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**Economic Commission for Europe**

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**Working Party on Pollution and Energy**

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Item 3(a) of the provisional agenda

**Light vehicles: UN Regulations Nos. 68 (Measurement of the   
maximum speed, including electric vehicles), 83 (Emissions of   
M1 and N1 vehicles), 101 (CO2 emissions/fuel consumption) and   
103 (Replacement pollution control devices)**

**Proposal for a new 00 series of amendments to a new UN Regulation on uniform provisions concerning the approval of light duty passenger and commercial vehicles with regards to criteria emissions, emissions of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric range (WLTP)**

**Submitted by the Informal Working Group on Worldwide harmonized Light vehicles Test Procedure (WLTP)**[[1]](#footnote-2)\*

The text reproduced below was prepared by the Transposition Task Force of the Informal Working Group (IWG) on Worldwide harmonized Light vehicles Test Procedure (WLTP) in line with Phase 2 of its mandate (ECE/TRANS/WP.29/AC.3/44).

The 00 series of amendments contains two levels against which approvals can be granted; Level 1A which relates to vehicles tested using a 4-phase WLTC; and Level 1B for vehicles tested on a 3-phase WLTC.

Annex B6

Type 1 test procedures and test conditions

1. Description of tests

1.2. The number of tests shall be determined according to the flowchart in Figure A6/1. The limit value is the maximum allowed value for the respective criteria emission as specified in Table 1 of this Regulation.

1.2.1. The flowchart in Figure A6/1 shall be applicable only to the whole applicable WLTP test cycle and not to single phases.

1.2.2. The test results shall be the values after the applicable adjustments specified in the post-processing tables in Annex B7 and Annex B8 are applied.

1.2.3. Determination of total cycle values

1.2.3.1. If during any of the tests a criteria emissions limit is exceeded, the vehicle shall be rejected.

1.2.3.2. Depending on the vehicle type, the manufacturer shall declare as applicable the total cycle value of the CO2 mass emission, fuel efficiency, the electric energy consumption, fuel consumption, fuel efficiency as well as PER and AER according to Table A6/1.

1.2.3.3. For Level 1A

The declared value of the electric energy consumption for OVC-HEVs under charge-depleting operating condition shall not be determined according to Figure A6/1. It shall be taken as the type approval value if the declared CO2 value is accepted as the approval value. If that is not the case, the measured value of electric energy consumption shall be taken as the type approval value. Evidence of a correlation between declared CO2mass emission and electric energy consumption shall be submitted to the responsible authority in advance, if applicable.

For Level 1B

The declared value of the fuel efficiency for OVC-HEVs under charge-depleting operating condition shall not be determined according to Figure A6/1. It shall be taken as the type approval value if the declared electric energy consumption value is accepted as the approval value. If that is not the case, the measured value of fuel efficiency shall be taken as the type approval value. Evidence of a correlation between declared fuel efficiency and electric energy consumption shall be submitted to the responsible authority in advance, if applicable.

1.2.3.4. If after the first test all criteria in row 1 of the applicable Table A6/2 are fulfilled, all values declared by the manufacturer shall be accepted as the type approval value. If any one of the criteria in row 1 of the applicable Table A6/2 is not fulfilled, a second test shall be performed with the same vehicle.

1.2.3.5. After the second test, the arithmetic average results of the two tests shall be calculated. If all criteria in row 2 of the applicable Table A6/2 are fulfilled by these arithmetic average results, all values declared by the manufacturer shall be accepted as the type approval value. If any one of the criteria in row 2 of the applicable Table A6/2 is not fulfilled, a third test shall be performed with the same vehicle.

1.2.3.6. After the third test, the arithmetic average results of the three tests shall be calculated. For all parameters which fulfil the corresponding criterion in row 3 of the applicable Table A6/2, the declared value shall be taken as the type approval value. For any parameter which does not fulfil the corresponding criterion in row 3 of the applicable Table A6/2, the arithmetic average result shall be taken as the type approval value.

1.2.3.7. In the case that any one of the criterion of the applicable Table A6/2 is not fulfilled after the first or second test, at the request of the manufacturer and with the approval of the responsible authority, the values may be re-declared as higher values for emissions or consumption, or as lower values for electric ranges, in order to reduce the required number of tests for type approval.

1.2.3.8. Determination of the acceptance values

For Level 1A: dCO21, dCO22 and dCO23

1.2.3.8.1. Additional to the requirement of paragraph 1.2.3.8.2., the following values for dCO21, dCO22, dCO23, dFE1, dFE2 and dFE3 (as applicable) shall be used in relation to the criteria for the number of tests in Table A6/2:

For Level 1A;

dCO21 = 0.990

dCO22 = 0.995

dCO23 = 1.000

1.2.3.8.2. For Level 1A:

If the charge depleting Type 1 test for OVC-HEVs consists of two or more applicable WLTP test cycles and the dCO2x value is below 1.0, the dCO2x value shall be replaced by 1.0.

1.2.3.9. In the case that a test result or an average of test results was taken and confirmed as the type approval value, this result shall be referred to as the “declared value” for further calculations.

