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# JAMA Initial Comments

## Annex 8 -Appendix 2

### REESS charge balance (RCB) correction

This Appendix describes the test procedure for REESS charge balance correction of CO<sub>2</sub> and fuel consumption for NOVC-HEV and OVC-HEV for the CS type 1 test.

#### 1. General requirements

1.1. To determine if a correction of fuel consumption and CO<sub>2</sub> mass emission measured over the whole cycle is required according to paragraph 1.2. of this Appendix, paragraph 4.3 of Annex 8 shall be used to calculate the charge-sustaining REESS energy change  $\Delta E_{REESS,CS}$  of the CS type 1 test. The considered period is defined by the CS type 1 test. (difficult to understand)

コメント [DTF1]:

NEW CONTENT:

Due to adoption of phase specific CO<sub>2</sub> mass emission and fuel consumption this part only excludes the correction of the CO<sub>2</sub> mass emission and fuel consumption determined over the whole cycle.

1.2. The correction of the charge-sustaining fuel consumption and the charge-sustaining CO<sub>2</sub> mass emission over the whole cycle and each phase shall be omitted and the uncorrected values shall be used if any of the following criteria is fulfilled:

コメント [DTF2]:

NEW CONTENT:

Due to adoption of phase specific CO<sub>2</sub> mass emission and fuel consumption this part only excludes the correction of the CO<sub>2</sub> mass emission and fuel consumption determined over the whole cycle.

- (a) The manufacturer can prove the technical service by measurement that there is no relation between  $\Delta E_{REESS,CS}$  and CO<sub>2</sub> mass emission and  $\Delta E_{REESS,CS}$  and fuel consumption respectively;
- (b)  $\Delta E_{REESS,CS}$  is negative, which corresponds to REESS charging;
- (c)  $\Delta E_{REESS,CS}$  is positive, which corresponds to REESS discharging, and the correction criterion according to paragraph 1.3. of this Appendix is not fulfilled.

1.2. can be deleted because there is almost no chance to be these situations

1.3. The correction criterion c is fulfilled if the ratio between charge-sustaining REESS energy change  $\Delta E_{REESS,CS}$  and the charge sustaining cycle fuel energy is higher than the percentage specified in Table A8/5. This ratio is calculated as follows:

$$c = \frac{\Delta E_{REESS,CS}}{E_{fuel,CS}} \quad (1)$$

where:

$\Delta E_{REESS,CS}$  is the charge-sustaining REESS energy change according to paragraph 1.1. of this Appendix, Wh;

$E_{fuel,CS}$  is the charge-sustaining fuel energy according to the equation below, Wh;

and

$$E_{fuel,CS} = \frac{1}{360} \times NHV \times \rho_{fuel} \times FC_{CS,nb} \times d_{CS} \quad (2)$$

where:

$E_{fuel,CS}$  is the charge-sustaining fuel energy, Wh;

NHV is the net heating value according to the certificate of the reference fuel, MJ/kg; (this is fixed value, isn't it ?, of course, fuel depended, like E0, E10 and so on)

コメント [IR3]: Observation: in the drafting taskforce it was agreed not to include the actual evaluation of the criterion into the formula, if that is already explained in the text.

DTF:

Discussion in the drafting meeting to clarify this and to be in line with Annex 6 Appendix 2 "RCB-monitoring".

30.04.17 TDF:

Symbol in the test and the equation was adjusted due to agreement from 17.04.15 "#6, percentages in general" (drafting meeting in Stockholm)

Task for the drafting coordinator:

This paragraph is also used in Annex 6 Appendix 2 "RCB-monitoring" and has to be adjusted as well.

コメント [SMD4]: OPEN POINT: 21.04.2015 audio/web.

コメント [DTF5]: Adjusted due to avoid references to equation numbers.

$\rho_{fuel}$	is the density according to the certificate of the reference fuel, kg/m <sup>3</sup> ;
$FC_{CS,nb}$	is the non-balanced charge-sustaining fuel consumption of the CS type 1 test determined according to paragraph 6. of Annex 7, l/100 km;
$d_{CS}$	is the distance driven over the corresponding CS type 1 test cycle, km;
$\frac{1}{360}$	conversion factor to Wh.

