

## **Proposal for revision of the document ECE/TRANS/WP.29/GRPE/2012/2**

The document ECE/TRANS/WP.29/GRPE/2012/2 was further discussed with the experts from the United Kingdom, the Netherlands and the European Commission. The outcome of the discussion is a revision of the above mentioned document. In the revised document the wording of some paragraphs was improved for better clarification. Further the following points are changed:

- Take into account the UK proposal on amending Regulation No. 101 to introduce procedures for declaration of electric range and electrical energy consumption by the vehicle manufacturer to allow vehicle manufacturers some discretion for their declared value(s) and so help to manage customer expectations with this technology.
- Some rewording and further clarification of paragraphs 4.2.2.1.1. to 4.2.2.1.3. and reference to new paragraph 4.2.2.1.3.1.
- New paragraph 4.2.2.1.3.1. aiming at taking into account the recuperation energy and the electric range derived from a vehicle speed level that has provided by the battery.

### **I. Proposal**

*Paragraph 5.3.2, amend to read:*

"5.3. Description of tests for vehicles powered by an electric power train only

.....

5.3.2. The technical service in charge of the tests conducts the measurement of the electric range of the vehicle according to the method described in Annex 9.

~~The electric range measured by this method is the only one which may be included in sales promotional material."~~

*Paragraph 5.4.6, amend to read:*

"5.4. Description of tests for vehicles powered by a hybrid electric power train

.....

5.4.6. The technical service in charge of the tests conducts the measurement of the electric range of the vehicle according to the method described in Annex 9 to this Regulation. The result shall be expressed in km, rounded to the nearest whole number.

~~The electric range measured by this method is the only one which may be included in sales promotional material and which may be used for the calculations of Annex 8."~~

*Insert new Paragraphs 5.5.4 to 5.5.7, to read:*

"5.5. Interpretation of results

.....

**5.5.4. The electric range value adopted as the type approval value shall be the value declared by the manufacturer if this is no more than the value measured by the technical service. The declared value may be lower than the measured value without any limitations.**

**5.5.5 If the declared range value exceeds the value measured by the technical service,**

then another test is run on the same vehicle. When the manufacturer's declared value does not exceed the average of the two test results, then the value declared by the manufacturer is taken as the type approval value.

5.5.6 If the declared value still exceeds the average measured value a final test is run on the same vehicle. The average of the three results is taken as the type approval value.

5.5.7 The electric range determined according to paragraphs 5.5.4 to 5.5.6 is the only one which may be included in sales promotional material. This value must also be used for the calculations in Annex 8 paragraphs 3.4.2.1 and 3.4.4.1."

*Annex 9, Paragraphs 4.1.1.3.1, amend to read:*

"4.1.1.3.1. If there is not a pure electric position, the manufacturer shall provide the means for performing the **discharge of the battery measurement** with the vehicle running in pure electric operating state."

*Annex 9, Paragraphs 4.2.2.1 to 4.2.2.1.5., amend to read:*

4.2.2.1. To determine the electric range of a hybrid electric vehicle

4.2.2.1.1. The applicable test sequence and accompanying gear shift prescription, as defined in paragraph 1.4. of Annex 8, is applied on a chassis dynamometer adjusted as described in Appendices 2, 3, and 4 of Annex 4 of Regulation No. 83, until the end of the test criteria is reached.

**To determine the electric range (De) of OVC HEVs equipped with an operating mode switch the same operating mode position, in accordance with Table 4.1.3 and section 4.2.1 of Annex 8, shall be used as for the determination of CO<sub>2</sub> and fuel consumption.**

4.2.2.1.2. To measure the electric range the end of the test criteria is reached when the vehicle is not able to meet the target curve up to 50 km/h, or when an indication from the standard on-board instrumentation is given to the driver to stop the vehicle or when the battery has reached its minimum state of charge. Then the vehicle shall be slowed down to 5 km/h by releasing the accelerator pedal, without touching the brake pedal and then stopped by braking.

