Submitted by the IWG on WLTP

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Proposal for amendments to ECE/TRANS/WP.29/GRPE/2017/9

The text reproduced below was prepared by the IWG on Worldwide harmonized Light vehicles Test Procedure (WLTP). The modifications to the current text of ECE/TRANS/WP.29/GRPE/2017/9 are marked in bold for new or struck through for deletion.

Proposal

Annex 2, paragraph 2.(g), amend to read:
"n_{max}

n_{max1} = n_{95_high}~~n_{max_95}~~, the ~~minimum~~ **maximum** engine speed where 95 per cent of rated power is reached, min^{-1};

If n_{95_high} cannot be determined because the engine speed is limited to a lower value n_{lim} for all gears and the corresponding full load power is higher than 95 per cent of rated power, n_{95_high} shall be set to n_{lim}. ~~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 $(n_{rated} \times (n/v)3 / (n/v)2) < 1.1 \times (n_{idle} + 0.125 \times (n_{rated} - n_{idle}))$, n_{max_95} shall be set to:~~

~~$1.1 \times (n_{idle} + 0.125 \times (n_{rated} - n_{idle})) \times (n/v)2 / (n/v)3$~~

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

$$n_{max2} = \left(\frac{n/v}{ng_{max}}\right) \times v_{max,cycle}$$

$$n_{max3} = \left(\frac{n/v}{ng_{max}}\right) \times v_{max,vehicle}$$

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;
$v_{max,vehicle}$	**is the maximum speed of the vehicle according to paragraph 2.(i) of this annex, km/h;**
$(n/v)(ng_{vmax})$	**is the ratio obtained by dividing engine speed n by the vehicle speed v for gear ng_{vmax}, min^{-1}/(km/h);**
n_{max}	is the maximum of **n_{max1}, n_{max2} and n_{max3},** ~~n_{max_95} and $n_{max}(ng_{vmax})$,~~ min^{-1}."

Correction/justification: n_{max3} is necessary for the calculation of ng_{vmax} and v_{max}. Furthermore, some text was moved from paragraph 2.(h) to this paragraph as they are required for the equations in paragraph 2.(g).

Proposal

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

"$P_{wot}(n)$, the full load power curve over the engine speed range.

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

The power curve shall consist of a sufficient number of data sets (n, P_{wot}) so that the calculation of interim points between consecutive data sets can be performed by linear interpolation. Deviation of the linear interpolation from the full load power curve according to Regulation No. 85 shall not exceed 2 per cent. The first data set shall be at n_{min_drive} of $n_{gear} > 2$ (see (k) below) or lower. The last data set shall be at **n_{max} or higher engine speed.** ~~n_{rated} or n_{max}, or $(n/v)(ng_{vmax}) \times v_{max}$, whichever is greater.~~ Data sets need not be spaced equally. The full load power at engine speeds not covered by Regulation No. 85 shall be determined according to the method described in Regulation No. 85;"

Proposal

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

"**Determination of** ng_{vmax} **and** **v_{max}**

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

If $v_{max}(ng) \geq v_{max}(ng-1)$ **and $v_{max}(ng-1) \geq v_{max}(ng-2)$**, then~~,~~:

$ng_{vmax} = ng$ and $v_{max} = v_{max}(ng)$~~,~~.

If $v_{max}(ng) < v_{max}(ng-1)$ and $v_{max}(ng-1) \geq v_{max}(ng-2)$, then:

$ng_{vmax} = ng-1$ and $v_{max} = v_{max}(ng-1)$,

otherwise, $ng_{vmax} = ng$ ~~-1~~2 and $v_{max} = v_{max}(ng$~~-1~~2)

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 **(gear ng-1).** ~~(s~~See Figure A2/1b~~)~~.

$v_{max}(ng-2)$ is the vehicle speed at which the required road load power equals the available power P_{wot} in the gear ng-2.

Vehicle speed values rounded to one place of decimal shall be used for the determination of v_{max} and ng_{vmax}.

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

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

where:

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

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

$$n_{ng} = (n/v)_{ng} \times v_{max}(ng);$$

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

$$\mathbf{n_{ng-2} = (n/v)_{ng-2} \times v_{max}(ng-2),}$$

and by reducing the power values of the full load power curve by 10 per cent.