Table A8/5

**Correction criteria**

Test cycle	Low + Medium + High	Low + Medium + High + Extra High
Correction criterion c 1 (%)	1	0.5

2. Correction methodology

2.1. The CO<sub>2</sub> mass emission correction coefficient,  $K_{CO_2}$ , the fuel consumption correction coefficient,  $K_{fuel}$ , and if required the phase specific correction coefficients,  $K_{CO_2,m}$  and  $K_{fuel,m}$ , shall be developed based on the CS type 1 test. The CS type 1 test can be performed under the warm-up conditions

2.1.1. In case the vehicle H was tested for the correction coefficient determination the CO<sub>2</sub> mass emission correction coefficient,  $K_{CO_2}$ , and the fuel consumption correction coefficient,  $K_{fuel}$ , can be applied within the interpolation family.

2.2. The correction coefficients shall be determined from a set of  $n_{CS}$  CS type 1 tests performed by the manufacturer. This set shall contain at least one test with  $\Delta E_{REESS,CS} \leq 0$  and at least one with  $\Delta E_{REESS,CS} > 0$ .  $\Delta E_{REESS,CS,n}$  is the sum of electric energy changes of all REESS of test n calculated according to paragraph 1.1 of this Annex.

If the latter condition cannot be realised on the test cycle, the responsible authority shall evaluate the statistical significance of the extrapolation that is necessary to determine the corrected CO<sub>2</sub> mass emission and fuel consumption at  $\Delta E_{REESS,CS} = 0$ .

2.3. Determination of fuel consumption correction coefficient

2.3.1. The fuel consumption correction coefficient ( $K_{fuel}$ ) determined by driving a set of CS type 1 tests, is defined as follows:

$$K_{fuel} = \frac{\sum_{n=1}^{n_{CS}} ((EC_{DC,CS,n} - EC_{DC,CS,avg}) \times (FC_{CS,nb,n} - FC_{CS,nb,avg}))}{\sum_{n=1}^{n_{CS}} (EC_{DC,CS,n} - EC_{DC,CS,avg})^2} \quad (3)$$

where:

$K_{fuel}$  is the fuel consumption correction coefficient, l/100 km/Wh/km;

コメント [DTF6]: This part of par. 1.4 of this Appendix was moved to 4.1.1. of this Annex as proposed by Japan.

コメント [DTF7]: This part of par. 1.4. of this Appendix was moved to 4.2.1. of this Annex as proposed by Japan.

コメント [DTF8]: The phase specific correction coefficients are only required on request of the manufacturer.

削除: calculated

削除: cycles

コメント [DTF9]: NEW CONTENT: Due to RCB-correction adoption @ #10th IWG this paragraph was inserted.

コメント [IR10]: Observation: Since the manufacturer may request to modify the SOC of the battery in advance of the CS test, it should always be possible to have a positive and negative  $\Delta E_{REESS,CS}$  (see par. 2.1.4 of Annex 8)

DTF: This has to be discussed. In principal that is reasonable. One the other hand there should be an opportunity to handle such a case in order to give a manual if it is not possible due to some technical or operation strategy reasons. Maybe it is solution to define additional criteria to that option (e.g. a minimum range for  $\Delta E_{REESS}$  between the lowest and highest  $\Delta E_{REESS}$ ).

コメント [SMD11]: OPEN POINT: 21.04.2015 audio/web.

30.04.2015: further discussions on Subgroup EV necessary

コメント [DTF12]: IR: Observation: This unit can be simplified by taking out the km: l/100Wh

DTF: l/100 km/Wh/km is more clear for the reader -- > l/100Wh is also not a typical unit

SMD: 21.04.2015 audio/web: agreed to keep as l/100 km/Wh/km.

DTF: 30.04.2015: idea is to use square brackets -- >[l/100km]/[Wh/km]. Will be checked by DC.

$EC_{DC,CS,n}$  is the charge-sustaining electric energy consumption of CS type 1 test n based on the REESS depletion according to the equation below, Wh/km;

$EC_{DC,CS,avg}$  is the average charge-sustaining electric energy consumption of  $n_{CS}$  CS type 1 tests based on the REESS depletion according to the equation below, Wh/km;

$FC_{CS,nb,n}$  is the non-balanced charge-sustaining fuel consumption of the CS type 1 test n calculated according to paragraph 6 of Annex 7, l/100 km;

$FC_{CS,nb,avg}$  is the average charge-sustaining fuel consumption of  $n_{CS}$  CS type 1 tests based on the non-balanced fuel consumption according to the equation below, l/100 km;

n is the index number of the considered test;

