

Proposal for amendments to GRPE-76-26r1e

The text reproduced below was prepared by the IWG on Worldwide harmonized Light vehicles Test Procedure (WLTP). The modifications to the current text of GRPE-76-26r1e are marked in bold for new or struck through for deletion.

Proposal

I. Statement of technical rationale and justification, A. Introduction, 1., amend to read:

"The compliance with emission standards is a central issue of vehicle certification worldwide. Emissions comprise criteria ~~pollutants~~ **emissions** having a direct (mainly local) negative impact on health and environment, as well as pollutants having a negative environmental impact on a global scale. Regulatory emission standards typically are complex documents, describing measurement procedures under a variety of well-defined conditions, setting limit values for emissions, but also defining other elements such as the durability and on-board monitoring of emission control devices."

Correction/justification: The term "emissions" more correctly represents the various compounds emitted from vehicles.

Proposal

II. Text of the global technical regulation, 3. Definitions, amend to read:

"3.1.15. "Zero gas" means a gas containing no analyte, which is used to set a zero response on an analyser."

Correction/justification: Editorial (comma deleted).

Proposal

II. Text of the global technical regulation, 3. Definitions, amend to read:

"3.3. Pure electric, **pure ICE**, hybrid electric, fuel cell and alternatively-fuelled vehicles"

Correction/justification: Adds those vehicles which have no element of electric propulsion.

Proposal

II. Text of the global technical regulation, 3. Definitions, amend to read:

"3.4.3. *"Peripheral devices"* means **any** energy consuming, converting, storing or supplying devices, where the energy is not ~~primarily~~ **directly or indirectly** used for the purpose of vehicle propulsion ~~but, or other parts, systems and control units,~~ which are essential to the operation of the powertrain **and are therefore considered to be part of the powertrain.**"

Correction/justification: The current definition of peripheral devices does not say that they are part of the powertrain. They were clearly intended to be so as seen in Mutual Resolution (M.R.2) containing Vehicle Powertrain Definitions.

Furthermore, the last phrase is for consistency with the definition of *auxiliary devices*.

Proposal

II. Text of the global technical regulation, 4. Abbreviations, amend to read:

"CFD Computational fluid dynamics"

Correction/justification: The term "computational fluid dynamics" is used in GTR 15 but the abbreviation CFD is a widely-used term in engineering.

Proposal

II. Text of the global technical regulation, 5. General requirements, amend to read:

"5.3.2. The type of fuel for emissions testing shall be as specified in Annex 3 ~~to~~ of this UN GTR."

Correction/justification: Editorial.

Proposal

II. Text of the global technical regulation, 7. Rounding, amend to read:

"7. Rounding

7.1. When the digit immediately to the right of the last place to be retained is less than 5, that digit shall remain unchanged.

Example:

If a result is 1.234 grams but only two places of decimal are to be retained, the final result shall be 1.23 grams.

7.2. When the digit immediately to the right of the last place to be retained is greater than or equal to 5, that digit shall be increased by 1.

Example:

If a result is 1.236 grams but only two places of decimal are to be retained, and because 6 is greater than 5, the final result is 1.24 grams."

Correction/justification: The term "rounding" and "rounded" are often used in the GTR. This proposal defines a consistent rounding procedure.

Proposal

Annex 1, paragraph 1., amend to read:

"The cycle resulting from the requirements described in this annex shall be referred to in other parts of ~~the~~ **this** UN GTR as the "applicable cycle".

Correction/justification: Editorial.

Proposal

Annex 1, paragraph 8.3., amend to read:

"The resulting f_{dsc} ~~is~~ **shall be mathematically rounded according to paragraph 7. of this UN GTR** to 3 places of decimal and ~~is~~ **shall be** applied only if it exceeds 0.010."

Correction/justification: Amended to include reference to paragraph 7. on rounding. Also, editorial amendments.

Proposal

Annex 1, paragraph 9.2.2.1., amend to read:

"The number of time samples $n_{add,medium}$ with $v_i = v_{cap}$ to be added to the medium speed phase of the interim capped speed cycle equals Δt_{medium} , ~~mathematically~~ **rounded according to paragraph 7. of this UN GTR** to the nearest integer (e.g. 1.4 shall be rounded to 1, 1.5 shall be rounded to 2)."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 1, paragraph 9.2.2.2., amend to read:

"The number of time samples $n_{add,exhigh}$ with $v_i = v_{cap}$ to be added to the extra high speed phase of the interim capped speed cycle equals Δt_{exhigh} , ~~mathematically~~ **rounded according to paragraph 7. of this UN GTR** to the nearest integer."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 1, paragraph 9.2.2.3., amend to read:

"The number of time samples $n_{add,exhigh}$ with $v_i = v_{cap}$ to be added to the extra high speed phase of the interim capped speed cycle equals Δt_{exhigh} , ~~mathematically rounded~~ **rounded according to paragraph 7. of this UN GTR** to the nearest integer."