Table A6/1

**Applicable rules for a manufacturer’s declared values (total cycle values)(a)**

| *Vehicle type* | | | Level 1A only  *MCO2 (b)*  *(g/km)* | Level 1A:  *FC*  *(kg/100 km)*  Level 1B;  *FE (km/l or km/kg)* | *Electric energy consumption(c)*  *(Wh/km)* | *All electric range /  Pure Electric Range (c)*  *(km)* |
| --- | --- | --- | --- | --- | --- | --- |
| Vehicles tested according to Annex B6 (pure ICE) | | | MCO2  Paragraph 3. of Annex B7. | FE  Paragraph 1.4. of Annex B7. | - | - |
| NOVC-FCHV | | | - | FCCS  Paragraph 4.2.1.2.1. of Annex B8.  FECS  Paragraph 4.2.1.2.1.. of Annex B8. | - | - |
| [OVC-FCHV | CD | | - | FC,CD | ECAC,CD | AER |
| CS | | - | FCCS | - | -] |
| NOVC-HEV | | | MCO2,CS  Paragraph 4.1.1. of Annex B8. | FECS  Paragraph 4.1.1.1. of Annex B8. | - | - |
| OVC-HEV | | CD | MCO2,CD  Paragraph 4.1.2. of Annex B8. | FECD  Paragraph 4.6.1 of Annex B8. | For Level 1A : ECAC,CD  Paragraph 4.3.1. of Annex B8.  For Level 1B : EC  Paragraph 4.6.2. of Annex B8 | AER  Paragraph 4.4.1.1. of Annex B8. |
| CS | MCO2,CS  Paragraph 4.1.1. of Annex B8. | FECS  Paragraph 4.1.1.1. of Annex B8. | - | - |
| PEV | | | - | - | ECWLTC  Paragraph 4.3.4.2. of Annex B8. | PERWLTC  Paragraph 4.4.2. of Annex B8. |

(a) The declared value shall be the value to which the necessary corrections, as applicable, are applied

(b) Rounding to 2 places of decimal according to paragraph 6.1.8. of this Regulation

(c) Rounding to one place of decimal according to paragraph 6.1.8. of this Regulation

Table A6/2

**Criteria for number of tests**

For pure ICE vehicles, NOVC-HEVs and OVC-HEVs charge-sustaining Type 1 test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Test* | *Judgement parameter* | *Criteria emission* | For Level 1a: *MCO2*  For Level 1B: *FE* |
| Row 1 | First test | First test results | ≤ Regulation limit × 0.9 | ≤ Declared value × dCO21(b)  ≥ Declared value ×1.0) |
| Row 2 | Second test | Arithmetic average of the first and second test results | ≤ Regulation limit × 1.0(a) | ≤ Declared value × dCO22(b)  ≥ Declared value ×1.0 |
| Row 3 | Third test | Arithmetic average of three test results | ≤ Regulation limit × 1.0(a) | ≤ Declared value × dCO23(b)  ≥ Declared value ×1.0 |

(a) Each test result shall fulfil the regulation limit.

(b) dCO21, dCO22, and dCO23,(as applicable)shall be determined according to paragraph 1.2.3.8. of this annex

For OVC-HEVs charge-depleting Type 1 test.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Test* | *Judgement parameter* | *Criteria emissions* | For Level 1A: *MCO2,CD*  For Level 1B; *EC* | For Level 1A:*AER* |
| Row 1 | First test | First test results | ≤ Regulation limit × 0.9(a) | ≤ Declared value × dCO21(c)  ≤ Declared value ×1.0 | ≥ Declared value × 1.0 |
| Row 2 | Second test | Arithmetic average of the first and second test results | ≤ Regulation limit × 1.0(b) | ≤ Declared value × dCO22(c)  ≤ Declared value ×1.0 | ≥ Declared value × 1.0 |
| Row 3 | Third test | Arithmetic average of three test results | ≤ Regulation limit × 1.0(b) | ≤ Declared value × dCO23(c)  ≤ Declared value ×1.0 | ≥ Declared value × 1.0 |

(a) "0.9" shall be replaced by “1.0” for charge-depleting Type 1 test for OVC-HEVs, only if the charge-depleting test contains two or more applicable WLTC cycles.

(b) Each test result shall fulfil the regulation limit.

(c) dCO21, dCO22 and dCO23,(as applicable)shall be determined according to paragraph 1.2.3.8. of this annex.