The method described above shall be extended to even lower gears ng- 3, ng-4, etc. if necessary.

If, for the purpose of limiting maximum vehicle speed, the maximum engine speed ~~in the highest gear~~ is limited to n_{lim} which is lower than the engine speed corresponding to the intersection of the road load power curve and the available power curve, then:

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

Correction/justification: The text modification takes into consideration that some vehicles during the round robin test project reached their maximum vehicle speed in gear ng-2.

Proposal

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

"(j) Exclusion of a crawler gear

Gear 1 may be excluded at the request of the manufacturer if all of the following conditions are fulfilled:

(1) The vehicle does not have a dual-range transmission;

(2) The vehicle family is homologated to tow a trailer;

~~(3) ((n/v)1 / (n/v)(ng_vmax)) × (v_max × (n/v)(ng_vmax) / n_rated) > 7;~~

(3) $(n/v)_1 \times (v_{max} / n_{95\_high}) > 6.74$;

~~(4) ((n/v)2 / (n/v)(ng_vmax)) × (v_max × (n/v)(ng_vmax) / n_rated) > 4;~~

(4) $(n/v)_2 \times (v_{max} / n_{95\_high}) > 3.85$;"

Correction/justification: The use of n_{rated} as a calculation parameter could qualify vehicles with engines with extremely low n_{rated} values for a crawler gear although the transmission may not be designed accordingly. Hence, n_{rated} is not a technically good parameter for criteria (3) and (4). n_{95_high} is a more appropriate parameter resulting in an adjustment to the threshold values of 7 and 4 to 6.74 and 3.85 respectively.

Proposal

Annex 2, paragraph 3.3., amend to read:

"(a)   All gears $i < ng_{vmax}$ where $n_{min\_drive} \leq n_{i,j} \leq \mathbf{n_{max1}}\bcancel{n_{max\_95}}$;

(b)   All gears $i \geq ng_{vmax}$ where $n_{min\_drive} \leq n_{i,j} \leq \mathbf{n_{max2}}\bcancel{n_{max(ng_{vmax})}}$;"

Correction/justification: Modification due to the amendment to n_{max}.

Proposal

Annex 2, paragraph 3.5., amend to read:

"~~If in (b) P_available,i,j ≥ P_required,j can only be fulfilled in gear ng-1 when paragraph 3.3.(a) of this annex cannot be fulfilled because the corresponding engine speed exceeds n_max_95, this shall be accepted as long as the engine speed does not exceed n_rated.~~

~~If in (b) P_available,i,j ≥ P_required,j can only be fulfilled in a gear in which n_rated is exceeded, the next higher gear shall be used.~~"

Correction/justification: This text is no longer necessary due to the amendment to n_{max}.

Proposal

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

"**If the immediately following higher gear (n+1) is required for only 1 second and the gears before and after are the same (n), gear n+1 shall be corrected to gear n.**

If **the immediately preceding** lower gear is required at a higher vehicle speed during an acceleration phase **for more than 1 second**, the higher gears before shall be corrected to the lower gear. **This correction shall not be performed for gear 1.**

Example: $v_j < v_{j+1} < v_{j+2} < v_{j+3} < v_{j+4} < v_{j+5} < v_{j+6}$. The original calculated gear use is 2, 3, 3, 3, 2, 2, 3. In this case the gear use shall be corrected to 2, 2, 2, 2, 2, 2, 3.

If the immediately preceding lower gear (n-1) is required for only 1 second during an acceleration phase and the gears before and after are the same (n) or higher, gear n-1 shall be corrected to gear n.

Example: $v_{j-1} < v_j < v_{j+1}$. The original calculated gear use is 5, 4, 5 or 5, 4, 6. In this case the gear use shall be corrected to 5, 5, 5 or 5, 5, 6.

If the gear before the immediately preceding lower gear is required at a higher vehicle speed during an acceleration phase for just 1 second, this gear and the higher gears before shall be corrected to a one step lower gear. This correction shall not be performed for gear 1."

Correction/justification: The change makes the calculation procedure more logical and to improve the calculation result. The modification also eliminates impractical upshifts such as an upshift during the transition from an acceleration or from a constant speed phase to a deceleration phase.

