if possible) during all filter conditioning and weighing.
- (b) Humidity shall be maintained at a dew point of less than 10.5 °C and a relative humidity of 45 per cent ± 8 per cent.
- (c) Limited deviations from weighing **chamber (or room)** temperature and humidity specifications shall be permitted provided their total duration does not exceed 30 minutes in any one filter conditioning period.
- (d) The levels of ambient contaminants in the weighing chamber (or room) environment that would settle on the particulate sampling filters during their stabilisation shall be minimised.

(e) During the weighing operation no deviations from the specified conditions are permitted.”

Justification:

Both terms “chamber” and “room” are used in the text and both are potentially correct, as however they can be interpreted differently, the terminology used in 4.2.2.1. (a) should be adopted.

Annex 6

Proposal:

Amend paragraph 1.1.2.3.2. to read:

“1.1.2.3.2. Depending on the vehicle type, the manufacturer shall declare as applicable the total cycle value of the CO₂ mass emission, the electric energy consumption, **fuel consumption for NOVC-FCHV** as well as PER and AER according to Table A6/1.

Justification:

The text was agreed in IWG 12 but not integrated into the gtr and links to the modification to Table A6/1.

Proposal:

Add a new paragraph 1.1.2.3.9. to read:

“**1.1.2.3.9. In the case that a test result or an average of test results was taken and confirmed as the type approval value, this result is referred to as “declared value” for further calculations.**”

Justification:

The text was agreed in IWG 12 but not integrated into the gtr.

Proposal:

Add a new row and a new column to Table A6/1 to read:

Vehicle type		$M_{CO_2}^{(2)}$ (g/km)	<u>FC</u> <u>(kg/100km)</u>	Electric energy consumption ⁽³⁾ (Wh/km)	All electric range / Pure Electric Range ⁽³⁾ (km)
Vehicles tested according to Annex 6 (ICE)		M_{CO_2} Paragraph 3. of Annex 7	-	-	-
<u>NOVC-FCHV</u>			<u>FC_{CS}</u> <u>Paragraph 4.2.1.2.1. of Annex 8</u>		
NOVC-HEV		$M_{CO_2,CS}$ Paragraph 4.1.1. of Annex 8	-	-	-
OVC-HEV	CD	$M_{CO_2,CD}$ Paragraph 4.1.2. of Annex 8		$EC_{AC,CD}$ Paragraph 4.3.1. of Annex 8	AER Paragraph 4.4.1.1. of Annex 8
	CS	$M_{CO_2,CS}$ Paragraph 4.1.1. of Annex 8		-	-
PEV		-		EC_{WLTC} Paragraph 4.3.4.2. of Annex 8	PER_{WLTC} Paragraph 4.4.2. of Annex 8

(1) The declared value shall be the value that the necessary corrections are applied (i.e. Ki correction and the other regional corrections)

(2) Rounding xxx.xx

(3) Rounding xxx.x

Justification:

The text was agreed in IWG 12 but not integrated into the gtr.

Proposal:

Amend the header of the 5th column of the second sub-table in Table A6/2 to read:

	Test	Judgement parameter	Criteria emissions	$M_{CO_2,CD}$	AER
Row 1	First test	First test results	\leq Regulation limit $\times 0.9^{(1)}$	\leq Declared value $\times dCO_2^{(3)}$	\geq Declared value $\times 1.0$
Row 2	Second test	Arithmetic average of the first and second test results	\leq Regulation limit $\times 1.0^{(2)}$	\leq Declared value $\times dCO_2^{(3)}$	\geq Declared value $\times 1.0$
Row 3	Third test	Arithmetic average of three test results	\leq Regulation limit $\times 1.0^{(2)}$	\leq Declared value $\times dCO_2^{(3)}$	\geq Declared value $\times 1.0$

(1) "0.9" shall be replaced by "1.0" for charge depleting Type 1 test for OVC-HEVs, only if the charge depleting test contains two or more applicable WLTC cycles.

(2) Each test result shall fulfil the regulation limit.

(3) dCO_2 , dCO_2 and dCO_2 shall be determined according to paragraph 1.1.2.3.8. of this annex.

Justification:

The suffix "CD" was lost in the transposition.

Proposal:

Add a fourth sub table to Table A6/2 to read:

“For NOVC-FCHVs

	<u>Test</u>	<u>Judgement parameter</u>	<u>FC_{CS}</u>
Row 1	First test	First test results	< Declared value × 1.0
Row 2	Second test	Arithmetic average of the first and second test results	< Declared value × 1.0
Row 3	Third test	Arithmetic average of three test results	< Declared value × 1.0

“

Justification:

The text was agreed in IWG 12 but not integrated into the gr.

Proposal:

Amend paragraph 1.2.1.3.2.1. to read:

“1.2.1.3.2.1. Where the Contracting Party permits subtraction of either dilution air or dilution tunnel background particle number from emissions measurements ~~or~~ **and** a manufacturer requests a background correction, these background levels shall be determined as follows:

Justification:

Correction.

Proposal:

Amend paragraph 1.2.2.2.1.1. to read:

“1.2.2.2.1.1. The test cell shall have a temperature set point of 23 °C. The tolerance of the actual value shall be within ±5 °C. The air temperature and humidity shall be measured at the ~~vehicle~~ cooling fan outlet at a minimum frequency of 1 Hz. For the temperature at the start of the test, see paragraph 1.2.8.1. in Annex 6.”

Justification:

The cooling fan being referred to is the one in the laboratory that cools the vehicle and not one that is fitted to the vehicle, this deletion should clarify this.

Proposal:

Delete the last sentence from paragraph 1.2.4.2.2.:

~~**Auxiliary devices shall be switched off or deactivated during dynamometer operation unless their operation is required by regional legislation.**~~

Justification:

The text is a repeat of paragraph 1.2.4.2.1.