For PEVs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Test* | *Judgement parameter* | *Electric energy consumption* | *PER* |
| Row 1 | First test | First test results | ≤ Declared value × 1.0 | ≥ Declared value × 1.0 |
| Row 2 | Second test | Arithmetic average of the first and second test results | ≤ Declared value × 1.0 | ≥ Declared value × 1.0 |
| Row 3 | Third test | Arithmetic average of three test results | ≤ Declared value × 1.0 | ≥ Declared value × 1.0 |

[For OVC-FCHVs charge-depleting Type 1 test.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *Test* | *Judgement parameter* | *FC,CD* | *ECAC,CD* | *AER* |
| Row 1 | First test | First test results | ≤ Declared value x 1.0 | ≤ Declared value x 1.0 | ≥ Declared value × 1.0 |
| Row 2 | Second test | Arithmetic average of the first and second test results | ≤ Declared value x1.0 | ≤ Declared value x1.0 | ≥ Declared value × 1.0 |
| Row 3 | Third test | Arithmetic average of three test results | ≤ Declared value x 1.0 | ≤ Declared value x 1.0 | ≥ Declared value × 1.0 |

]

For NOVC-FCHVs [and OVC-FCHV in CS condition]

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Test* | *Judgement parameter* | For Level 1A: *FCCS* (upper)  For Level 1B: *FECS* (lower) |
| Row 1 | First test | First test results | ≤ Declared value × 1.0  ≥ Declared value × 1.0 |
| Row 2 | Second test | Arithmetic average of the first and second test results | ≤ Declared value × 1.0  ≥ Declared value × 1.0 |
| Row 3 | Third test | Arithmetic average of three test results | ≤ Declared value × 1.0  ≥ Declared value × 1.0 |

1.2.4. Determination of phase-specific values

1.2.4.1. Phase-specific value for CO2

1.2.4.1.1. After the total cycle declared value of the CO2 mass emission is accepted, the arithmetic average of the phase-specific values of the test results in g/km shall be multiplied by the adjustment factor CO2\_AF to compensate for the difference between the declared value and the test results. This corrected value shall be the type approval value for CO2.

where:

where:

is the arithmetic average CO2 mass emission result for the L phase test result(s), g/km;

is the arithmetic average CO2 mass emission result for the M phase test result(s), g/km;

is the arithmetic average CO2 mass emission result for the H phase test result(s), g/km;

is the arithmetic average CO2 mass emission result for the exH phase test result(s), g/km;

DL is theoretical distance of phase L, km;

DM is theoretical distance of phase M, km;

DH is theoretical distance of phase H, km;

DexH is theoretical distance of phase exH, km.

1.2.4.1.2. If the total cycle declared value of the CO2 mass emission is not accepted, the type approval phase-specific CO2 mass emission value shall be calculated by taking the arithmetic average of the all test results for the respective phase.

1.2.4.2. Phase-specific values for fuel consumption

The fuel consumption value shall be calculated by the phase-specific CO2 mass emission using the equations in paragraph 1.2.4.1. of this annex and the arithmetic average of the emissions.

Annex B6b

This annex is only applicable for Level 1A;

Correction of CO2 results against the target speed and distance

1. General

This Annex B6b defines the specific provisions regarding the correction of CO2 test results for tolerances against the target speed and distance.

This Annex B6b applies to pure ICE vehicles only.

Annex B7

Calculations

1. General requirements

1.1. Unless explicitly stated otherwise in Annex B8, all requirements and procedures specified in this annex shall apply for NOVC-HEVs, OVC-HEVs, NOVC-FCHVs and PEVs.

1.2. The calculation steps described in paragraph 1.4. of this annex shall be used for pure ICE vehicles only.

1.3. Rounding of test results

1.3.1. Intermediate steps in the calculations shall not be rounded unless intermediate rounding is required.

1.3.2. The final criteria emission results shall be rounded according to paragraph 6.1.8. of this Regulation 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.

1.3.3. The NOx correction factor shall be reported rounded according to paragraph 6.1.8. of this Regulation to two places of decimal.

1.3.4. The dilution factor shall be reported rounded according to paragraph 6.1.8. of this Regulation to two places of decimal.

1.3.5. For information not related to standards, good engineering judgement shall be used.

1.4. Stepwise procedure for calculating the final test results for vehicles using combustion engines

The results shall be calculated in the order described in Table A7/1. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

For the purpose of this table, the following nomenclature within the equations and results is used:

c complete applicable cycle;

p every applicable cycle phase;

i every applicable criteria emission component, without CO2;

CO2 CO2 emission.