Proposal

Annex 1, paragraph 9.2.3.2.1., amend to read:

"The length of the final capped speed cycle is equivalent to the length of the base cycle except for differences caused by the rounding process **according to paragraph 7. of this UN GTR** for $n_{add,medium}$, $n_{add,high}$ and $n_{add,exhigh}$."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 1, paragraph 9.2.3.2.2., amend to read:

"The length of the final capped speed cycle is equivalent to the length of the base cycle except for differences caused by the rounding process **according to paragraph 7. of this UN GTR** for $n_{add,high}$ and $n_{add,exhigh}$."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 1, paragraph 9.2.3.2.3., amend to read:

"The length of the final capped speed cycle is equivalent to the length of the base cycle except for differences caused by the rounding process **according to paragraph 7. of this UN GTR** for $n_{add,exhigh}$."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 2, paragraph 2.(c)., amend to read:

"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} ;"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 2, paragraph 2.(e)., amend to read:

" $(n/v)_i$, the ratio obtained by dividing the engine speed n by the vehicle speed v for each gear i , for $i = 1$ to $n_{g,max}$, $\text{min}^{-1}/(\text{km/h})$. $(n/v)_i$ shall be calculated according to the equations in paragraph 8. of Annex 7;"

Correction/justification: Consistency in the use of n_g as in paragraph 2.(d). Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 2.(g), amend to read:

$$n_{\max 2} = (n/v)(ng_{\max}) \times v_{\max, \text{cycle}}$$

$$n_{\max 3} = (n/v)(ng_{\max}) \times v_{\max, \text{vehicle}}$$

Correction/justification: In the aim of consistency with paragraph 2.(d), ng is used instead of ng_{\max} . Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 2.(g), amend to read:

~~" $ng_{v\max}$ is defined in paragraph 2.(i) of this annex;~~

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

$v_{\max, \text{vehicle}}$ is the maximum speed of the vehicle according to paragraph 2.(i) of this annex, km/h;

$(n/v)(ng_{v\max})$ is the ratio obtained by dividing engine speed n by the vehicle speed v for the gear $ng_{v\max}$, $\text{min}^{-1}/(\text{km/h})$;

$ng_{v\max}$ is defined in paragraph 2.(i) of this annex;

n_{\max} is the maximum of $n_{\max 1}$, $n_{\max 2}$ and $n_{\max 3}$, min^{-1} ."

Correction/justification: The equation is not changed but the order of defining the parameters is more logical.

Proposal

Annex 2, paragraph 2.(i), amend to read:

"Vehicle speed values **rounded according to paragraph 7. of this UN GTR** to one place of decimal shall be used for the determination of v_{\max} and $ng_{v\max}$."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 2, paragraph 2.(i), amend to read:

"The available power at vehicle speed v_{\max} in gear ng , gear $ng - 1$ or gear $ng - 2$ ~~may~~ **shall** be determined from the full load power curve, $P_{\text{wot}}(n)$, by using the following equations:"

Correction/justification: The available power shall be determined from the full load power curve using the specified equations, and not optionally as the word "may" implies.

Proposal

Annex 2, paragraph 2.(i), amend to read:

" $ng_{vmax} = ng_{max}$ and $v_{max} = n_{lim} / (n/v)(ng_{max})$ "

Correction/justification: In the aim of consistency with paragraph 2.(d), ng is used instead of ng_{max} . Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Figure A2/1a, Title, amend to read:

"An example where ng_{vmax} is the highest gear"

Correction/justification: Incorrect title (ng_{max} is replaced by ng_{vmax}). Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Figure A2/1b, Title, amend to read:

"An example where ng_{vmax} is the 2nd highest gear"

Correction/justification: Incorrect title (ng_{max} is replaced by ng_{vmax}). Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 2.(k)., amend to read:

"The final results for n_{min_drive} shall be rounded **according to paragraph 7. of this UN GTR** to the nearest integer. ~~Example: 1199.5 becomes 1200, 1199.4 becomes 1199.~~"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 2, paragraph 3.2., amend to read:

"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:"

Correction/justification: For consistency, ng_{max} is replaced by ng .

Proposal

Annex 2, paragraph 3.3., amend to read:

"(a) All gears $i < ng_{vmax}$ where $n_{min_drive} \leq n_{i,j} \leq n_{max1} \cdot \frac{v_{max_95}}{v}$;

(b) All gears $i \geq ng_{vmax}$ where $n_{min_drive} \leq n_{i,j} \leq n_{max2} \cdot \frac{v_{max}(ng_{vmax})}{v}$;

Correction/justification: Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 3.3., amend 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 $i < ng_{vmax}$ where $n_{min_drive} \leq n_{i,j} \leq n_{max1}$;
- (b) All gears $i \geq ng_{vmax}$ where $n_{min_drive} \leq n_{i,j} \leq n_{max2}$;
- (c) Gear 1, if $n_{1,j} < n_{min_drive}$.

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

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

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

If $a_j \geq 0$ and $n_{i,j} < \max(1.15 \times n_{idle}; \text{min. engine speed of the } P_{wot}(n) \text{ curve})$, $n_{i,j}$ shall be set to the maximum of $1.15 \times n_{idle}$ or $(n/v)_i \times v_j$ and the clutch shall be set to "undefined".

"undefined" covers any status of the clutch between disengaged and engaged, depending on the individual engine and transmission design. In this case the real engine speed may deviate from the calculated engine speed."

Correction/justification: The minimum engine speed of the power curve was changed from n_{idle} to $n_{min_drive_set}$. The amendments are necessary since no power check can be performed in this engine speed range. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 4.(a), amend to read:

"If a one step higher gear ($n+1$) is required for only 1 second and the gears before and after are the same (n) or one of them is one step lower ($n - 1$), gear ($n + 1$) shall be corrected to gear n .

Examples:

Gear sequence $i - 1, i, i - 1$ shall be replaced by:

$i - 1, i - 1, i - 1$;

Gear sequence $i - 1, i, i - 2$ shall be replaced by:

$i - 1, i - 1, i - 2$;

Gear sequence $i - 2, i, i - 1$ shall be replaced by:

$i - 2, i - 1, i - 1$.

Gears used during accelerations at vehicle speeds ≥ 1 km/h shall be used for a period of at least 2 seconds.

Examples:

~~(e.g. a gear sequence 1, 2, 3, 3, 3, 3, 3 shall be replaced by:~~

1, 1, 2, 2, 3, 3, 3).