4.2.2.1.3 At a speed over 50 km/h, when the vehicle does not reach the required acceleration or speed of the test cycle, the accelerator pedal shall remain fully depressed until the reference curve has been reached again. **The maximum possible speed in pure electric operating state in the first combined cycle shall be recorded in the test report and in the drivers' handbook of production vehicles.**

**During this procedure, the electricity balance (Q<sub>ES<sub>i</sub></sub>) of the high voltage battery (expressed in Ampere hours), measured continuously and using the procedure specified in Appendix 2 to the Annex 8 of this Regulation, the vehicle speed (V<sub>ES<sub>i</sub></sub>) and De<sub>i</sub> shall be recorded at the instant when the fuel consuming engine starts and the accumulation of De<sub>i</sub> shall be stopped. Further accumulation of De<sub>i</sub> shall not be permitted unless**

- the fuel consuming engine stopped running and
- V<sub>ES<sub>i</sub></sub> has returned to the same or any lower level of V<sub>ES<sub>i</sub></sub> as recorded before the fuel consuming engine started and

- $Q_{ES_i}$  has returned to the same or any lower level of  $Q_{ES_i}$  as recorded before the last fuel consuming engine start or, where applicable, to the same or any lower level of  $Q_{SA_i}$  as determined in accordance with paragraph 4.2.2.1.3.1.

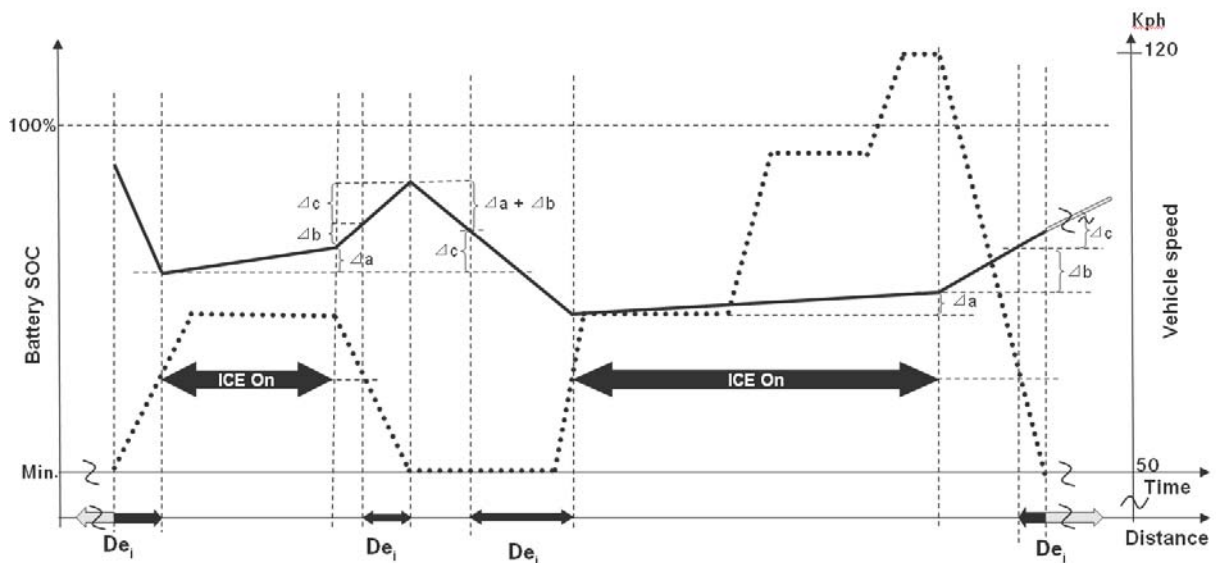
This procedure shall be followed until the end of the test as defined in paragraph 4.2.2.1.2.

