

**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**

*II Text of the global technical regulation, paragraph 3.5.2., amend to read:*

"*Category 1 vehicle*" means a power-driven vehicle with four or more wheels designed and constructed primarily for the carriage of one or more persons."

Correction/justification: Hyphen added between power and driven.

**Proposal**

*II Text of the global technical regulation, paragraph 3.5.5., amend to read:*

"*Category 2 vehicle*" means a power-driven vehicle with four or more wheels designed and constructed primarily for the carriage of goods."

Correction/justification: Hyphen added between power and driven.

**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;

$v_{\max, \text{cycle}}$  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 gear  $ng_{v_{\max}}$ ,  $\text{min}^{-1}/(\text{km/h})$ ;**

$n_{\max}$  is the maximum of  $n_{\max 1}$ ,  $n_{\max 2}$  **and**  $n_{\max 3}$ ,  ~~$n_{\max 95}$  and  $n_{\max}(ng_{v_{\max}})$~~ ,  $\text{min}^{-1}$ ."

Correction/justification:  $n_{\max 3}$  is necessary for the calculation of  $ng_{v_{\max}}$  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:

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

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

The power curve shall consist of a sufficient number of data sets ( $n$ ,  $P_{\text{wot}}$ ) 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  $n_{\text{min\_drive}}$  of  $n_{\text{gear}} > 2$  (see (k) below) or lower. The last data set shall be at  **$n_{\max}$  or higher engine speed.**  ~~$n_{\text{rated}}$  or  $n_{\max}$  or  $(n/v)(ng_{v_{\max}}) \times v_{\max}$ , 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;"

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

## Proposal

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

**"Determination of  $ng_{v_{\max}}$  and  $v_{\max}$**

$ng_{v_{\max}}$ , 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,:

$ng_{v_{\max}} = ng$  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:**

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

otherwise,  $ng_{v_{\max}} = ng-2$  and  $v_{\max} = v_{\max}(ng-2)$

where:

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

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

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

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

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

where:

$v_{\max}$  is stands for the vehicle speed specified above, 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,  $P_{\text{wot}}(n)$ , by using the following equations:

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

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

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

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, i.e. 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  $n_{\text{lim}}$  which is lower than the engine speed corresponding to the intersection of the road load power curve and the available power curve, then:

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

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)  $((n/v)_1 / (n/v)(ng_{v_{\max}})) \times (v_{\max} \times (n/v)(ng_{v_{\max}}) / n_{\text{rated}}) > 7;$~~

~~(32)  $(n/v)_1 \times (v_{\max} / n_{95\_high}) > 6.74;$~~

~~(4)  $((n/v)_2 / (n/v)(ng_{v_{\max}})) \times (v_{\max} \times (n/v)(ng_{v_{\max}}) / n_{\text{rated}}) > 4;$~~

~~(43)  $(n/v)_2 \times (v_{\max} / n_{95\_high}) > 3.85;$ "~~

~~(54) The vehicle, having a mass  $m_t$  as defined in the equation below, is able to pull away from standstill within 4 seconds, on an uphill gradient of at least 12 per cent, on five separate occasions within a period of 5 minutes.~~

$$m_t = m_{r0} + 25 \text{ kg} + (MC - m_{r0} - 25 \text{ kg}) \times 0.28$$

~~(factor 0.28 in the above equation shall be replaced by factor 0.15 in the case of M category vehicles),~~

~~where:~~

$v_{\max}$  is the maximum vehicle speed as specified in paragraph 2. (i) of this annex. **Only the  $v_{\max}$  value resulting from the intersection of the required road load power curve and the available power curve of the relevant gear shall be used for the conditions in (3) and (4) above. A  $v_{\max}$  value resulting from a limitation of the engine speed which prevents this intersection of curves shall not be used;**"

Correction/justification: The use of  $n_{\text{rated}}$  as a calculation parameter could qualify vehicles with engines with extremely low  $n_{\text{rated}}$  values for a crawler gear although the transmission may not be designed accordingly. Hence,  $n_{\text{rated}}$  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  $i < n_{g_{v_{\max}}}$  where  $n_{\text{min\_drive}} \leq n_{i,j} \leq n_{\text{max}1} n_{\text{max\_95}}$ ;
- (b) All gears  $i \geq n_{g_{v_{\max}}}$  where  $n_{\text{min\_drive}} \leq n_{i,j} \leq n_{\text{max}2} n_{\text{max}(n_{g_{v_{\max}}})}$ ;"