Proposal:

Amend paragraphs 1.2.8.2. and 1.2.8.2.1. to read:

“1.2.8.2. The test vehicle shall be pushed onto a dynamometer.
1.2.8.2.1. The drive wheels of the vehicle shall be placed on the dynamometer without starting the engine.”

Justification:

The carriage return between the paragraphs was missing.

Proposal:

Amend paragraph 1.2.10.1.2.1. to read:

“1.2.10.1.2.1. At least 1 hour before the test, the filter shall be placed in a petri dish protecting against dust contamination and allowing air exchange, and placed in a weighing chamber **(or room)** for stabilization.

At the end of the stabilization period, the filter shall be weighed and its weight shall be recorded. The filter shall subsequently be stored in a closed petri dish or sealed filter holder until needed for testing. The filter shall be used within 8 hours of its removal from the weighing chamber **(or room)**.

The filter shall be returned to the stabilization room within 1 hour after the test and shall be conditioned for at least 1 hour before weighing.”

Justification:

Both terms “chamber” and “room” are used in the text and both are potentially correct, as however they can be interpreted differently, the terminology used in Annex 5 paragraph 4.2.2.1. (a) should be adopted.

Proposal:

Amend paragraph 1.2.14.3.1. to read:

“1.2.14.3.1. The particulate sample filter shall be returned to the weighing chamber **(or room)** no later than 1 hour after completion of the test. It shall be conditioned in a petri dish, which is protected against dust contamination and allows air exchange, for at least 1 hour, and weighed. The gross weight of the filter shall be recorded.”

Justification:

Both terms “chamber” and “room” are used in the text and both are potentially correct, as however they can be interpreted differently, the terminology used in Annex 5 paragraph 4.2.2.1. (a) should be adopted.

Proposal:

Amend paragraph 1.2.14.3.3. and 1.2.14.3.4. to read:

“1.2.14.3.3. If the specific weight of any reference filter changes by more than $\pm 5\mu\text{g}$ between sample filter weighings, the sample filter and reference filters shall be reconditioned in the weighing **chamber (or room)** and reweighed.

1.2.14.3.4. The comparison of reference filter weighings shall be made between the specific weights and the rolling arithmetic average of that reference filter's specific weights. The rolling arithmetic average shall be calculated from the specific weights collected in the period after the reference filters were placed in the weighing **chamber (or room)**. The averaging period shall be at least one day but not more than 15 days.”

Justification:

Both terms “chamber” and “room” are used in the text and both are potentially correct, as however they can be interpreted differently, the terminology used in Annex 5 paragraph 4.2.2.1. (a) should be adopted.

Proposal:

Amend paragraph 1.2.14.3.6. and 1.2.14.3.7. to read:

“1.2.14.3.6. In the case that less than half of the reference filters meet the $\pm 5\mu\text{g}$ criterion, the sample filter shall be discarded, and the emissions test repeated. All reference filters shall be discarded and replaced within 48 hours. In all other cases, reference filters shall be replaced at least every 30 days and in such a manner that no sample filter is weighed without comparison to a reference filter that has been present in the weighing **chamber (or room)** for at least one day.

1.2.14.3.7. If the weighing **chamber (or room)** stability criteria outlined in paragraph 4.2.2.1. of Annex 5 are not met, but the reference filter weighings meet the above criteria,

the vehicle manufacturer has the option of accepting the sample filter weights or voiding the tests, repairing the weighing **chamber (or room)** control system and re-running the test.”

Justification:

Both terms “chamber” and “room” are used in the text and both are potentially correct, as however they can be interpreted differently, the terminology used in Annex 5 paragraph 4.2.2.1. (a) should be adopted.

Annex 6, Appendix 1

Proposal:

Amend paragraph 1.2.to read:

“1.2. During cycles where regeneration occurs, emission standards need not apply. If a periodic regeneration occurs at least once per Type 1 test and has already occurred at least once during vehicle preparation, it does not require a special test procedure. **This In this case, this** appendix does not apply.”

Justification:

The last sentence was not linked to the previous ones.

Proposal:

Amend the last sentence of paragraph 2. to read:

“.....

At the request of the manufacturer and with **approval agreement** of the **responsible** authority, an "engineering control unit" which has no effect on original engine calibrations can be used during K_i determination.”

Justification:

This amendment makes the terminology consistent with the rest of the gtr.

Annex 6, Appendix 2

Proposal:

Amend paragraph 4.5. to read:

“4.5. The resulting CO₂ mass emission difference for the considered period j due to load behaviour of the alternator for charging a REESS shall be calculated using the following equation:

$$\Delta M_{CO_2,j} = \frac{1}{0.0036} 0.0036 \times \Delta E_{REESS,j} \times \frac{1}{\eta_{alternator}} \times Willans_{factor} \times \frac{1}{d_j}$$

where:

$\Delta M_{CO_2,j}$ is the resulting CO₂ mass emission difference of period j, g/km;

$\Delta E_{REESS,j}$ is the REESS energy change of the considered period j calculated according to paragraph 4.1. of this appendix, Wh;

d_j is the driven distance of the considered period j, km;

j is the index number for the considered period, where a period shall be any applicable cycle phase, combination of cycle phases and the applicable total cycle;

$\frac{1}{0.0036} 0.0036$ is the conversion factor **from Wh to g/km MJ**;

$\eta_{alternator}$ is the efficiency of the alternator according to paragraph 4.4. of this appendix;

Willans_{factor} is the combustion process specific Willans factor as defined in Table A6.App2/3, gCO₂/MJ;”

Justification:

The formula is wrong (it would correct for millions of grams CO₂).

Explanation: It corrects Delta_E_REESS from Wh to MJ, so * 3600 / 1000000 = 0.0036.