Proposal

Annex 2, new paragraph 4.(g):

"**No upshift to a higher gear at the transition from an acceleration or constant speed phase to a deceleration phase if the gear in the phase following the deceleration phase is lower than the upshifted gear.**

Example: If $v_i \leq v_{i+1}$ and $v_{i+2} < v_{i+1}$ and gear i = 4 and gear i+1 = 5 and gear i+2 = 5, then gear i+1 and gear i+2 shall be set to 4 if the gear for the phase following the deceleration phase is gear 4 or lower. For all following cycle trace points with gear = 5 within the deceleration phase the gear shall also be set to 4. If the gear following the deceleration phase is gear 5, the upshift shall be done.

If there is an upshift during the transition and the initial deceleration phase by 2 gears, an upshift by 1 gear shall be performed."

Correction/justification: The modification eliminates impractical upshifts such as an upshift during the transition from an acceleration or from a constant speed phase to a deceleration phase.

Proposal

Annex 4, paragraph 8.1.3.3., amend to read:

"The simulated road load on the chassis dynamometer shall be calculated according to the method as specified in paragraph 4.3.1.4. of this annex, with the exception of measuring in opposite directions: and with applicable corrections according to paragraph 4.5. of this annex, resulting in a simulated road load curve:"

Correction/justification: Ambient condition corrections not required when driving on a dynamometer. Agreement reached by experts in IWG #17, Bern, April 2017.

Proposal

Annex 5, paragraphs 6.1.2.1., 6.1.2.2. and 6.1.2.4., amend to read:

" Purity: ≤ 1 ppm $\mathbf{C_1}$~~C1~~"

Correction/justification: Subscript "1" required.

Proposal

Annex 6, paragraph 2.6.5.3., amend to read:

"~~2.6.5.3.~~ ~~All transmissions~~

~~2.6.5.3.1.~~ ~~Vehicles equipped with a predominant mode shall be tested in that mode.~~

~~2.6.5.3.2.~~ ~~The manufacturer shall give evidence to the responsible authority of the existence of a mode that fulfils the requirements of paragraph 3.5.9. of this UN GTR. With the agreement of the responsible authority, the predominant mode may be used as the only mode for the determination of criteria emissions, CO2 emissions, and fuel consumption.~~

~~2.6.5.3.3.~~ ~~If the vehicle has no predominant mode or the requested predominant mode is not agreed by the responsible authority as a predominant mode, the vehicle shall be tested in the best case mode and worst case mode for criteria emissions, CO2 emissions, and fuel consumption. Best and worst case modes shall be identified by the evidence provided on the CO2 emissions and fuel consumption in all modes. CO2 emissions and fuel consumption shall be the arithmetic average of the test results in both modes. Test results for both modes shall be recorded.~~

~~2.6.5.3.4.~~ ~~On the basis of technical evidence provided by the manufacturer and with the agreement of the responsible authority, the dedicated driver selectable modes for very special limited purposes shall not be considered (e.g. maintenance mode, crawler mode). All remaining modes used for forward driving shall be considered and the criteria limits shall be fulfilled in all these modes.~~

~~2.6.6.~~ ~~Unexpected engine stop~~

~~If the engine stops unexpectedly, the preconditioning or Type 1 test shall be declared void.~~"

Correction/justification: Replaced by new paragraph 2.6.6. and 2.6.7. Agreement reached by experts in IWG #17, Bern, April 2017.

Proposal

Annex 6, paragraph 2.6.6., amend to read:

"2.6.6.   **Driver-selectable modes**

2.6.6.1.   **Vehicles equipped with a predominant mode shall be tested in that mode. At the request of the manufacturer, the vehicle may also be tested with the driver-selectable mode in the worst-case position for CO_2 emissions.**

2.6.6.2.   **The manufacturer shall provide evidence to the responsible authority of the existence of a mode that fulfils the requirements of paragraph 3.5.9. of this UN GTR. With the agreement of the responsible authority, the predominant mode may be used as the only mode for the determination of criteria emissions, CO_2 emissions, and fuel consumption.**