Gear sequence 1, 2, 3, 4, 5, 5, 6, 6, 6, 6 shall be replaced by:

1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6.

This requirement shall not be applied to downshifts during an acceleration phase or if the use of a gear for just one second follows immediately after such a downshift. SuchIn these cases, the downshifts shall be corrected first according to paragraph 4.(b) of this annex.

Example:

Gear sequence 4, 4, 3, 4, 5, 5, 5, where the first second determines the start of an acceleration phase, shall be replaced by:

4, 4, 4, 4, 5, 5, 5.

Gears shall not be skipped during acceleration phases.

However, an upshift by two gears is permitted at the transition from an acceleration phase to a constant speed phase if the duration of the constant speed phase exceeds 5 seconds."

Correction/justification: Clarification of the gears to use during accelerations at vehicle speeds ≥ 1 km/h for a period of at least 2 seconds, and to avoid misinterpretations. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 4.(b), amend to read:

"If a downshift is required during an acceleration phase, the gear which is required during this downshift ~~is~~ **shall be noted (i_{DS}). The starting point of a correction procedure is defined by either the last previous second when i_{DS} was identified or by the starting point of the acceleration phase if all time samples before have gears $> i_{DS}$. The last previous second where i_{DS} shall be identified and defines the start point of a correction procedure.** ~~The highest gear of the time samples before the downshift determines the reference gear i_{ref} for the downshift. A downshift where $i_{DS} = i_{ref} - 1$ is referred to as a one step downshift, a downshift where $i_{DS} = i_{ref} - 2$ is referred to as a two step downshift.~~ The following check shall then be applied.

~~Working backwards~~ **forward** from the **starting point of the correction procedure to the** end of the acceleration phase, the latest occurrence of a 10 second window containing i_{DS} for either 2 or more consecutive seconds, or 2 or more individual seconds, shall be identified. The last usage of i_{DS} in this window defines the end point of the correction procedure. Between the start and end of the correction period, all requirements for gears greater than i_{DS} shall be corrected to a requirement of i_{DS} .

If one step downshifts as well as two step downshifts occur during an acceleration phase, two step downshifts shall be corrected before one step downshifts are corrected. In this case, the starting point of the correction procedure for the one step downshifts is the second immediately following the end of the correction period for the

two step downshifts. If a two step downshift occurs after a one step downshift, it shall overrule the one step downshift in the time period before the two step downshift.

From the end of the correction period (in case of 10 second windows containing i_{DS} for either 2 or more consecutive seconds, or 2 or more individual seconds) or from the starting point of the correction procedure (in case all 10 second windows contain i_{DS} only for one second or some 10 second windows contain no i_{DS} at all) to the end of the acceleration phase, if the downshift was a one step downshift, all downshifts with a duration of only one second shall be removed, if the downshift was a one step downshift. If the downshift was a two step downshift, all requirements for gears greater than or equal to i_{DS} up to the latest occurrence of i_{DS} shall be corrected to $(i_{DS} + 1)$.

~~This final correction shall also be applied from the start point to the end of the acceleration phase, if no 10 second window containing i_{DS} for either 2 or more consecutive seconds or 2 or more individual seconds was identified.~~

Examples are shown in Tables A2/2 to A2/6.:

(i) ~~If the initially calculated gear use is:~~

~~2, 2, 3, [3, 4, 4, 4, 4, 3, 4, 4, 4, 4], 4, 4, 3, 4, 4, 4,~~

~~the gear use shall be corrected to:~~

~~2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4.~~

(ii) ~~If the initially calculated gear use is:~~

~~2, 2, 3, [3, 4, 4, 3, 4, 4, 4, 4, 4, 4], 4, 4, 4, 4, 3, 4,~~

~~the gear use shall be corrected to:~~

~~2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4.~~

(iii) ~~If the initially calculated gear use is:~~

~~2, 2, 3, [3, 4, 4, 4, 4, 4, 4, 4, 4, 4], 4, 4, 4, 3, 3, 4,~~

~~the gear use shall be corrected to:~~

~~2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4.~~

~~The first 10 second windows are indicated by square brackets in the examples above.~~

~~The underlined gears (e.g. 3) indicate those cases which could lead to a correction of the gear before it.~~

This correction shall not be performed for gear 1.

After the application of paragraph 4.(b) of this annex, a downshift by more than one gear could occur at the transition from a deceleration or constant speed phase to an acceleration phase.

In this case, the gear for the last sample of the deceleration or constant speed phase shall be replaced by gear 0 and the clutch shall be disengaged. If the “suppress gear 0 during downshifts” option according to paragraph 4.(f) of this annex is chosen, the following lower gear shall be used instead of gear 0.”

Correction/justification: A downshift by more than 1 gear could occur at the transition from a deceleration or constant speed phase to the acceleration phase. In these cases, the necessary computer program, ACCESS, replaces the gear for the last sample of the deceleration or constant speed phase by gear 0 and sets the clutch “disengaged”. Some text is also required for reasons of clarity. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Table A2/2, (new table), amend to read:

Time	j	j+1	j+2	j+3	j+4	j+5	j+6	j+7	j+8	j+9	j+10	j+11	j+12	j+13	j+14	j+15	j+16	j+17	j+18	
	Start of accel.								Down shift, ins = 3							Down shift, ins = 3			End of accel.	
Initial gear use	2	2	3	3	4	4	4	4	3	4	4	4	4	4	4	3	4	4	4	
				Start of correction check																
					her = 4															
					First 10 second window for the correction check										Last 10 second window for the correction check					
					Latest 10 second window containing ins twice															
																End of correction				
Correction Removal					3	3	3	3		3	3	3	3	3	3					
Final gear use	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	