Table A7/1

**Procedure for calculating final test results**

| *Step No.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Annex B6 | Raw test results | Mass emissions  Paragraphs 3. to 3.2.2. inclusive of this annex. | Mi,p,1, g/km;  MCO2,p,1, g/km. |
| 2 | Output step 1 | Mi,p,1, g/km;  MCO2,p,1, g/km. | Calculation of combined cycle values:  where:  Mi/CO2,c,2 are the emission results over the total cycle;  dp are the driven distances of the cycle phases, p. | Mi,c,2, g/km;  MCO2,c,2, g/km. |
| 2b  This step is only applicable for Level 1A; | Output step 1  Output step 2 | MCO2,p,1, g/km;  MCO2,c,2, g/km. | Correction of CO2 results against the target speed and distance.  Annex B6b.  Note: As the distance is also corrected, from this calculation step onwards any reference to a driven distance shall be interpreted as a reference to the target distance. | MCO2,p,2b, g/km;  MCO2,c,2b, g/km. |
| 3 | For Level 1A  Output step 2b | MCO2,p,2b, g/km;  MCO2,c,2b, g/km. | RCB correction  Appendix 2 to Annex B6. | MCO2,p,3, g/km;  MCO2,c,3, g/km. |
| For Level 1B  Output step 1  Output step 2 | MCO2,p,1, g/km;  MCO2,c,2, g/km. | RCB correction  Appendix 2 to Annex B6. | MCO2,p,3, g/km;  MCO2,c,3, g/km. |
| 4a | Output step 2  Output step 3 | Mi,c,2, g/km;  MCO2,c,3, g/km. | Emissions test procedure for all vehicles equipped with periodically regenerating systems, Ki.  Annex B6, Appendix 1.  Mi,c,4 = Ki × Mi,c,2  or  Mi,c,4 = Ki + Mi,c,2  and  MCO2,c,4 = KCO2 × MCO2,c,3  or  MCO2,c,4 = KCO2 + MCO2,c,3  Additive offset or multiplicative factor to be used according to Ki determination.  If Ki is not applicable:  Mi,c,4 = Mi,c,2  MCO2,c,4 = MCO2,c,3 | Mi,c,4a, g/km;  MCO2,c,4a, g/km. |
| 4b | Output step 3  Output step 4a | MCO2,p,3, g/km;  MCO2,c,3, g/km;  MCO2,c,4a, g/km. | If Ki is applicable, align CO2 phase values to the combined cycle value:  for every cycle phase p;  where:  If Ki is not applicable:  MCO2,p,4 = MCO2,p,3 | MCO2,p,4, g/km. |
| 4c | For Level 1A  Output step 4a | Mi,c,4a, g/km;  MCO2,c,4a, g/km. | In the case these values are used for the purpose of conformity of production, the criteria emission values and CO2 mass emission values shall be multiplied with the run in factor determined according to paragraph 8.2.4 of this Regulation:  Mi,c,4c = RIC × Mi,c,4a  MCO2,,4c = RICO2 x MCO2,c,4a  In the case these values are not used for the purpose of conformity of production:  Mi,c,4c = Mi,c,4a  MCO2,,4c = MCO2,c,4a | Mi,c,4c;  MCO2,c,4c |
| For Level 1B Output step 4a | Mi,c,4a, g/km;  MCO2,c,4a, g/km. | Calculate fuel efficiency (FEc,4c\_tepm)　according to paragraph 6.14. of Annex B6.  In the case this value is used for the purpose of conformity of production, the fuel efficiency value shall be multiplied with the run in factor determined according to paragraph 8.2.4 of this Regulation:  FEc,4c = RIFE x FE,c,4c\_temp  In the case these values are not used for the purpose of conformity of production:  FEc,4c = FE,c,4c\_temp | FEc,4c, km/l; |
| 5  Result of a single test. | For L1A  Output step 4b and 4c | MCO2,c,4c, g/km;  MCO2,p,4, g/km. | ATCT correction in accordance with paragraph 3.8.2. of Annex B6a. | MCO2,c,5, g/km;  MCO2,p,5, g/km. |
| For Level 1A and 1BOutput step 4b and 4c | Mi,c,4c, g/km;  FEc,4c, km/l; | Apply deterioration factors calculated in accordance with Annex C4 to the criteria emissions values.  In the case these values are used for the purpose of conformity of production, the further steps (6 to 10) are not required and the output of this step is the final result. | Mi,c,5, g/km;  FEc,5, km/l; |
| 6 | For Level 1A  Output step 5 | For every test:  Mi,c,5, g/km;  MCO2,c,5, g/km;  MCO2,p,5, g/km. | Averaging of tests and declared value.  Paragraphs 1.2. to 1.2.3. inclusive of Annex B6. | Mi,c,6, g/km;  MCO2,c,6, g/km;  MCO2,p,6, g/km.  MCO2,c,declared, g/km. |
| For Level 1B  Output step 5 | FEc,5, km/l; | Averaging of tests and declared value.  Paragraphs 1.2. to 1.2.3. inclusive of Annex B6.  The conversion from FEc,declared to MCO2,c,declared, shall be performed for the applicable cycle. For that purpose, the criteria emission over the complete cycle shall be used. | FEc,declared, km/l  MCO2,c,declared, g/km. |
| 7 | Output step 6 | Mi,c,6, g/km;  MCO2,c,6, g/km;  MCO2,p,6, g/km.  MCO2,c,declared, g/km. | Alignment of phase values.  Paragraph 1.2.4. of Annex B6.  and:  MCO2,c,7 = MCO2,c,declared | MCO2,c,7, g/km;  MCO2,p,7, g/km. |
| 8  Result of a Type 1 test for a test vehicle. | Output steps 6  Output steps 7 | Mi,c,6, g/km;  MCO2,c,7, g/km;  MCO2,p,7, g/km. | Calculation of fuel consumption and conversion to fuel efficiency for phase value only.  Paragraph 6 of this annex.  The calculation of fuel consumption shall be performed for the applicable cycle and its phases separately. For that purpose: (a) the applicable phase or cycle CO2 values shall be used;  (b) the criteria emission over the complete cycle shall be used.  and:  Mi,c,8 = Mi,c,6  MCO2,c,8 = MCO2,c,7  MCO2,p,8 = MCO2,p,7 | FCc,8, l/100 km;  FCp,8, l/100 km;  FEc,8, km/l  FEp,8, km/l  Mi,c,8, g/km;  MCO2,c,8, g/km;  MCO2,p,8, g/km. |
| 9  Interpolation family result.  For L1A  Final criteria emission result | Step 8 | For each of the test vehicles H and L:  Mi,c,8, g/km;  MCO2,c,8, g/km;  MCO2,p,8, g/km;  FCc,8, l/100 km;  FCp,8, l/100 km;  FEc,8, km/l.  FEp,8, km/l | For Level 1A;  If a test vehicle either L or L and M was tested in addition to a test vehicle H, the resulting criteria emission value shall be the highest of the values and referred to as Mi,c.  In the case of the combined THC+NOx emissions, the highest value of the sum referring to the VH or VL or VM is to be used.  Level 1A and Level 1B  Otherwise, if no vehicle L was tested,  Mi,c = Mi,c,8  For CO2, FE and FC, the values derived in step 8 shall be used, and CO2 values shall be rounded according to paragraph 6.1.8. of this Regulation to two places of decimal, and FE and FC values shall be rounded according to paragraph 6.1.8. of this Regulation to three places of decimal. | Mi,c, g/km;  MCO2,c,H, g/km;  MCO2,p,H, g/km;  FCc,H, l/100 km;  FCp,H, l/100 km;  FEc,H, km/l; FEp,H, km/l;  and if a vehicle L was tested:  MCO2,c,L, g/km;  MCO2,p,L, g/km;  FCc,L, l/100 km;  FCp,L, l/100 km;  FEc,L, km/l. FEp,L, km/l. |
| 10  Result of an individual vehicle.  Final CO2, FE and FC result. | Step 9 | MCO2,c,H, g/km;  MCO2,p,H, g/km;  FCc,H, l/100 km;  FCp,H, l/100 km;  FEc,H, km/l;  FEp,H, km/l;  and if a vehicle L was tested:  MCO2,c,L, g/km;  MCO2,p,L, g/km;  FCc,L, l/100 km;  FCp,L, l/100 km.  FEc,L, km/l;  FEp,L, km/l. | Fuel consumption, fuel efficiency and CO2 calculations for individual vehicles in an interpolation family.  Paragraph 3.2.3. of this annex.  Fuel consumption, fuel efficiency and CO2 calculations for individual vehicles in a road load matrix family  Paragraph 3.2.4. of this annex.  CO2 emissions shall be expressed in grams per kilometre (g/km) rounded to the nearest whole number;  FC values shall be rounded according to paragraph 6.1.8. of this Regulation to one place of decimal, expressed in (l/100 km) ;  FE values shall be rounded according to paragraph 6.1.8. of this Regulation to one place of decimal, expressed in (km/l). | MCO2,c,ind g/km;  MCO2,p,ind, g/km;  FCc,ind l/100 km;  FCp,ind, l/100 km  FEc,ind, km/l.  FEp,ind, km/l |