2.6.6.3.   **If the vehicle has no predominant mode or the requested predominant mode is not agreed by the responsible authority as being a predominant mode, the vehicle shall be tested in the best case mode and worst case mode for criteria emissions, CO_2 emissions, and fuel consumption. Best and worst case modes shall be identified by the evidence provided on the CO_2 emissions and fuel consumption in all modes. CO_2 emissions and fuel consumption shall be the arithmetic average of the test results in both modes. Test results for both modes shall be recorded.**

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

2.6.6.4.   **On the basis of technical evidence provided by the manufacturer and with the agreement of the responsible authority, the dedicated driver-selectable modes for very special limited purposes shall not be considered (e.g. maintenance mode, crawler mode). All remaining modes used for forward driving shall be considered and the criteria emissions limits shall be fulfilled in all these modes.**

2.6.6.5.   **Paragraphs 2.6.6.1. to paragraph 2.6.6.4. inclusive of this annex shall apply to all vehicle systems with driver-selectable modes, including those not solely specific to the transmission.**"

Correction/justification: Clarification of driver-selectable modes. Agreement reached by experts in IWG #17, Bern, April 2017.

Proposal

Annex 4, paragraph 2.6.7., amend to read:

"2.6.7.   **Voiding of the Type I test and** ~~C~~completion of the cycle

            If the engine stops unexpectedly, the preconditioning or Type 1 test shall be declared void.

            After completion of the cycle, the engine shall be switched off. The vehicle shall not be restarted until the beginning of the test for which the vehicle has been preconditioned."

Correction/justification: In conjunction with the new paragraph 2.6.6., this was agreed by experts in IWG #17, Bern, April 2017.

Proposal

Annex 6, Appendix 2, paragraph 4.1., amend to read:

"U_{REESS} is the nominal REESS voltage determined according to ~~DIN EN~~ **IEC** 60050-482, V;"

Correction/justification: DIN IEC 60050-482 has been cancelled because it was a draft standard issued in 2001. It was cancelled in 2004 when the actual IEC standard was approved. IEC 60050-482 is the current standard.

Proposal

Annex 7, paragraph 3.2.1.1.3.2., amend to read:

"If $\text{r}_\text{f}\mathbf{R_f}$ < 1.05, it may be omitted in the equations for case (b) above for C_{CH4} and C_{NMHC}."

Correction/justification: Editorial change to replace r_f with R_f.

Proposal

Annex 7, paragraph 8., amend to read:

"r_i is the transmission ratio in gear $\text{I}i$;"

Correction/justification: Editorial change to replace upper case "I" with lower case "i".

Proposal

Annex 7, paragraph 8., amend to read:

"H/W   is the tyre's aspect ratio, e.g. "45" for a 225/45 R17 tyre;

W   is the tyre width, mm; e.g. "225" for a 225/45 R17 tyre;

   R   is the wheel diameter, inch; e.g. "17" for a 225/45 R17 tyre.

   U_{dyn} shall be rounded to whole millimeters.

If U_{dyn} is different for the front and the rear axles, the value of n/v for the predominantly powered axle shall be applied. Upon request, the responsible authority shall be provided with the necessary information for that selection."

Correction/justification: Calculation of the n/v ratio for vehicles with different tyre dynamic rolling circumferences for 4WD vehicles. Agreed by experts in IWG #17, Bern, April 2017.

Proposal

Annex 8, Appendix 6, paragraph 1.1., amend to read:

"The manufacturer shall select the driver-selectable mode for the Type 1 test procedure according to paragraph**s** 2. to ~~paragraph~~ 4. inclusive of this appendix which enables the vehicle to follow the considered test cycle within the speed trace tolerances according to paragraph 2.6.8.3. of Annex 6. **This shall apply to all vehicle systems with driver-selectable modes including those not transmission-specific.**"

Correction/justification:

1. Editorial improvement in the first sentence.

2. Extending the selection of driver-selectable modes to those not only specific to transmissions. Agreed by experts in IWG #17, Bern, April 2017.

Proposal

Annex 8, Appendix 3, paragraph 3.2., amend to read:

"Nominal REESS voltage

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

Correction/justification: DIN IEC 60050-482 has been cancelled because it was a draft standard issued in 2001. It was cancelled in 2004 when the actual IEC standard was approved. IEC 60050-482 is the current standard.