Correction/justification: Clarifies gear use. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Table A2/3, (new table) amend to read

Time	j	j+1	j+2	j+3	j+4	j+5	j+6	j+7	j+8	j+9	j+10	j+11	j+12	j+13	j+14	j+15	j+16	j+17	j+18	
	Start of accel.						Down shift, ins = 3											Down shift, ins = 3	End of accel.	
Initial gear use	2	2	3	3	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	
				Start of correction check																
					her = 4															
					First 10 second window for the correction check										Last 10 second window for the correction check					
					Latest 10 second window containing ins twice															
							End of correction													
Correction Removal					3	3												4		
Final gear use	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	

Correction/justification: Clarifies gear use. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Table A2/4, (new table), amend to read:

Time	j	j+1	j+2	j+3	j+4	j+5	j+6	j+7	j+8	j+9	j+10	j+11	j+12	j+13	j+14	j+15	j+16	j+17	j+18	
	Start of accel.			Down shift, ins = 3											Down shift, ins = 3				End of accel.	
Initial gear use	4	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	5	5	
	Start of correction check																			
					her = 4															
					First 10 second window for the correction check										Last 10 second window for the correction check					
					no 10 second window containing ins twice															
Correction Removal				4											4					
Final gear use	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	

Correction/justification: Clarifies gear use. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Table A2/5, (new table), amend to read:

Time	j	j+1	j+2	j+3	j+4	j+5	j+6	j+7	j+8	j+9	j+10	j+11	j+12	j+13	j+14	j+15	j+16	j+17	j+18	j+19
	Start of accel.			Down-shift, $ins_1 = 5$		Down-shift by 2 steps, $ins_1 = 4$													Down-shift by 1 step, $ins_2 = 5$	End of accel.
Initial gear use	6	6	6	5	5	4	4	4	4	4	5	6	6	6	6	6	6	6	5	5
	Start of correction check for ins_1										Start of correction check for ins_2									
	$i_{ref} = 6$										$i_{ref} = 6$									
	Latest 10 second window containing ins_1 twice or more										Latest 10 second window containing ins_2 twice or more									
						End of correction for ins_1													End of correction for ins_2	
Correction Removal	4	4	4	4	4						5	5	5	5	5	5	5	5		
Final gear use	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5

Correction/justification: Clarifies gear use. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, Table A2/6, (new table), amend to read:

Time	j	j+1	j+2	j+3	j+4	j+5	j+6	j+7	j+8	j+9	j+10	j+11	j+12	j+13	j+14	j+15	j+16	j+17	j+18	
	Start of accel.	Down-shift, $ins_1 = 3$					Down-shift, $ins_2 = 4$							Down-shift, $ins_3 = 5$					End of accel.	
Initial gear use	4	3	3	4	5	5	4	5	5	6	6	6	6	5	5	6	6	6	6	
	Start of correction check ins_1			Start of correction check ins_2					Start of correction check ins_3											
	$i_{ref} = 4$					$i_{ref} = 5$					$i_{ref} = 6$									
	Latest 10 second window containing ins_1 twice or more										Latest 10 second window containing ins_2 twice or more									
						End of correction ins_2								End of correction ins_3						
correction removal	3				4	4				5	5	5	5	5						
Final gear use	3	3	3	4	4	4	4	5	5	5	5	5	5	5	5	6	6	6	6	

Correction/justification: Clarifies gear use. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 4.(c), amend to read with this first paragraph:

"The modification check described in paragraph 4.(c) of this annex shall be applied to the complete cycle trace twice prior to the application of paragraphs 4.(d) to 4.(f) of this annex."

Correction/justification: Checks the modifications prior to further application of gear shifting requirements. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 2, paragraph 5., amend to read:

"In order to enable the assessment of the correctness of the calculation, the average gear for $v \geq 1$ km/h, rounded **according to paragraph 7. of this UN GTR** to four places of decimal, shall be calculated and recorded."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 4, paragraph 2.4., amend to read:

- " f_0 is the constant road load coefficient and shall be rounded **according to paragraph 7. of this UN GTR** to one place of decimal, N;
- f_1 is the first order road load coefficient and shall be rounded **according to paragraph 7. of this UN GTR** to three places of decimal, N/(km/h);
- f_2 is the second order road load coefficient and shall be rounded **according to paragraph 7. of this UN GTR** to five places of decimal, N/(km/h)²."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 4, paragraph 4.3.1.4.4., amend to read:

"The following equation shall be used to compute the arithmetic average of the road load where the harmonic average of the alternate coastdown times shall be used:

$$F_j = \frac{1}{3.6} \times (m_{av} + m_r) \times \frac{2 \times \Delta v}{\Delta t_j}$$

where:

Δv is 5 km/h;"

Correction/justification: Consistent with the equations in paragraphs 8.1.3.2. and paragraph 8.2.4.3. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 4, paragraph 4.4.3.1., amend to read:

" α_j is the arithmetic average acceleration, m/s², ~~which~~ calculated using the following equation:"

Correction/justification: Editorial.

Proposal

Annex 4, paragraph 4.5.2., amend to read:

"The correction factor K_0 for rolling resistance, in ~~Celsius⁻¹ Kelvin⁻¹~~ ($^{\circ}\text{C}^{-1}\text{K}^{-1}$), may be determined based on empirical data and approved by the responsible authority for the particular vehicle and tyre **combination to be tested**, or may be assumed to be as follows:

$$K_0 = 8.6 \times 10^{-3} \text{ }^{\circ}\text{C}^{-1}\text{K}^{-1}$$

Correction/justification: GTR 15 uses $^{\circ}\text{C}$ and not Kelvin. Also, editorial. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 4, paragraph 4.5.4., amend to read:

$$K_1 = f_0 \times (1 - TM/m_{av})$$

where:

f_0 is a constant term, Nm;"

Correction/justification: Incorrect equation.