Proposal:

Insert new paragraph 4.5.1. to read:

“4.5.1. The CO₂ values of each phase and the total cycle shall be corrected as follows:

$$M_{CO_2,p,3} = M_{CO_2,p,1} - \Delta M_{CO_2,j}$$

$$M_{CO_2,c,3} = M_{CO_2,c,2} - \Delta M_{CO_2,j}$$

where

$\Delta M_{CO_2,j}$ is the result from paragraph 4.5. of this Annex for a period j, g/km.”

Justification:

The CO₂-result follows the Delta-RCB, so the correction should have a minus.

It is probably clear, but should be written to avoid misunderstandings.

Annex 7

Proposal:

Amend paragraph 1.4. to read:

“1.4. Stepwise prescription for calculating the final test results for vehicles using combustion engines

The results shall be calculated in the order described in ~~the~~ Table A7/1. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

For the purpose of this table, the following nomenclature within the equations and results is used:

c complete applicable cycle;

p every applicable cycle phase;

i every applicable criteria emission component, without CO₂;

CO₂ CO₂ emission.”

Justification:

The table reference was incomplete and the English has been improved.

Proposal:

Amend the title of Table 7/1 and the content of the “Process” column in Table A7/1 for steps 8 and 10 to read:

“Table A7/1

Procedure for calculating final test results

Output steps 6 and 7	$M_{i,c,6}$, g/km; $M_{CO_2,c,7}$, g/km; $M_{CO_2,p,7}$, g/km.	Calculation of fuel consumption. Annex 7, paragraph 6 . The calculation of fuel consumption shall be performed for the applicable cycle and its phases separately. For that purpose: (a) the applicable phase or cycle CO ₂ values shall be used; (b) the criteria emission over the complete cycle shall be used. and: $M_{i,c,8} = M_{i,c,6}$ $M_{CO_2,c,8} = M_{CO_2,c,7}$ $M_{CO_2,p,8} = M_{CO_2,p,7}$	$FC_{c,8}$, l/100km; $FC_{p,8}$, l/100km; $M_{i,c,8}$, g/km; $M_{CO_2,c,8}$, g/km; $M_{CO_2,p,8}$, g/km.	8 "result of a Type 1 test for a test vehicle"
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Source	Input	Process	Output	Step No.
Step 9	$M_{CO_2,c,H}$, g/km; $M_{CO_2,p,H}$, g/km; $FC_{c,H}$, l/100km; $FC_{p,H}$, l/100km; and if a vehicle L was tested: $M_{CO_2,c,L}$, g/km; $M_{CO_2,p,L}$, g/km; $FC_{c,L}$, l/100km; $FC_{p,L}$, l/100km.	Fuel consumption and CO ₂ calculations for individual vehicles in an CO ₂ interpolation family. Annex 7, paragraph 3.2.3 . CO ₂ emissions must be expressed in grams per kilometre (g/km) rounded to the nearest whole number; FC values shall be rounded to one decimal place, expressed in (l/100km).	$M_{CO_2,c,ind}$ g/km; $M_{CO_2,p,ind}$, g/km; $FC_{c,ind}$ l/100km; $FC_{p,ind}$, l/100km.	10 "result of an individual vehicle" Final CO ₂ and FC result

“

Justification:

The table reference was incomplete

The word “paragraph” was omitted

Proposal:

Amend paragraph 3.2.3.2.1. to read:

“3.2.3.2.1. Fuel consumption and CO₂ emissions of test vehicles L and H

The mass of CO₂ emissions, M_{CO_2-L} , and M_{CO_2-H} and its phases p, $M_{CO_2-L,p}$ and $M_{CO_2-H,p}$, of test vehicles L and H, used for the following calculations, shall be taken from step 9 of Table A7/1.

Fuel consumption values are also taken from step 9 of Table A7/1 and are referred to as $FC_{L,p}$ and $FC_{H,p}$.”

Justification:

The table reference was incomplete (twice)

Proposal:

Amend paragraph 3.2.3.2.2.1. to read:

“3.2.3.2.2.1. Mass of an individual vehicle

The test masses of vehicles H and L shall be used as input for the interpolation method.

TM_{ind} , in kg, shall be the individual test mass of the vehicle according to paragraph 3.2.25. of ~~H. text of the global technical~~ **this** regulation.

If the same test mass is used for test vehicles L and H, the value of TM_{ind} shall be set to the mass of test vehicle H for the interpolation method.”

Justification:

The body of a regulation is normally referred to as “this regulation”.

Proposal:

Amend the last sentence of paragraph 3.2.3.2.2.4. to read:

“.....

In the case of a road load matrix family, the road load coefficients f_0 , f_1 and f_2 for an individual vehicle shall be calculated according to the equations in paragraph ~~5.1.2~~ 5.1.1 of Annex 4.

Justification:

Correction of an incorrect reference.

Proposal:

Amend paragraph 3.2.4.1. to read:

“3.2.4.1. Determination of fuel consumption and CO₂ emissions of vehicles L_M and H_M

The mass of CO₂ emissions M_{CO_2} of vehicles L_M and H_M shall be determined according to the calculations in paragraph 3.2.1. of this annex for the individual cycle phases p of the applicable WLTC and are referred to as ~~table~~ $M_{CO_2-LM,p}$ and $M_{CO_2-HM,p}$ respectively. Fuel consumption for individual cycle phases of the applicable WLTC shall be determined according to paragraph 6. of this annex and are referred to as $FC_{LM,p}$ and $FC_{HM,p}$ respectively.”

Justification:

The word “table” appears to have been inserted erroneously.

Proposal:

Amend paragraph 3.2.3.4.1.1. to read:

“3.2.4.1.1.1. Mass of an individual vehicle

The test masses of vehicles H_M and L_M selected according to paragraph 4.2.1.4. of Annex 4 shall be used as input.

TM_{ind} , in kg, shall be the test mass of the individual vehicle according to the definition of test mass in paragraph 3.2.25. of ~~H. text of the global technical~~ this regulation.