3.2.3. Fuel consumption, fuel efficiency and CO2 calculations for individual vehicles in an interpolation family

3.2.3.1. Fuel consumption, fuel efficiency and CO2 emissions without using the interpolation method (i.e. using vehicle H only)

The CO2 value, as calculated in paragraphs 3.2.1. to 3.2.1.1.2. inclusive of this annex, and fuel efficiency/fuel consumption, as calculated according to paragraph 6. of this annex, shall be attributed to all individual vehicles in the interpolation family and the interpolation method shall not be applicable.

3.2.3.2. Fuel consumption and CO2 emissions using the interpolation method

The CO2 emissions and the fuel consumption for each individual vehicle in the interpolation family may be calculated according to paragraphs 3.2.3.2.1. to 3.2.3.2.5. inclusive of this annex.

3.2.3.2.1. Fuel consumption and CO2 emissions of test vehicles L and H

The mass of CO2 emissions, , and and its phases p, and , of test vehicles L and H, used for the following calculations, shall be taken from step 9 of Table A7/1.

Fuel consumption values are also taken from step 9 of Table A7/1 and are referred to as FCL,p and FCH,p.

3.2.3.2.3. Calculation of cycle energy demand

The cycle energy demand of the applicable WLTC Ek and the energy demand for all applicable cycle phases shall be calculated according to the procedure in paragraph 5. of this annex for the following sets k of road load coefficients and masses:

k=1:

(test vehicle L)

k=2:

(test vehicle H)

k=3:

(an individual vehicle in the interpolation family)

These three sets of road loads may be derived from different road load families.

3.2.3.2.4. For Level 1A

Calculation of the CO2 value for an individual vehicle within an interpolation family using the interpolation method

For each cycle phase p of the applicable cycle the mass of CO2 emissions g/km, for an individual vehicle shall be calculated using the following equation:

The mass of CO2 emissions, g/km, over the complete cycle for an individual vehicle shall be calculated using the following equation:

The terms E1,p, E2,p and E3,p and E1, E2 and E3 respectively shall be calculated as specified in paragraph 3.2.3.2.3. of this annex.