Proposal

Annex 4, paragraph 4.5.5.1., amend to read:

$$F^* = ((f_0 - w_1 - f_0 \times K_1) + f_1 v) \times (1 + K_0 (T - 20)) + K_2 f_2 v^2$$
$$F^* = ((f_0(1 - K_1) - w_1) + f_1 v) \times (1 + K_0(T - 20)) + K_2 f_2 v^2$$

where:

F^* is the corrected road load, N;

f_0 is the **constant road load coefficient**, N;

f_1 is the **first order road load** coefficient, ~~of the first order term,~~ N/(km/h);

f_2 is the **second order road load** coefficient, ~~of the second order term,~~ N/(km/h)²;"

Correction/justification: First, the equation was corrected as it had an error, the equation was then written more mathematically correct, and proper terminology was introduced.

Proposal

Annex 4, paragraph 4.5.5.1., amend to read:

"The result of the calculation $((f_0(1 - K_1) - w_1) + f_1 v) \times (1 + K_0(T - 20))$ ~~$((f_0 - w_1 - f_0 \times K_1) \times (1 + K_0 \times (T - 20)))$~~ shall be used as the target road load coefficient A_t in the calculation of the chassis dynamometer load setting described in paragraph 8.1. of this annex."

Correction/justification: Amendment of the equation based on the preceding amendment proposal.

Proposal

Annex 4, paragraph 4.5.5.2.1., amend to read:

$$C^* = ((c_0 - w_2 - c_0 \times K_1) + c_1 v) \times (1 + K_0(T - 20)) + K_2 c_2 v^2$$
$$C^* = ((c_0(1 - K_1) - w_2) + c_1 v) \times (1 + K_0(T - 20)) + K_2 f_2 v^2$$

Correction/justification: First, the equation was corrected as it had an error, and has been written more mathematically correct. Amendment based on the amendments to paragraph 4.5.5.1.

Proposal

Annex 4, paragraph 4.5.5.2.3., amend to read:

"The result of the calculation $((c_0(1 - K_1) - w_2) + c_1 v) \times (1 + K_0(T - 20))$ (~~$(c_0 - w_2 - c_0 \times K_1) \times (1 + K_0 \times (T - 20))$~~) shall be used as the target running resistance coefficient a_t in the calculation of the chassis dynamometer load setting described in paragraph 8.2. of this annex."

Correction/justification: Amendment based on the preceding proposal.

Proposal

Annex 4, paragraph 5.1.2.1., amend to read:

" c_1 is the first order ~~road load~~ **running resistance** coefficient, Nm/(km/h), and shall be set to zero;"

Correction/justification: The torque meter method refers to running resistance and not to road load.

Proposal

Annex 4, paragraph 8.1.3.2., amend to read:

"The measured road load shall be calculated using the following equation:

$$F_{mj} = \frac{1}{3.6} \times (TM + m_r) \times \frac{2 \times \Delta v}{\Delta t_j}$$

where:

Δv is 5 km/h;"

Correction/justification: Alignment of the use of Δv in equations 8.1.3.2. and 8.2.4.3. Amendments approved at the IWG meeting in Ispra.

Proposal

Annex 4, paragraph 8.1.3.3., amend to read:

"The **coefficients A_s, B_s and C_s in the road load equation of the** simulated road load on the chassis dynamometer shall be calculated **using a least squares regression analysis:** according to the method as specified in paragraph 4.3.1.4. of this annex, with the exception of measuring in opposite directions:

$$F_s = A_s + (B_s \times v) + (C_s \times v^2)$$
$$F_s = A_s + B_s \times v + C_s \times v^2"$$

Correction/justification: Clarification how road load coefficients A_s, B_s and C_s are calculated. The equation has been written with the introduction of parentheses for better readability. Amendments approved at IWG 22 (Ispra).

Proposal

Annex 4, paragraph 8.1.3.3., amend to read:

$$"F_{sj} = A_s + (B_s \times v_j) + (C_s \times v_j^2)"$$

Correction/justification: Introduction of parentheses in the equation for better readability.

Proposal

Annex 4, paragraph 8.2.4.3., amend to read:

$$"F_j = \frac{1}{3.6} \times (TM + m_r) \times \frac{2 \times \Delta v}{\Delta t_j}"$$

and additionally: " $\Delta v = 10.5$ km/h"

Correction/justification: Consistency with equation 8.1.3.2.

Proposal

Annex 5, paragraph 2.2.3., amend to read:

"The dynamometer shall have a time measurement system for use in determining acceleration rates and for measuring vehicle/dynamometer coastdown times. This time measurement system shall **not exceed** have an accuracy of ~~at least~~ ± 0.001 per cent **after at least 1000 seconds of operation.** ~~and.~~ **This** shall be verified upon initial installation."

Correction/justification: Definition as to when the dyno must fulfil a specified accuracy.

Proposal

Annex 5, paragraph 2.2.6., amend to read:

"The base inertia of the dynamometer shall be stated by the dynamometer manufacturer and shall be confirmed to within ~~±0.5~~**±1.0** per cent for each measured base inertia and ±0.2 per cent relative to any arithmetic average value by dynamic derivation from trials at constant acceleration, deceleration and force."

Correction/justification: The value of 1.0 per cent corresponds to that in CFR Title 1066. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 5, paragraph 2.3.1.2., amend to read:

"The speed difference between the front and rear rollers ~~is~~ **shall** be assessed by applying a 1 second moving average filter to roller speed data acquired at a minimum frequency of 20 Hz."