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

## Proposal

*Annex 2, paragraph 3.5., amend to read:*

~~"If in (b)  $P_{\text{available},i,j} \geq P_{\text{required},j}$  can only be fulfilled in gear  $n_g - 1$  when paragraph 3.3.(a) of this annex cannot be fulfilled because the corresponding engine speed exceeds  $n_{\text{max\_95}}$ , this shall be accepted as long as the engine speed does not exceed  $n_{\text{rated}}$ "~~

~~"If in (b)  $P_{\text{available},i,j} \geq P_{\text{required},j}$  can only be fulfilled in a gear in which  $n_{\text{rated}}$  is exceeded, the next higher gear shall be used."~~

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

## 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), gear n+1 shall be corrected to gear n.**

If a **one step** 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 a one step 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 a two step 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 shall be performed 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 performed.**

**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 4.3.2.1.3., amend to read:*

"Before the coastdown, the anemometer shall be calibrated for speed and yaw offset as specified in ISO 10521-1:2006(E) Annex A-."

Correction/justification: Space between A and the end of the sentence removed.

## 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 #18, Bern, April 2017.

## Proposal

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

" Purity:  $\leq 1 \text{ ppm C}_1\text{C}_4$ "

Correction/justification: Subscript "1" required.

## Proposal

*Annex 6, paragraph 2.3.1.*, amend to read:

"If at the request of the manufacturer the interpolation method is used (see paragraph 3.2.3.2. of Annex 7), an additional measurement of emissions shall be performed with the road load as determined with test vehicle L. Tests on vehicles H and L should be performed with the same test vehicle and shall be tested with the shortest **n/v ratio (with a tolerance of ±1.5 per cent) final transmission ratio** within the interpolation family. In the case of a road load matrix family, an additional measurement of emissions shall be performed with the road load as calculated for vehicle L<sub>M</sub> according to paragraph 5.1. of Annex 4."

Correction/justification: Agreed by experts in IWG #18, Bern, April 2017.

## 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, CO<sub>2</sub> 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, CO<sub>2</sub> emissions, and fuel consumption. Best and worst case modes shall be identified by the evidence provided on the CO<sub>2</sub> emissions and fuel consumption in all modes. CO<sub>2</sub> 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 #18, 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> emissions, and fuel consumption. Best and worst case modes shall be identified by the evidence provided on the CO<sub>2</sub> emissions and fuel consumption in all modes. CO<sub>2</sub> 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<sub>2</sub> 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 to include those not transmission-specific. Agreement reached by experts in IWG #18, Bern, April 2017.

## **Proposal**

*Annex 6, paragraph 2.6.7., amend to read:*

- "2.6.7. **Voiding of the Type 1 test and 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 #18, Bern, April 2017.

## **Proposal**

*Annex 6, Appendix 2, paragraph 2.1.1., amend to read:*

"The REESS current(s) shall be measured during the tests using a clamp-on or closed type current transducer. The current measurement system shall fulfil the requirements specified in Table A8/1. The current transducer(s) shall be capable of handling the peak currents at engine starts and temperature conditions at the point of measurement.

**In order to have an accurate measurement, zero adjustment and degaussing shall be performed before the test according to the instrument manufacturer's instructions."**

Correction/justification: Agreed by experts in IWG #19, Geneva, June 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  $r_f R_f < 1.05$ , 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  $H_i$ ;"

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~~ millimetres.

**If  $U_{dyn}$  is different for the front and the rear axles, the value of n/v for the mainly 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 #18, Bern, April 2017.



## Proposal

*Annex 8, Appendix 3, paragraph 2.1.1.*, amend to read:

"The REESS current(s) shall be measured during the tests using a clamp-on or closed type current transducer. The current measurement system shall fulfil the requirements specified in Table A8/1 of this annex. The current transducer(s) shall be capable of handling the peak currents at engine starts and temperature conditions at the point of measurement.

**In order to have an accurate measurement, zero adjustment and degaussing shall be performed before the test according to the instrument manufacturer's instructions."**

Correction/justification: Agreed by experts in IWG #19, Geneva, June 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.

## 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 paragraphs 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 solely specific to the transmission.**"

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 #18, Bern, April 2017.