$n_{CS}$  is the total amount of CS type 1 tests;

and

$$EC_{DC,CS,avg} = \frac{1}{n_{CS}} \times \sum_{n=1}^{n_{CS}} EC_{DC,CS,n} \quad (4)$$

and

$$FC_{CS,nb,avg} = \frac{1}{n_{CS}} \times \sum_{n=1}^{n_{CS}} FC_{CS,nb,n} \quad (5)$$

and

$$EC_{DC,CS,n} = \frac{\Delta E_{REESS,CS,n}}{d_{CS,n}} \quad (6)$$

where:

$\Delta E_{REESS,CS,n}$  is the charge-sustaining REESS energy change of test n according to paragraph 1.1. of this Appendix, Wh;

$d_{CS,n}$  is the distance driven over the corresponding CS type 1 test n, km.

The fuel consumption correction coefficient shall be rounded to four significant figures. The statistical significance of the fuel consumption correction coefficient shall be evaluated by the responsible authority.

2.3.2. The fuel consumption correction coefficient developed over the whole cycle can be applied for the correction of each individual phase.

2.3.3. Without prejudice to the requirements of paragraph 2.2. of this Appendix, at the manufacturer's request, separate fuel consumption correction coefficients  $K_{fuel,m}$  for each individual phase may be developed. Therefore the same conditions as described in paragraph 2.2. of this Appendix have to be fulfilled in each individual phase and the procedure described in paragraph 2.3.1. of this Appendix shall be applied for each individual phase to determine each phase specific correction coefficient.

コメント [DTF13]: Adjusted due to avoid references to equation numbers.

コメント [DTF14]: Adjusted due to avoid references to equation numbers.

コメント [DTF15]: The paragraph 2.4. of this Appendix was moved to 4.2.1. of this Annex as proposed by Japan.

2.4. Determination of CO<sub>2</sub> mass emission correction coefficient

2.4.1. The CO<sub>2</sub> mass emission correction coefficient (K<sub>CO2</sub>) determined by driving a set of CS type 1 tests, is defined as follows:

$$K_{CO2} = \frac{\sum_{n=1}^{n_{CS}} (EC_{DC,CS,n} - EC_{DC,CS,avg}) \times (M_{CO2,CS,nb,n} - M_{CO2,CS,nb,avg})}{\sum_{n=1}^{n_{CS}} (EC_{DC,CS,n} - EC_{DC,CS,avg})^2} \quad (7)$$

where:

- K<sub>CO2</sub> is the CO<sub>2</sub> mass emission correction coefficient, g/km/Wh/km;
- EC<sub>DC,CS,n</sub> is the charge-sustaining electric energy consumption of CS type 1 test n based on the REESS depletion according to paragraph 2.3.1. of this Appendix, Wh/km;
- EC<sub>DC,CS,avg</sub> is the average charge-sustaining electric energy consumption of n<sub>CS</sub> CS type 1 tests based on the REESS depletion according to paragraph 2.3.1. of this Appendix, Wh/km;
- M<sub>CO2,CS,nb,n</sub> is the non-balanced charge-sustaining CO<sub>2</sub> mass emission of the CS type 1 test n calculated according to paragraph 3.2.1. of Annex 7, g/km;
- M<sub>CO2,CS,nb,avg</sub> is the average charge-sustaining CO<sub>2</sub> mass emission of n<sub>CS</sub> CS type 1 tests based on the non-balanced CO<sub>2</sub> mass emission according to the equation below, g/km;
- n is the index number of the considered test;
- n<sub>CS</sub> is the total amount of CS type 1 tests;

$$M_{CO2,CS,nb,avg} = \frac{1}{n_{CS}} \times \sum_{n=1}^{n_{CS}} M_{CO2,CS,nb,n} \quad (8)$$

The CO<sub>2</sub> mass emission correction coefficient shall be rounded to four significant figures. The statistical significance of the CO<sub>2</sub> mass emission correction coefficient shall be evaluated by the responsible authority.

2.4.2. The CO<sub>2</sub> mass emission correction coefficient developed over the whole cycle can may be applied for the correction of each individual phase.