3.2.3.2.5. For Level 1A

Calculation of the fuel consumption FC value for an individual vehicle within an interpolation family using the interpolation method

For each cycle phase p of the applicable cycle, the fuel consumption, l/100 km, for an individual vehicle shall be calculated using the following equation:

The fuel consumption, l/100 km, of the complete cycle for an individual vehicle shall be calculated using the following equation:

The terms E1,p, E2,p and E3,p, and E1, E2 and E3 respectively shall be calculated as specified in paragraph 3.2.3.2.3. of this annex.

For Level 1B

Calculation of the fuel efficiency FE value for an individual vehicle within an interpolation family using the interpolation method

For each cycle phase p of the applicable cycle, the fuel efficiency, km/l, for an individual vehicle shall be calculated using the following equation:

The fuel efficiency, km/l,, of the complete cycle for an individual vehicle shall be calculated using the following equation:

The terms E1,p, E2,p and E3,p, and E1, E2 and E3 respectively shall be calculated as specified in paragraph 3.2.3.2.3. of this annex.

3.2.3.2.6. For Level 1A

The individual CO2 value determined in paragraph 3.2.3.2.4. of this annex may be increased by the original equipment manufacturer (OEM). In such cases:

(a) The CO2 phase values shall be increased by the ratio of the increased CO2 value divided by the calculated CO2 value;

(b) The fuel consumption values shall be increased by the ratio of the increased CO2 value divided by the calculated CO2 value.

This shall not compensate for technical elements that would effectively require a vehicle to be excluded from the interpolation family.

For Level 1B

The individual fuel efficiency value determined in paragraph 3.2.3.2.5. of this annex may be increased by the original equipment manufacturer (OEM). In such cases:

(a) The fuel efficiency phase values shall be increased by the ratio of the increased fuel efficiencyvalue divided by the calculated fuel efficiency value;

This shall not compensate for technical elements that would effectively require a vehicle to be excluded from the interpolation family.

3.2.4. Fuel consumption , fuel efficiency and CO2 calculations for individual vehicles in a road load matrix family

The CO2 emissions and the fuel efficiency/fuel consumption for each individual vehicle in the road load matrix family shall be calculated according to the interpolation method described in paragraphs 3.2.3.2.3. to 3.2.3.2.5. inclusive of this annex. Where applicable, references to vehicle L and/or H shall be replaced by references to vehicle LM and/or HM respectively.

3.2.4.1. Determination of fuel consumption, fuel efficiency and CO2 emissions of vehicles LM and HM

The mass of CO2 emissions of vehicles LM and HM shall be determined according to the calculations in paragraph 3.2.1. of this annex for the individual cycle phases p of the applicable WLTC and are referred to as and respectively. Fuel consumption and fuel efficiency for individual cycle phases of the applicable WLTC shall be determined according to paragraph 6. of this annex and are referred to as FCLM,p ,FCHM,p, FELM,p and FELM,p respectively.

3.2.5. Alternative interpolation calculation method

Upon request of the manufacturer and with approval of the responsible authority, a manufacturer may apply an alternative interpolation calculation procedure in the case that the interpolation method creates unrealistic phase-specific parameter results or an unrealistic road load curve. Before such permission is granted, the manufacturer shall check and where possible correct:

(a) The reason for having small differences between the road load relevant characteristics between vehicle L and H in the case of unrealistic phase- specific parameter results;

(b) The reason for having an unexpected difference between the f1,L and f1,H coefficients in the case of an unrealistic road load curve.

The request of the manufacturer to the responsible authority shall include evidence that such a correction is not possible, and that the resultant error is significant.

3.2.5.1. Alternative calculation to correct unrealistic phase-specific parameter results

Alternatively to the procedures defined in paragraphs 3.2.3.2.4. and 3.2.3.2.5. of this annex, calculations of phase CO2 , phase fuel efficiency and phase fuel consumption may be calculated according to the equations in paragraphs 3.2.5.1.1., 3.2.5.1.2. and 3.2.5.1.3. below.

For each parameter, MCO2 is replaced by FC or FE.

3.2.5.1.1. Ratio determination for each phase of VL and VH

where:

are from step 9 in Table A7/1 in this annex.

3.2.5.1.2. Ratio determination for each phase for vehicle Vind

where:

is from step 10 in Table A7/1 in this annex and shall be rounded to the nearest whole number.

3.2.5.1.3. Phase per phase mass emission of vehicle Vind

6. Calculation of fuel consumption and fuel efficiency (as applicable)

6.1. The fuel characteristics required for the calculation of fuel consumption values shall be taken from Annex B3.

6.2. For Level 1A

The fuel consumption values shall be calculated from the emissions of hydrocarbons, carbon monoxide, and carbon dioxide using the results of step 6 for criteria emissions and step 7 for CO2 of Table A7/1.