If the same test mass is used for vehicles L_M and H_M , the value of TM_{ind} shall be set to the mass of vehicle H_M for the road load matrix family method.”

Justification:

The body of a regulation is normally referred to as “this regulation”.

Proposal:

Amend paragraph 4. to read:

“4. Determination of PN (if applicable)”

Justification:

The inclusion of “if applicable” after references to PN was requested by Japan in IWG 12 but one instance was missed.

Proposal:

Amend paragraph 6.2. to read:

“6.2. The fuel consumption values shall be calculated from the emissions of hydrocarbons, carbon monoxide, and carbon dioxide using the results of step 6 for criteria emissions and step 7 for CO₂ of Table A7/1.”

Justification:

The table reference was incomplete

Annex 8

Proposal:

Add another row to Table A8/2 so that the table reads:

“

<i>Parameter</i>	<i>Units</i>	<i>Communication of final test result</i>
PER _(p) ⁽²⁾ , PER _{city} , AER _(p) ⁽²⁾ , AER _{city} , EAER _(p) ⁽²⁾ , EAER _{city} , R _{CDA} ⁽¹⁾ , R _{CDC}	km	Rounded to nearest whole number
FC _{CS(p)} ⁽²⁾ , FC _{CD} , FC _{weighted} for HEVs	l/100 km	Rounded to the first place of decimal
FC _{CS(p)} ⁽²⁾ for FCHVs	kg/100 km	Rounded to the second place of decimal
M _{CO2,CS(p)} ⁽²⁾ , M _{CO2,CD} , M _{CO2,weighted}	g/km	Rounded to the nearest whole number
EC _(p) ⁽²⁾ , EC _{city} , EC _{AC,CD} , EC _{AC,weighted}	Wh/km	Rounded to the nearest whole number
E_{AC}	kWh	<u>Rounded to the first place of decimal</u>

⁽¹⁾ no vehicle individual parameter.

⁽²⁾ (p) means the considered period which can be a phase, a combination of phases or the whole cycle”

Justification:

The value E_{AC} has to be measured but there is no requirement in the gtr to communicate this measurement.

Proposal:

Amend paragraph 2.1. to read:

“2.1. For all OVC-HEVs, NOVC-HEVs, **NOVC-FCHVs** and PEVs, the following shall apply:

- (a) Without prejudice to the requirements of paragraph 1.2.3.3. of Annex 6, the vehicles tested according to this annex shall have been run-in at least 300 km with those REESSs installed;
- (b) In the case that the REESSs are operated above the normal operating temperature range, the operator shall follow the procedure recommended by the vehicle manufacturer in order to keep the temperature of the REESS in its normal operating range. The manufacturer shall provide evidence that the thermal management system of the REESS is neither disabled nor reduced.”

Justification:

The text was agreed in IWG 12 but not integrated into the gtr.

Proposal:

Amend paragraph 3.1.1.5. to read:

3.1.1.5. For OVC-HEVs and NOVC-HEVs, gaseous emission compounds, shall be analysed for each individual test phase. It is permitted to omit the phase analysis for phases where no combustion engine **operates starts to consume fuel**.

Justification:

The formulation was open to incorrect interpretation.

Proposal:

Amend paragraph 3.2.4.2.1. to read:

“3.2.4.2.1. The test shall be carried out with a fully charged REESS according to the charging requirements as described in paragraph ~~2.2.5.~~ 2.2.3. of Appendix 4 to this Annex and with the vehicle operated in charge-depleting operating condition as defined in paragraph 3.3.5. of this gtr”

Justification:

The paragraph referenced was incorrect and should be corrected

Proposal:

Amend paragraph 3.4.4.3.1. to read:

“3.4.4.3.1. After coming to a standstill according to paragraph 3.4.4.1.3. of this Annex for the consecutive cycle Type 1 test procedure and in paragraph 3.4.4.2.3. of this Annex for the shortened Type 1 test procedure, the vehicle shall be connected to the mains within 120 minutes.

The REESS is fully charged when the end-of-charge criterion, as defined in paragraph ~~3.1.~~ 2.2.3.2. of Appendix 4 to this Annex, is reached.”

Justification:

The hyphenation was missing from “end-of-charge”

The paragraph referenced was incorrect and should be corrected

Proposal:

Amend paragraph 3.4.4.3.2. to read:

“3.4.4.3.2. The energy measurement equipment, placed between the vehicle charger and the mains, shall measure the recharged electric energy EAC delivered from the mains as well as its duration. Electric energy measurement may be stopped when the end-of-charge criterion, as defined in paragraph ~~3.4.~~ 2.2.3.2. of Appendix 4 to this Annex, is reached.”

Justification:

The paragraph referenced was incorrect and should be corrected

Proposal:

Amend paragraph 3.5.3.1. to read:

“3.5.3.1. Vehicles shall be tested according to the Type 1 test procedure described in Annex 6 and fuel consumption ~~measured~~ calculated according to Appendix 7 to this annex.”

Justification:

Fuel consumption is calculated according to the gtr, not measured.

Proposal:

Amend the 9th row of Table A8/5 (step 8) to read:

Output from steps Nos. 6 and 7 of this table.	For each of the test vehicles H and L: $M_{i,CS,c,6}$, g/km; $M_{CO_2,CS,c,7}$, g/km; $M_{CO_2,CS,p,7}$, g/km.	If in addition to a test vehicle H a test vehicle L was also tested, the resulting criteria emission values of L and H shall be the average and are referred to as $M_{i,CS,c}$ At the request of a Contracting Party, the averaging of the criteria emissions may be omitted and the values for vehicle H and L remain separated. Otherwise, if no vehicle L was tested, $M_{i,CS,c} = M_{i,CS,c,6}$ For CO ₂ the values derived in step 8 of this Table shall be used. CO ₂ values shall be rounded to two decimal places.	$M_{i,CS,c}$, g/km; $M_{CO_2,CS,c,H}$, g/km; $M_{CO_2,CS,p,H}$, g/km; and if a vehicle L was tested: $M_{CO_2,CS,c,L}$, g/km; $M_{CO_2,CS,p,L}$, g/km.	8 "interpolation family result" final criteria emission result
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Justification:

The row currently refers to itself, the correct reference would be to the previous row (step 7).