4.2.2.1.3.1 During the first deceleration phase following each start of the fuel consuming engine, when the vehicle speed is less than the vehicle speed at which the fuel consuming engine started previously

- the distance covered with engine off should be counted as  $De_i$  and
- the increase in electricity balance during this period should be recorded ( $\Delta Q_{rb_i}$ ), and
- the electricity balance when the fuel consuming engine starts ( $Q_{ES_i}$ ) defined previously should be corrected by  $\Delta Q_{rb_i}$  (hence new  $Q_{SA_i} = Q_{ES_i} + \Delta Q_{rb_i}$ )

- $V_{ES_i}$  : Vehicle speed at the moment when the ICE starts
- $Q_{ES_i}$  : Energy of the battery at the moment when the ICE starts
- $\Delta Q_{rb_i}$  : The increase in electricity balance during deceleration phases, when the vehicle speed is less than the vehicle speed at which the ICE started previously
- $Q_{SA_i}$  : Energy of the battery at the moment of the further accumulation of  $De$

Example:



- $\triangle a$ : Charged by ICE
- $\triangle b$ : Charged by regeneration (vehicle acceleration by ICE)
- $\triangle c$ : Charged by regeneration ( $\Delta Q_{rb_i}$ , vehicle acceleration with energy from battery)
- $De = \sum De_i$
- $De_i =$  Distances where the propulsive energy was not produced by ICE
- Battery SOC
- ..... Vehicle Speed

4.2.2.1.4 To respect human needs, up to three interruptions are permitted between test sequences, of no more than 15 minutes in total.

4.2.2.1.5 ~~At the end, the measure  $D_e$  of the distance covered using the electrical motor only in km is the electric range of the hybrid electric vehicle. It shall be rounded to the nearest whole number.~~

~~Where the vehicle operates both in electric and hybrid modes during the test, the periods of electric only operation will be determined by measuring current to the injectors or ignition.~~

**At the end, the electric range is the sum of all cycle portions  $D_{e_i}$  in km. It shall be rounded to the nearest whole number."**

## II. Justification

1. At present Regulation 101 requires that the measured value of electric range is the only value that may be used in promotional literature. Unlike CO<sub>2</sub>, fuel consumption and electrical energy consumption, manufacturers are not permitted to specify more conservative values. It is proposed that, in order to manage customer expectations regarding the electric range of electric and hybrid electric vehicles, manufacturers be permitted to use declared electric range values which are lower than the measured value.

2. This proposal inserts additional text permitting lower values to be declared for electric range than those measured. The declared value shall then be the value that is used in promotional literature and, for Off Vehicle Charging hybrid electric vehicles, for the calculation of weighted CO<sub>2</sub>, fuel consumption and electrical energy consumption in Annex 8.

3. To prevent adjustments of OVC HEV aiming at extending  $D_e$  just within the corresponding test procedure the determination of CO<sub>2</sub> and fuel consumption and of  $D_e$  shall be undertaken in the same operation mode.

4. For consumer information on the electric performance the maximum electric speed of the OVC HEC should be recorded both in the test report and the drivers handbook of the vehicle.

5. If – as foreseen in current regulation - the usage of a fuel consuming engine is allowed for the procedure to determine the electric range of a hybrid electric vehicle, manufacturer might take advantage of using recuperation energy from a higher vehicle speed level that has been provided by the fuel consuming engine or using the fuel consuming engine as electric generator up to this higher speed level. The recuperation/generator energy increases the SOC and the electric range can this way be extended. Therefore, the influence of the fuel consuming engine should be restricted by stopping the accumulation of the electric range until the fuel consuming engine stops running. But also the recuperated/generated energy from the fuel consuming engine needs to be adequately considered. Therefore the level of electricity balance of the high voltage battery is measured continuously and at latest from the moment on when the fuel consuming engine starts first time. The level of electricity balance when the fuel consuming engine starts is recorded. When this or any lower level is reached again, after loading and depleting operations of the high voltage battery, the accumulation of  $D_e$  can be continued. Following this approach no advantages can be taken from usage of the fuel consuming engine regarding the determination of  $D_e$ .

6. The recuperation energy and the electric range derived from a vehicle speed level that has provided by the battery is regarded using the procedures and formulae under 4.2.2.1.3.1.