Correction/justification: Editorial.

Proposal

Annex 5, paragraph 3.3.5.3., amend to read:

"A temperature sensor shall be installed immediately before the volume measuring device. This temperature sensor shall have an accuracy of ±1 °C and a response time of **1 second or less** ~~0.1 seconds~~ at 62 per cent of a given temperature variation (value measured in **water or** silicone oil)."

Correction/justification: A response time of less than 1.0 seconds was proposed in Ispra. Yet to be confirmed.

Proposal

Annex 5, paragraph 3.4.2.4., amend to read:

"Ambient temperature, T	±0.2 K °C
Air temperature at LFE, ETI	±0.15 K °C
Air temperature at CVS pump inlet, PTI	±0.2 K °C
Air temperature at CVS pump outlet, PTO	±0.2 K °C"

Correction/justification: The units of the four temperature-related variables are changed from K to °C in keeping with the rest of GTR 15. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 5, paragraph 3.4.3.2., amend to read:

"LFE air temperature, flow meter, ETI ±0.15 ~~K~~°C,
 Temperature at venturi inlet, T_v ±0.2 ~~K~~°C."

Correction/justification: The units of the two temperature-related variables are changed from K to °C in keeping with the rest of GTR 15. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 5, paragraph 3.4.5.6., amend to read:

"LFE air temperature, flow meter, ETI ±0.15 ~~K~~°C,
 Temperature at UFM inlet, T_{act} ±0.2 ~~K~~°C."

Correction/justification: The units of the two temperature-related variables are changed from K to °C in keeping with the rest of GTR 15. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 5, paragraph 4.2.2.4., amend to read:

$$"P_{emf} = P_{em_{uncorr}} \times \left(\frac{1 - \frac{\rho_a}{\rho_w}}{1 - \frac{\rho_a}{\rho_f}} \right) "$$

Correction/justification: The original variables in the equation and in their definition did not correlate.

Proposal

Annex 5, Table A5/3, amend to read:

Gas analyser linearization (calibration)	Every 6 months or after major maintenance	±2 per cent of reading
Mid-span	Every 6 months or after major maintenance	±2 per cent
CO NDIR: CO ₂ /H ₂ O interference	Monthly or after major maintenance	-1 to 3 ppm
NO _x converter check	Monthly or after major maintenance	> 95 per cent
CH ₄ cutter check	Yearly or after major maintenance	98 per cent of ethane
FID CH ₄ response	Yearly Not applicable	See paragraph 5.4.3. of this annex.

Correction/justification: Clarifies the calibration intervals of instruments. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 6, paragraph 1.2.3.8., amend to read:

"Determination of **the acceptance values** dCO_{2,1}, dCO_{2,2} and dCO_{2,3}"

Correction/justification: The variables dCO_{2,1}, dCO_{2,2} and dCO_{2,3} were not defined. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 6, Table A6/1, amend to read:

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

(2) Rounding **according to paragraph 7. of this UN GTR ~~xxx.xx~~**

(3) **Rounding according to paragraph 7. of this UN GTR ~~xxx.x~~**"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 6, Figure A6/1, amend to read:

"Any of criteria ~~pollutant~~ **emissions** > Limit" changed in the boxes below "First test", "Second test" and "Third test".

Proposal

Annex 6, paragraph 2.3.2.3., amend to read:

"At the request of the manufacturer and with approval of the responsible authority, the interpolation line may be extrapolated to a maximum of 3 g/km above the CO₂ emission of vehicle H and/or below the CO₂ emission of vehicle L. **This extension is valid only within the boundaries of the interpolation range specified in this paragraph.**"

Correction/justification: Clarification of the magnitude of the extension of the extrapolation line.

Proposal

Annex 6, paragraph 2.6.6.1., amend to read:

"Vehicles equipped with a predominant mode shall be tested in that mode. At the request of the manufacturer, the vehicle may ~~also~~ **alternatively** be tested with the driver-selectable mode in the worst case position for CO₂ emissions."

Correction/justification: Clarifies that a vehicle may optionally be tested in a worst-case position for CO₂ emissions. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 6, paragraph 2.6.6.3., amend to read:

"At the request of the manufacturer, the vehicle may ~~also~~ **alternatively** be tested with the driver-selectable mode in the worst case position for CO₂ emissions."

Correction/justification: Clarifies that a vehicle may optionally be tested in a worst-case position for CO₂ emissions. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 7, paragraph 1.3.2., amend to read:

"The final criteria emission results shall be rounded **according to paragraph 7. of this UN GTR** in one step to the number of places to the right of the decimal point indicated by the applicable emission standard plus one additional significant figure."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 7, paragraph 1.3.3., amend to read:

"The NO_x correction factor, KH, shall be rounded **according to paragraph 7. of this UN GTR** to two decimal places."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 7, paragraph 1.3.4., amend to read:

"The dilution factor, DF, shall be rounded **according to paragraph 7. of this UN GTR** to two decimal places."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 7, paragraph 1.3.6., amend to read:

~~"Rounding of CO₂ and fuel consumption results is described in paragraph 1.4. of this annex."~~

Correction/justification: Paragraph not necessary as paragraph 7. of UN GTR 15 covers rounding.