Proposal:

Amend the second formula in paragraph 4.3.3.1. to read:

$$EC = \frac{E_{AC}}{E_{AER}} \text{ †}$$

Justification:

The letter a following the formula is a typographical error.

Proposal:

In paragraph 4.4.2.1.3., remove the words “Type 1” from the explanations of $EC_{DC,p,j}$ and $K_{p,j}$ to read:

“.....”

$EC_{DC,p,j}$ is the electric energy consumption for phase p where the first phase p of DS₁ is indicated as j = 1, the second phase p of DS₁ is indicated as j = 2, the first phase p of DS₂ is indicated as j = 3 and the second phase p of DS₂ is indicated as j = 4 of the shortened Type 1 test procedure ~~Type 1~~ according to paragraph 4.3. of this annex, Wh/km;

$K_{p,j}$ is the weighting factor for phase p where the first phase p of DS₁ is indicated as j = 1, the second phase p of DS₁ is indicated as j = 2, the first phase p of DS₂ is indicated as j = 3, and the second phase p of DS₂ is indicated as j = 4 of the shortened Type 1 test procedure ~~Type 1~~;

..... “

Justification:

Typographical error.

Proposal:

Amend the second formula in paragraph 4.4.4.2. to read:

$$M_{CO_2,CD,avg,p} = \frac{\sum_{c=1}^{n_c} (M_{CO_2,CD,p,c} \times d_{p,c})}{\sum_{c=1}^{n_c} d_{p,c}} \text{ †}$$

i.e. (as the deletions and additions cannot be clearly displayed in this paper) replace the counter k with n_c in the denominator.

Justification:

The amendment was included in draft amendments to Annex 8 but was missed in the transposition to the gtr.

Proposal:

Amend paragraph 4.5.3. to 4.5.7.3. to read:

“4.5.3. Calculation of the interpolation coefficient **for individual vehicles** $K_{\text{intind},p}$

The interpolation coefficient $K_{\text{intind},p}$ per period shall be calculated for each considered period p using the following equation:

$$K_{\text{intind},p} = \frac{E_{3,p} - E_{1,p}}{E_{2,p} - E_{1,p}}$$

where:

$K_{\text{intind},p}$ is the interpolation coefficient for the considered individual vehicle for period p;

$E_{1,p}$ is the energy demand for the considered period for vehicle L according to paragraph 5. of Annex 7, Ws;

$E_{2,p}$ is the energy demand for the considered period for vehicle H according to paragraph 5. of Annex 7, Ws;

$E_{3,p}$ is the energy demand for the considered **phase period** for the individual vehicle according to paragraph 5. of Annex 7, Ws;

p is the index of the individual period within the applicable test cycle.

In the case that the considered period p is the applicable WLTP test cycle, $K_{\text{ind},p}$ is named K_{ind} .

4.5.4. Interpolation of the CO₂ mass emission for individual vehicles

4.5.4.1. Individual charge-sustaining CO₂ mass emission for OVC-HEVs and NOVC-HEVs

The charge-sustaining CO₂ mass emission for an individual vehicle shall be calculated using the following equation:

$$M_{\text{CO}_2-\text{intind},\text{CS},p} = M_{\text{CO}_2-L,\text{CS},p} + K_{\text{intind},p} \times (M_{\text{CO}_2-H,\text{CS},p} - M_{\text{CO}_2-L,\text{CS},p})$$

where:

$M_{\text{CO}_2-\text{intind},\text{CS},p}$ is the charge-sustaining CO₂ mass emission for an individual vehicle of the considered period p according to Table A8/5, step No. 9, g/km;

$M_{\text{CO}_2-L,\text{CS},p}$ is the charge-sustaining CO₂ mass emission for vehicle L of the considered period p according to Table A8/5, step No. , g/km;

$M_{\text{CO}_2-H,\text{CS},p}$ is the charge-sustaining CO₂ mass emission for vehicle H of the considered period p according to Table A8/5, step No. 8, g/km;

$K_{\text{intind},p}$ is the interpolation coefficient for the considered individual vehicle for period p;

p is the index of the individual **phase period** within the applicable WLTP test cycle.

The considered periods shall be the low-phase, mid-phase, high-phase, extra high-phase and the applicable WLTP test cycle. In the case that the Contracting Party requests to exclude the extra high-phase, this phase value shall be omitted.

4.5.4.2. Individual utility factor-weighted charge-depleting CO₂ mass emission for OVC-HEVs

The utility factor-weighted charge-depleting CO₂ mass emission for an individual vehicle shall be calculated using the following equation:

$$M_{\text{CO}_2\text{-ind,CD}} = M_{\text{CO}_2\text{-L,CD}} + K_{\text{int,ind}} \times (M_{\text{CO}_2\text{-H,CD}} - M_{\text{CO}_2\text{-L,CD}})$$

where:

$M_{\text{CO}_2\text{-ind,CD}}$ is the utility factor-weighted charge-depleting CO₂ mass emission for an individual vehicle, g/km;

$M_{\text{CO}_2\text{-L,CD}}$ is the utility factor-weighted charge-depleting CO₂ mass emission for vehicle L, g/km;

$M_{\text{CO}_2\text{-H,CD}}$ is the utility factor-weighted charge-depleting CO₂ mass emission for vehicle H, g/km;

$K_{\text{int,pind}}$ is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.4.3. Individual utility factor-weighted CO₂ mass emission for OVC-HEVs