For Level 1B

The fuel efficiency values shall be calculated from the emissions of hydrocarbons, carbon monoxide, and carbon dioxide using the results of step 2 for criteria emissions and step 4a for CO2 of Table A7/1.

6.14. This paragraph is applicable only for Level 1B;

Calculation of fuel efficiency (FE)

6.14.1. FE = 100/FC

where

FC is the fuel consumption of a specific fuel, l/100 km (or m³ per 100 km in the case of natural gas or kg/100 km in the case of hydrogen);

FE is fuel efficiency; km/l (or km/m³ in the case of natural gas, or km/ kg in the case of hydrogen).

Annex B8

Pure electric, hybrid electric and compressed hydrogen fuel cell hybrid vehicles

1.4. Vehicle classification

All OVC-HEVs, NOVC-HEVs, PEVs [,OVC-FCHVs] and NOVC-FCHVs shall be classified as Class 3 vehicles. The applicable test cycle for the Type 1 test procedure shall be determined according to paragraph 1.4.2. of this annex based on the corresponding reference test cycle as described in paragraph 1.4.1. of this annex.

1.4.1. Reference test cycle

1.4.1.1. The Class 3 reference test cycles are specified in paragraph 3.3. of Annex B1.

1.4.1.2. For PEVs, the downscaling procedure, according to paragraphs 8.2.3. and 8.3. of Annex B1, may be applied on the test cycles according to paragraph 3.3. of Annex B1 by replacing the rated power with maximum net power according to Regulation No. 85. In such a case, the downscaled cycle is the reference test cycle.

1.4.2. Applicable test cycle

1.4.2.1. Applicable WLTP test cycle

The reference test cycle according to paragraph 1.4.1. of this annex shall be the applicable WLTP test cycle (WLTC) for the Type 1 test procedure.

In the case that paragraph 9. of Annex B1 is applied based on the reference test cycle as described in paragraph 1.4.1. of this annex, this modified test cycle shall be the applicable WLTP test cycle (WLTC) for the Type 1 test procedure.

1.4.2.2. Level 1A only

Applicable WLTP city test cycle

The Class 3 WLTP city test cycle (WLTCcity) is specified in paragraph 3.5. of Annex B1.

1.5. OVC-HEVs, NOVC-HEVs [,OVC-FCHVs, NOVC-FCHVs] and PEVs with manual transmissions

The vehicles shall be driven according to the technical gear shift indicator, if available, or according to instructions incorporated in the manufacturer's handbook.

2. Run-in of test vehicle

The vehicle tested according to this annex shall be presented in good technical condition and shall be run-in in accordance with the manufacturer’s recommendations. In the case that the REESSs are operated above the normal operating temperature range, the operator shall follow the procedure recommended by the vehicle manufacturer in order to keep the temperature of the REESS in its normal operating range. The manufacturer shall provide evidence that the thermal management system of the REESS is neither disabled nor reduced.

2.1. OVC-HEVs and NOVC-HEVs shall have been run-in according to the requirements of paragraph 2.3.3. of Annex B6.

2.2. NOVC-FCHVs [and OVC-FCHVs] shall have been run-in at least 300 km with their fuel cell and REESS installed.

2.3. PEVs shall have been run-in at least 300 km or one full charge distance, whichever is longer.

2.4. All REESS having no influence on CO2 mass emissions or H2 consumption shall be excluded from monitoring.

3. Test procedure

4. Calculations for hybrid electric, pure electric and compressed hydrogen fuel cell vehicles

4.1. Calculations of gaseous emission compounds, particulate matter emission and particle number emission

4.1.1. Charge-sustaining mass emission of gaseous emission compounds, particulate matter emission and particle number emission for OVC-HEVs and NOVC-HEVs

The charge-sustaining particulate matter emission shall be calculated according to paragraph 3.3. of Annex B7.

The charge-sustaining particle number emission shall be calculated according to paragraph 4. of Annex B7.

4.1.1.1. Stepwise procedure for calculating the final test results of the charge-sustaining Type 1 test for NOVC-HEVs and OVC-HEVs

The results shall be calculated in the order described in Table A8/5. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

For the purpose of this table, the following nomenclature within the equations and results is used:

complete applicable test cycle;

every applicable cycle phase, for the purpose of city test cycle calculation (as applicable), p shall represent also the city driving cycle;

applicable criteria emission component (except CO2);

CS charge-sustaining;

CO2 CO2 mass emission.