Proposal

Annex 7, Table A7/1, step 8, amend to read:

"For CO₂ and FC, the values derived in step 8 shall be used, and CO₂ values shall be rounded **according to paragraph 7. of this UN GTR** to two decimal places, and FC values shall be rounded **according to paragraph 7. of this UN GTR** to three decimal places."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 7, Table A7/1, step 9, amend to read:

"FC values shall be rounded **according to paragraph 7. of this UN GTR** to one decimal place, expressed in (l/100 km)."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 7, paragraph 3.2.1.1.1., amend to read:

"The mean concentration of a gaseous compound shall be calculated using the following equation:

$$\bar{C}_i = \frac{\sum_{\text{phase}=1}^n (C_{i,\text{phase}} \times V_{\text{mix,phase}})}{\sum_{\text{phase}=1}^n V_{\text{mix,phase}}}$$

where:

C_i is mean concentration of a gaseous compound;

$C_{i,\text{phase}}$ is the concentration of each phase;

$V_{\text{mix,phase}}$ is the V_{mix} of the corresponding phase;

n is the number of phases."

Correction/justification: The definition of "n" was missing. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 7, paragraph 3.2.1.1.3.2., amend to read:

" R_f has been amended to $R_{f\text{CH}_4}$ and r_f has been amended to $R_{f\text{CH}_4}$ in the following six cases:

- Case 1:
$$C_{CH_4} = \frac{C_{HC(w/NMC)} - C_{HC(w/oNMC)} \times (1 - E_E)}{R_{fCH_4} \times (E_E - E_M)}$$
- Case 2: If $R_{fCH_4} < 1.05$, it may be omitted from the equation above for C_{CH_4} .
- Case 3:
$$C_{CH_4} = \frac{C_{HC(w/NMC)} \times R_{fCH_4} \times (1 - E_M) - C_{HC(w/oNMC)} \times (1 - E_E)}{R_{fCH_4} \times (E_E - E_M)}$$
- Case 4:
$$C_{NMHC} = \frac{C_{HC(w/oNMC)} \times (1 - E_M) - C_{HC(w/NMC)} \times R_{fCH_4} \times (1 - E_M)}{E_E - E_M}$$
- Case 5: R_{fCH_4} is the methane response factor as determined per paragraph 5.4.3.2. of Annex 5;
- Case 6: If $R_{fCH_4} < 1.05$, it may be omitted in the equations for case (b) above for C_{CH_4} and C_{NMHC} .

Correction/justification: In two steps, rf (small r) should have been originally written as Rf (capital R). And, R_f should have been written as R_{fCH_4} . Agreed by experts at IWG #22, Ispra.

Proposal

Annex 7, paragraph 3.2.1.1.4., amend to read:

- C_e is the flow-weighted arithmetic average concentration;
- $q_{V_{CVS}}(i)$ is the CVS flow rate at time $t = i \times \Delta t$, m^3/min ;
- $C(i)$ is the concentration at time $t = i \times \Delta t$, ppm;
- Δt sampling interval, s;
- V total CVS volume, m^3 ;
- n is the test time, s."**

Correction/justification: The counter "n" was not defined. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 7, paragraph 3.2.3.2.2.3.2.(a), amend to read:

"CFD Computational Fluid Dynamics"

Correction/justification: Editorial.

Proposal

Annex 7, paragraph 6.1., amend to read:

"The fuel characteristics required for the calculation of fuel consumption values shall be taken from Annex 3 ~~to~~ of this UN GTR."

Correction/justification: Editorial.

Proposal

Annex 7, Table A7/2, amend to read:

53	0.965	0.922	1.416	1.891	2.338	2.765	3.174	3.570	3.954	4.329
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Correction/justification: The value "3.570" in the column under 700 K and in the row 53 bar should have three places of decimal, the same as all other entries in the table.

Proposal

Annex 7, paragraph 8., amend to read:

"U_{dyn} shall be rounded **according to paragraph 7. of this UN GTR** to whole millimetres."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/2, third column, all entries, amend to read:

<i>Precision of final test result</i>
Rounded according to paragraph 7. of this UN GTR to nearest whole number
Rounded according to paragraph 7. of this UN GTR to the first place of decimal
Rounded according to paragraph 7. of this UN GTR to the second place of decimal
Rounded according to paragraph 7. of this UN GTR to the nearest whole number
Rounded according to paragraph 7. of this UN GTR to the nearest whole number
Rounded according to paragraph 7. of this UN GTR to the first place of decimal

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, paragraph 3.4.3., amend to read:

"For vehicles equipped with a driver-selectable mode, the mode for the test shall be selected according to paragraph ~~34~~ of Appendix 6 to this annex."

Correction/justification: Incorrect reference. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 8, Table A8/5, second last row labelled "Output from steps Nos. 6 and 7 of this table", amend to read:

"CO₂ values shall be rounded **according to paragraph 7. of this UN GTR** to two decimal places."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/6, second row, amend to read:

"FC values shall be rounded **according to paragraph 7. of this UN GTR** to three decimal places."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, paragraph 4.4.2.1.1., amend to read:

"EC_{DC,WLTC,j} is the electric energy consumption for the applicable WLTP test cycle **of DS_j** of the shortened Type 1 test procedure according to paragraph 4.3. of this annex, Wh/km;"

Correction/justification: Clarification that the test cycle is not called DS_j but that EC_{DC,WLTC,j} refers to a test cycle which is part of DS_j. Agreed by experts at IWG #22, Ispra.

Proposal

Annex 8, paragraph 4.5.1., amend to read:

"The maximum delta CO₂ allowed over the applicable cycle resulting from the calculation of the charge-sustaining CO₂ mass emission, M_{CO₂,CS}, from step 8 of Table A8/5 of Annex 8, between test vehicles L and H shall be 20 per cent of the CO₂ emissions from vehicle H plus 5 g/km, but shall be at least 15 g/km and not exceed 20 g/km.