The utility factor-weighted CO₂ mass emission for an individual vehicle shall be calculated using the following equation:

$$M_{\text{CO}_2\text{-ind,weighted}} = M_{\text{CO}_2\text{-L,weighted}} + K_{\text{int,ind}} \times (M_{\text{CO}_2\text{-H,weighted}} - M_{\text{CO}_2\text{-L,weighted}})$$

where:

$M_{\text{CO}_2\text{-ind,weighted}}$ is the utility factor-weighted CO₂ mass emission for an individual vehicle, g/km;

$M_{\text{CO}_2\text{-L,weighted}}$ is the utility factor-weighted CO₂ mass emission for vehicle L, g/km;

$M_{\text{CO}_2\text{-H,weighted}}$ is the utility factor-weighted CO₂ mass emission for vehicle H, g/km;

$K_{\text{int,ind}}$ is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.5. Interpolation of the fuel consumption for individual vehicles

4.5.5.1. Individual charge-sustaining fuel consumption for OVC-HEVs and NOVC-HEVs

The charge-sustaining fuel consumption for an individual vehicle shall be calculated using the following equation:

$$FC_{\text{ind,CS,p}} = FC_{\text{L,CS,p}} + K_{\text{int,ind,p}} \times (FC_{\text{H,CS,p}} - FC_{\text{L,CS,p}})$$

where:

$FC_{\text{ind,CS,p}}$ is the charge-sustaining fuel consumption for an individual vehicle of the considered period p according to Table A8/6, step No. 3, l/100 km;

$FC_{\text{L,CS,p}}$ is the charge-sustaining fuel consumption for vehicle L of the considered period p according to Table A8/6, step No. 2, l/100 km;

$FC_{\text{H,CS,p}}$ is the charge-sustaining fuel consumption for vehicle H of the considered period p according to Table A8/6, step No. 2, l/100 km;

$K_{\text{int,ind,p}}$ is the interpolation coefficient for the considered individual vehicle for period p;

p is the index of the individual **phase period** within the applicable WLTP test cycle.

The considered periods shall be the low-phase, mid-phase, high-phase, extra high-phase, and the applicable WLTP **test** cycle. In the case that the Contracting Party requests to exclude the extra high-phase, this phase value shall be omitted.

4.5.5.2. Individual utility factor-weighted charge depleting fuel consumption for OVC-HEVs

The utility factor-weighted charge-depleting fuel consumption for an individual vehicle shall be calculated using the following equation:

$$FC_{ind,CD} = FC_{L,CD} + K_{intind} \times (FC_{H,CD} - FC_{L,CD})$$

where:

$FC_{ind,CD}$ is the utility factor-weighted charge-depleting fuel consumption for an individual vehicle, l/100 km;

$FC_{L,CD}$ is the utility factor-weighted charge-depleting fuel consumption for vehicle L, l/100 km;

$FC_{H,CD}$ is the utility factor-weighted charge-depleting fuel consumption for vehicle H, l/100 km;

K_{intind} is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.5.3. Individual utility factor-weighted fuel consumption for OVC-HEVs

The utility factor-weighted fuel consumption for an individual vehicle shall be calculated using the following equation:

$$FC_{ind,weighted} = FC_{L,weighted} + K_{intind} \times (FC_{H,weighted} - FC_{L,weighted})$$

where:

$FC_{ind,weighted}$ is the utility factor-weighted fuel consumption for an individual vehicle, l/100 km;

$FC_{L,weighted}$ is the utility factor-weighted fuel consumption for vehicle L, l/100 km;

$FC_{H,weighted}$ is the utility factor-weighted fuel consumption for vehicle H, l/100 km;

K_{intind} is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.6. Interpolation of electric energy consumption for individual vehicles

4.5.6.1. Individual utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs

The utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from for an individual vehicle shall be calculated using the following equation:

$$EC_{AC-ind,CD} = EC_{AC-L,CD} + K_{intind} \times (EC_{AC-H,CD} - EC_{AC-L,CD})$$

where:

$EC_{AC-ind,CD}$ is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for an individual vehicle, Wh/km;

$EC_{AC-L,CD}$ is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for vehicle L, Wh/km;

$EC_{AC-H,CD}$ is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for vehicle H, Wh/km;

K_{intind} is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle

4.5.6.2. Individual utility factor-weighted electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs

The utility factor-weighted electric energy consumption based on the recharged electric energy from the mains for an individual vehicle shall be calculated using the following equation:

$$EC_{AC-ind,weighted} = EC_{AC-L,weighted} + K_{intind} \times (EC_{AC-H,weighted} - EC_{AC-L,weighted})$$

where:

$EC_{AC-ind,weighted}$ is the utility factor weighted electric energy consumption based on the recharged electric energy from the mains for an individual vehicle, Wh/km;

$EC_{AC-L,weighted}$ is the utility factor weighted electric energy consumption based on the recharged electric energy from the mains for vehicle L, Wh/km;

$EC_{AC-H,weighted}$ is the utility factor weighted electric energy consumption based on the recharged electric energy from the mains for vehicle H, Wh/km;

K_{intind} is the interpolation coefficient for the considered individual vehicle for the applicable **WLTP** test cycle.

4.5.6.3. Individual electric energy consumption for OVC-HEVs and PEVs

The electric energy consumption for an individual vehicle according to paragraph 4.3.3. of this annex in the case of OVC-HEVs and according to paragraph 4.3.4. of this annex in the case of PEVs shall be calculated using the following equation:

$$EC_{ind,p} = EC_{L,p} + K_{intind,p} \times (EC_{H,p} - EC_{L,p})$$

where:

$EC_{ind,p}$ is the electric energy consumption for an individual vehicle for the considered period p, Wh/km;

$EC_{L,p}$ is the electric energy consumption for vehicle L for the considered period p, Wh/km;

$EC_{H,p}$ is the electric energy consumption for vehicle H for the considered period p, Wh/km;

$K_{intind,p}$ is the interpolation coefficient for the considered individual vehicle for period p;

p is the index of the individual **phase period** within the applicable test cycle.