2.4.3. Without prejudice to the requirements of paragraph 2.2. of this Appendix, at the manufacturer's request, separate CO<sub>2</sub> mass emission correction coefficients K<sub>CO2,m</sub> for each individual phase may be developed. Therefore the same conditions as described in paragraph 2.2. of this Appendix shall be fulfilled in each individual phase and the procedure described in paragraph 2.5.1. of this Appendix shall be applied for each individual phase to determine each phase correction coefficients.

3. **????? (have we discussed this alternative procedure ????)**  
**Alternative test procedure for the determination of the correction coefficient**

3.1. Alternatively to the charge-sustaining test procedure for OVC-HEV described in paragraph 3.2.5. of this Annex, the following test sequence can be used to measure all values that are necessary for the determination of the correction coefficient according to paragraph 2 of this Appendix.

コメント [DTF16]:  
30.04.15: Same issue as [1/100km]/[Wh/km]. Will be checked by DC.

コメント [DTF17]:  
30.04.15: Adjusted due to avoid references to equation numbers.

コメント [DTF18]:  
30.04.15: Adjusted due to avoid references to equation numbers.

コメント [DTF19]:  
30.04.15: Adjusted due to avoid references to equation numbers.

コメント [DTF20]:  
30.04.2015: Avoid redundant symbol description in the same paragraph!

コメント [SMD21]: 21.04.2015 audio/web.  
DTF: Please confirm amendment and delete the comment.

コメント [SMD22]: 21.04.2015 audio/web.  
DTF: Please confirm amendment and delete the comment.

コメント [DTF23]: The paragraph 2.6. of this Appendix was moved to 4.1.1. of this Annex as proposed by Japan.

コメント [DTF24]:  
NEW CONTENT:  
Due to RCB-correction adoption @ #10th IWG this paragraph was inserted.

- 3.1.1. In advance of the preconditioning the REESS can be discharged according to manufacturers recommendation.
- 3.1.2. The operation mode for the preconditioning cycle and for the test cycle shall be selected according to paragraph 3.2.5.2.2. of this Annex.
- 3.1.3. For preconditioning and testing the applicable test cycle shall be driven.
- 3.1.4. The test vehicle shall be preconditioned by driving consecutive test cycles. The preconditioning shall be finished if the break-off criterion according to paragraph 3.2.4.5. of this Annex was reached for the first time.
- 3.1.5. The last preconditioning test cycle shall be followed by a break with the maximum duration of 30 minutes.
- 3.1.6. During break time the manufacturer is allowed to set the state of charge of the REESS in order to reach different electric energy balances over the test cycle that are required for the determination of the correction coefficient according to paragraph 2.2. of Appendix 2 of this Annex.
- 3.1.7. After break time the vehicle shall be tested according to the type 1 test procedure described in Annex 6. The manufacturer shall give evidence that the break-off criterion according to paragraph 3.2.4.5.2. is fulfilled.
- 3.1.8. To get a set of charge-sustaining tests that are required for the determination of the correction coefficients, the type 1 test can be followed by a certain amount of consecutive sequences consisting of a break according to paragraph 3.1.6. of this Appendix and a charge-sustaining test according to paragraph 3.1.7. of this Appendix.
- 3.2. Alternatively to the charge-sustaining test procedure for NOVC-HEV described in paragraph 3.3. of this Annex, the following test sequence can be used to measure all values that are necessary for the determination of the correction coefficient according to paragraph 2 of this Appendix.
  - 3.2.1. The operation mode for the preconditioning cycle and for the test cycle shall be selected according to paragraph 3.3.2.2. of this Annex.
  - 3.2.2. For preconditioning and testing the applicable test cycle shall be driven.
  - 3.2.3. The test vehicle shall be preconditioned by driving one applicable cycle.
  - 3.2.4. The preconditioning test cycle shall be followed by a break with the maximum duration of 30 minutes.
  - 3.2.5. During break time the manufacturer is allowed to set the state of charge of the REESS in order to reach different electric energy balances over the test cycle that are required for the determination of the correction coefficient according to paragraph 2.2. of Appendix 2 of this Annex.
  - 3.2.6. After break time the vehicle shall be tested according to the type 1 test procedure described in Annex 6.
  - 3.2.7. To get a set of charge-sustaining tests that are required for the determination of the correction coefficients, the type 1 test can be followed by a certain amount of consecutive sequences consisting of a break according to paragraph 3.2.5. of this Appendix and a charge-sustaining test according to paragraph 3.2.6. of this Appendix.