~~The interpolation method shall only be used if the difference in charge-sustaining CO₂ mass emission, M_{CO₂,CS}, according to Table A8/5, step No. 8 between test vehicles L and H is between a minimum of 5 g/km and a maximum of 20 g/km or 20 per cent plus 5 g/km of the charge-sustaining CO₂ mass emission, M_{CO₂,CS}, according to Table A8/5, step No. 8 for vehicle H, whichever value is smaller."~~

Correction/justification: Clarification of the allowable maximum delta CO₂.

Proposal

Annex 8, paragraph 4.5.1., amend to read:

"The maximum absolute boundary boundaries of the interpolation range specified in this paragraph 20 g/km charge sustaining CO₂ mass emission difference between vehicle L and vehicle H or 20 per cent of the charge sustaining CO₂ mass emission for vehicle H, whichever is smaller, may be extended by 10 g/km if a vehicle M is tested. Vehicle M is a vehicle within the interpolation family with a cycle energy demand within ± 10 per cent of the arithmetic average of vehicles L and H."

Correction/justification: Clarification of the maximum boundaries of the interpolation range.

Proposal

Annex 8, Table A8/8, step 16, amend to read:

"Intermediate rounding according to paragraph 7. of this UN GTR."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/8, step 17, amend to read:

"Interpolation of individual values based on input from vehicle L, M and H, and final rounding according to paragraph 7. of this UN GTR."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/9, step 8, amend to read:

"Averaging and intermediate rounding according to paragraph 7. of this UN GTR."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/9, step 9, amend to read:

"Interpolation of individual values based on input from vehicle low, medium and high according to paragraph 4.5. of this annex, and final rounding according to paragraph 7. of this UN GTR."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/9, step 9 at "Output step 4", amend to read:

Output step 8	AER _{city,final} , km; AER _{final} , km; M _{CO2,weighted,final} , g/km; FC _{weighted,final} , l/100 km; EC _{final} , Wh/km; EC _{p,final} , Wh/km; EAER _{final} , km; EAER _{p,final} , km;	Interpolation of individual values based on input from vehicle low, medium and high according to paragraph 4.5. of this annex, and final rounding. Output available for individual vehicles.	AER _{city,ind} , km; AER _{ind} , km; M _{CO2,weighted,ind} , g/km; FC _{weighted,ind} , l/100 km; EC _{ind} , Wh/km; EC _{p,ind} , Wh/km; EAER _{ind} , km; EAER _{p,ind} , km.	9
Output step 4	AER-interpolation availability.			

Correction/justification: Insertion of a carriage return to align "Output step 4" with "AER-interpolation availability".

Proposal

Annex 8, Table A8/10, step 9, amend to read:

"Intermediate rounding **according to paragraph 7. of this UN GTR.**"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/10, step 10, amend to read:

"Interpolation according to paragraph 4.5. of this annex, and final rounding **according to paragraph 7. of this UN GTR.**"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/11, step 8, amend to read:

"Intermediate rounding **according to paragraph 7. of this UN GTR.**"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8/11, step 9, amend to read:

"Interpolation according to paragraph 4.5. of this annex and final rounding **according to paragraph 7. of this UN GTR.**"

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Appendix 2, paragraph 2.3.1., amend to read:

"The fuel consumption correction coefficient shall be rounded **according to paragraph 7. of this UN GTR** to four significant figures. The statistical significance of the fuel consumption correction coefficient shall be evaluated by the responsible authority."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Appendix 2, paragraph 2.3.2., amend to read:

"The CO₂ mass emission correction coefficient shall be rounded **according to paragraph 7. of this UN GTR** to four significant figures. The statistical significance of the CO₂ mass emission correction coefficient shall be evaluated by the responsible authority."

Correction/justification: Amended to include reference to paragraph 7. on rounding.

Proposal

Annex 8, Table A8.App5/1, amend to read:

<i>Parameter</i>	<i>Europe</i>	<i>Japan</i>
d _n	800 km	400 km
C1	26.25	11.9 11.8

Correction/justification: The value in this cell should be 11.8 and not 11.9. Agreed by experts at IWG #22, Ispra.

Potential GTR Modification to be added into GTR# 15/Amendment# 5

WLTP-23-06e

Section		contents	justification	reference documents (WLTP-23-06e_Appendix??)		
II	3. Definitions	add and/or modify (i.e. pair run, peripheral devices and so on)	1	05e_Appendix01		
	5. General requirements	modify family definition	1, 2	WLTP-22-11e_Appendix15		
	7. Rounding (NEW)	define how to derive final value	3	05e_Appendix01		
Annex	Appendix	para.				
2			improve the logic based on practical operation	3	01	
4	3.	Wind tunnel facility		2	08	
	4. 6.	Road load measurement on road		1, 4	NA	
	2.5.3.	4WD chassis dynamometer requirement		4	04	
	4.3.1.3.4.	Split run		4	06	
	7.	4WD chassis dynamometer requirement		4	04	
5	2.3.	4WD chassis dynamometer requirement		4	04	
	3.3.5.3.	CVS response time		3	GRPE-77-xx	
	5.	Response factor		1	13	
6	2.3.2.3.	3g/km extension		2	14	
	2.4. 2.6.	4WD chassis dynamometer requirement		4	04	
	Table A6/1	significant number		1	04e_Appendix12	
	appendix 2	modify family definition		1	WLTP-22-11e_Appendix15	
7	2.3.2.	Vehicle_M concept to ICE		4	09	
	3.2.1.1.3.	Response factor		1	13	
	3.2.3.2. and others	alternative road load coefficients		3	11	
	Table A7/1	significant number		1	04e_Appendix12	
8	Table A8/5~ 11	significant number		1	04e_Appendix12	
	3	3.	measurement of REESS voltage		4	NA
	4	2.2.3.	define "normal charge"		1	NA

1. make it clear
2. avoid multi-interpretation
3. solution
4. new