The considered periods shall be the low-phase, mid-phase, high-phase, extra high-phase, **the applicable WLTP city test cycle** and the applicable WLTP test cycle. In the case that the Contracting Party requests to exclude the extra high-phase, this phase value shall be omitted.

4.5.7. Interpolation of electric ranges for individual vehicles

4.5.7.1. Individual all-electric range for OVC-HEVs

If the following criterion

$$\left| \frac{AER_L}{R_{CDA,L}} - \frac{AER_H}{R_{CDA,H}} \right| \leq 0.1$$

where:

AER_L is the all-electric range of vehicle L for the applicable WLTP test cycle, km;

AER_H is the all-electric range of vehicle H for the applicable WLTP test cycle, km;

$R_{CDA,L}$ is the actual charge-depleting range of vehicle L, km;

$R_{CDA,H}$ is the actual charge-depleting range of vehicle H, km;

is fulfilled, the all-electric range for an individual vehicle shall be calculated using the following equation:

$$AER_{ind,p} = AER_{L,p} + K_{int,ind,p} \times (AER_{H,p} - AER_{L,p})$$

where:

$AER_{ind,p}$ is the all-electric range for an individual vehicle for the considered period p, km;

$AER_{L,p}$ is the all-electric range for vehicle L for the considered period p, km;

$AER_{H,p}$ is the all-electric range for vehicle H for the considered period p, km;

$K_{int,ind,p}$ is the interpolation coefficient for the considered individual vehicle for **phase period** p;

p is the index of the individual **phase period** within the applicable test cycle.

The considered periods shall be the applicable WLTP city test cycle and the applicable WLTP test cycle. In the case that the Contracting Party requests to exclude the extra high-phase, this phase value shall be omitted.

If the criterion defined in this paragraph is not fulfilled, the AER determined for vehicle H is applicable to all vehicles within the interpolation family.

4.5.7.2. Individual pure electric range for PEVs

The pure electric range for an individual vehicle shall be calculated using the following equation:

$$PER_{ind,p} = PER_{L,p} + K_{int,ind,p} \times (PER_{H,p} - PER_{L,p})$$

where:

$PER_{ind,p}$ is the pure electric range for an individual vehicle for the considered period p, km;

$PER_{L,p}$ is the pure electric range for vehicle L for the considered period p, km;

$PER_{H,p}$ is the pure electric range for vehicle H for the considered period p, km;

$K_{int,ind,p}$ is the interpolation coefficient for the considered individual vehicle for **phase period** p;

p is the index of the individual **phase period** within the applicable test cycle.

The considered periods shall be the low-phase, mid-phase, high-phase, extra high-phase, the applicable WLTP city test cycle and the applicable WLTP test cycle. In the case that the Contracting Party requests to exclude the extra high-phase, this phase value shall be omitted.

4.5.7.3. Individual equivalent all-electric range for OVC-HEVs

The equivalent all-electric range for an individual vehicle shall be calculated using the following equation:

$$EAER_{ind,p} = EAER_{L,p} + K_{intind,p} \times (EAER_{H,p} - EAER_{L,p})$$

where:

- EAER_{ind,p} is the equivalent all-electric range for an individual vehicle for the considered period p, km;
- EAER_{L,p} is the equivalent all-electric range for vehicle L for the considered period p, km;
- EAER_{H,p} is the equivalent all-electric range for vehicle H for the considered period p, km;
- K_{intind,p} is the interpolation coefficient for the considered individual vehicle for **phase period p**;
- p is the index of the individual **phase period** within the applicable test cycle.

The considered periods shall be the low-phase, mid-phase, high-phase, extra high-phase, the applicable WLTP city test cycle and the applicable WLTP test cycle. In the case that the Contracting Party requests to exclude the extra high-phase, this phase value shall be omitted.”

i.e. make the highlighted text changes and replace the subscripts “int” with “ind” in the formulae and the clarification of component terms.

Justification:

The sentence following the formulae and their components explains that “period” refers to phases of the test cycle and to complete test cycles. It is therefore the correct term to define in the formula.

The reference to the city cycle was forgotten in the text of paragraph 4.5.6.3.

The subscripts “int” (interpolation) and “ind” (individual) have the same meaning in this context, “ind” is however consistent with the rest of the gtr.

Annex 8, Appendix 6

Proposal:

Amend paragraph 2.2. to read:

- “2.2. 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-depleting operating condition, the mode for the test shall be selected according to the following conditions:
- (a) If ~~this is a single~~ **there is only one** mode **which allows the vehicle to follow the reference test cycle under charge-depleting operating conditions**, this mode shall be selected;
 - (b) If several modes are capable of following the reference test cycle **under charge-depleting operating conditions**, the most electric energy consuming of those modes shall be selected.”

Justification:

The previous text was unclear and contradicts the content of the figure which is referenced from paragraph 2. The figure reflects the agreement in IWG 12 and so the text needs to be brought in line.

Proposal:

Delete paragraphs 2.4. and 3.4. and insert a new paragraph 1.3.:

- ~~2.4. 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 for charge-depleting operating condition testing.~~
- ~~3.4. 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 for charge-depleting operating condition testing.~~
- 1.3. 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.

Justification:

This paragraph is also valid for PEVs where it was missing. Can be put under general requirements. In addition there was an error in paragraph 2.4.

Proposal:

Amend paragraph 3.2. to read:

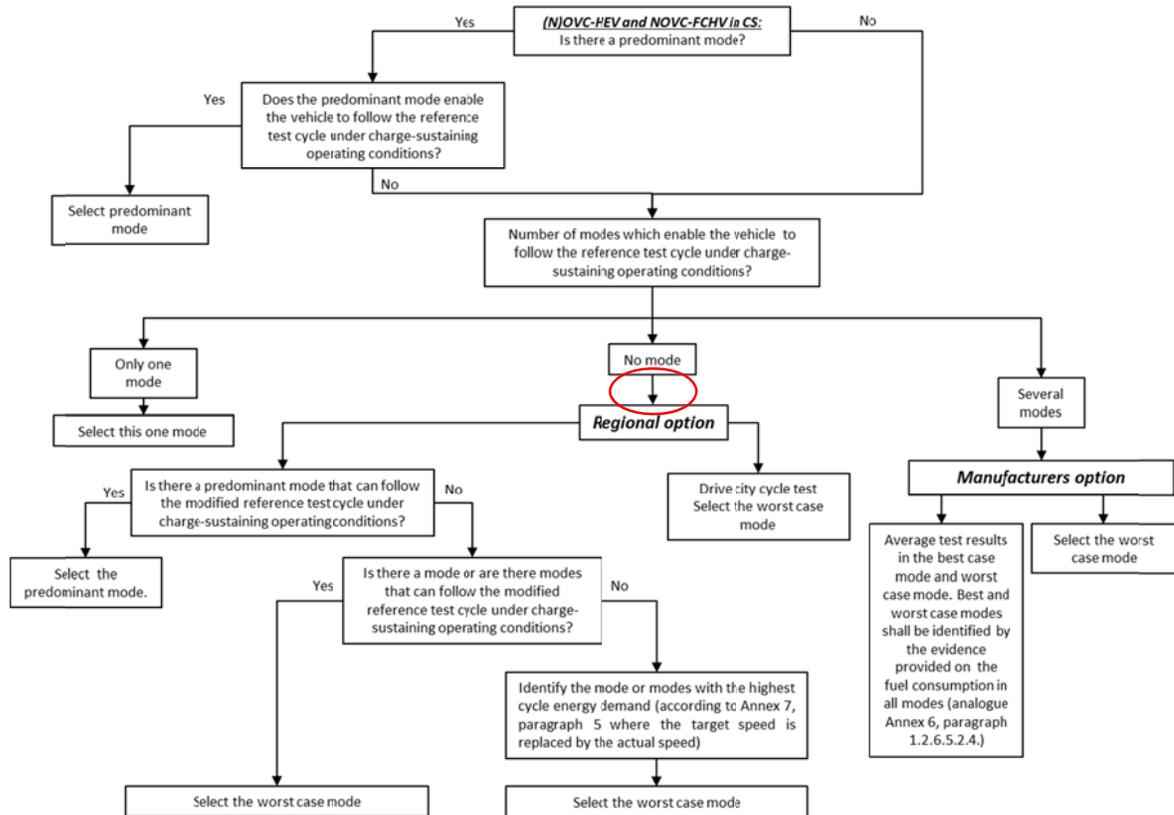
- “3.2. If there is no predominant mode or if there is a predominant mode but this mode does not enable the vehicle to follow the reference test cycle under charge-sustaining operating condition, the mode for the test shall be selected according to the following conditions:
- (a) If ~~this is a single~~ **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**, the most electric energy consuming mode of those shall be selected.”

Justification:

The previous text was unclear and contradicts the content of the figure which is referenced from paragraph 3. The figure reflects the agreement in IWG 12 and so the text needs to be brought in line.

Proposal:

In Figure A8.App6/2 insert an arrow from the box “No mode” to the box “Regional option” as shown:



Justification:

The arrow did not copy from the original graphic

Proposal:

Amend paragraph 4.2. to read:

“4.2. 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, ~~the test shall be performed by using a mode that enables the vehicle to follow the reference test cycle.~~ the mode for the test shall be selected according to the following conditions:

- (a) If ~~this is a single~~ there is only one mode which allows the vehicle to follow the reference test cycle, this mode shall be selected.
- (b) If several modes are capable of following the reference test cycle, the most electric energy consuming mode of those shall be selected.”

Justification:

The previous text was unclear and contradicts the content of the figure which is referenced from paragraph 4. The figure reflects the agreement in IWG 12 and so the text needs to be brought in line.

Annex 8, Appendix 7

Proposal:

Amend the second sentence of paragraph 2.1.4. to read:

“.....

In the case that influence of pressure difference is expected, the manufacturer and ~~responsibility~~ responsible authority shall agree whether correction is necessary or not.”

Justification:

Correction of incorrect wording

Proposal:

Amend Table A8.App7/1 to read:

<i>Measurement system</i>	<i>Resolution (readability)</i>	<i>Precision (repeatability)</i>
Precision balance	0.01 g maximum	0.02 maximum ⁽¹⁾

⁽¹⁾ Fuel consumption (REESS charge balance = 0) during the test, in mass, standard deviation

Justification:

Sub Group EV agreed to amend the Resolution (readability) from 0.01 g to 0.1 g during the Phase 1b discussions but this decision was not transposed.

II. Proposal for amending ECE-TRANS-WP29-GRPE-2016-03e (purely editorial changes)

The following paragraphs have been identified as needing editorial (e.g. formatting) amendments; these are shown only in the appendix to this document.

Annex 2:

Paragraph 2. (c)

Paragraphs 8.2.3. and 8.3. (removal of equation numbers)

Annex 4:

Paragraph 3.2.4.

Paragraph 4.3.2.6.1.

Paragraph 4.4.

Paragraph 7.3.4.3.3.

Paragraph 8.1.1.

Annex 5

Paragraph 3.4.2.6.

Paragraph 7.2.1.3.3

Annex 6

Table A6/2 (PEVs)

Annex 7

Paragraph 3.2.4.1.1.2.

Paragraph 6.2.

Annex 8

Paragraph 4.1.3.

Paragraph 4.4.1.