Table A8/5

**Calculation of final charge-sustaining gaseous emission values**

| *Step No.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Annex B6 | Raw test results | Charge-sustaining mass emissions  Paragraphs 3. to 3.2.2. inclusive of Annex B7. | , g/km; , g/km. |
| 2 | Output step 1 | , g/km; , g/km. | Calculation of combined charge-sustaining cycle values:  where:  is the charge-sustaining mass emission result over the total cycle;  is the charge-sustaining CO2 mass emission result over the total cycle;  are the driven distances of the cycle phases p. | , g/km; , g/km. |
| 3 | Output step 1 | , g/km; | REESS electric energy change correction  Paragraphs 4.1.1.2. to 4.1.1.5. inclusive of this annex. | , g/km; , g/km. |
| Output step 2 | , g/km. |
| 4a | Output step 2 | , g/km; | Charge-sustaining mass emission correction for all vehicles equipped with periodically regenerating systems according to Annex B6, Appendix 1.  or and or  Additive offset or multiplicative factor to be used according to Ki determination.  If Ki is not applicable: | , g/km; , g/km. |
| Output step 3 | , g/km. |
| 4b | Output step 3 | , g/km; , g/km; | If Ki is applicable, align CO2 phase values to combined cycle value:  for every cycle phase p;  where:  If Ki is not applicable: | , g/km. |
| Output step 4a | , g/km. |
| 4c | For Level 1A  Output step 4a | Mi,CS,c,4a, g/km;  MCO2,CS,c,4a, g/km. | In the case these values are used for the purpose of conformity of production, the criteria emission values and CO2 mass emission values shall be multiplied with the run-in factor RIdetermined according to paragraph 8.2.4 of this Regulation:  Mi,CS,c4c = RIC × Mi,CS,c,4a  MCO2,CS,c,4c = RICO2 x MCO2,CS,c,4a  In the case these values are not used for the purpose of conformity of production:  Mi,c,4c = Mi,c,4a  MCO2,,4c = MCO2,c,4a | Mi,CS,c,4c;  MCO2,CS,c,4c |
| For Level 1B Output step 4a | Mi,c,4a, g/km;  MCO2,c,4a, g/km. | Calculate fuel efficiency (FEc,4c\_tepm)　according to paragraph 6.14.1. of Annex B6.  FEc,4c = RIFE x FE,c,4c\_temp  In the case these values are not used for the purpose of conformity of production:  FEc,4c = FE,c,4c\_temp | FEc,4c, km/l; |
| 5  Result of a single test. | For Level 1A  Output step 4b and 4c | , g/km; , g/km; | ATCT correction in accordance with paragraph 3.8.2. of Annex 6a. | , g/km;, g/km. |
| Output step 4b and 4c | , g/km;FEc,4c, km/l; | Apply deterioration factors calculated in accordance with Annex C4 to the criteria emissions values.  In the case these values are used for the purpose of conformity of production, the further steps (6 to 9) are not required and the output of this step is the final result. | , g/km;  FEc,5, km/l; |
| 6  results of a Type 1 test for a test vehicle. | For Level 1A  Output step 5 | For every test: , g/km;, g/km;, g/km. | Averaging of tests and declared value according to paragraphs 1.2. to 1.2.3. inclusive of  Annex B6. | , g/km;, g/km;, g/km; , g/km. |
| For Level 1B  Output step 5 | FEc,5, km/l; | Averaging of tests and declared value.  Paragraphs 1.2. to 1.2.3. inclusive of Annex B6.  The conversion from FEc,declared to MCO2,c,declared, shall be performed for the applicable cycle. For that purpose, the criteria emission over the complete cycle shall be used. | FEc,declared, km/l  MCO2,c,declared, g/km. |
| 7  results of a Type 1 test for a test vehicle. | Output step 6 | , g/km;, g/km; , g/km. | Alignment of phase values. Paragraph 1.2.4. of Annex B6,  and: | , g/km; , g/km. |
| For Level 1A 8  Interpo-lation family result.  Final criteria emission result.  If the interpolation method is not applied, step No. 9 is not required and the output of this step is the final CO2 result. | Output step 6 | For each of the test vehicles H and L and, if applicable, vehicle M:  , g/km; | For Level 1A  If in addition to a test vehicle H a test vehicle L and, if applicable vehicle M was also tested, the resulting criteria emission value shall be the highest of the two or, if applicable, three values and referred to as  In the case of the combined THC+NOx emissions, the highest value of the sum referring to either the vehicle H or vehicle L or, if applicable, vehicle M is to be declared.  Otherwise, if no vehicle L or if applicable vehicle M was tested,  In the case that the interpolation method is applied, intermediate rounding shall be applied according to paragraph 6.1.8. of this Regulation:  CO2 values derived in step 7 of this table shall be rounded to two places of decimal. Also, the output for CO2 is available for vehicles H and vehicle L and, if applicable, for vehicle M.  In the case that the interpolation method is not applied, final rounding shall be applied according to paragraph 6.1.8. of this Regulation:  CO2 values derived in step 7 of this table shall be rounded to the nearest whole number. | , g/km; , g/km; , g/km; |
| Output step 7 | For each of the test vehicles H and L and, if applicable, vehicle M: , g/km; , g/km. |
| For Level 1A  9  Result of an individual vehicle.  Final CO2 result. | Output step 8 | , g/km; , g/km; | CO2 mass emission calculation according to paragraph 4.5.4.1. of this annex for individual vehicles in an interpolation family.  Final rounding of individual vehicle CO2 values shall be performed according to paragraph 6.1.8. of this Regulation.  CO2 values shall be rounded to the nearest whole number.  Output is available for each individual vehicle. | , g/km; , g/km. |

4.1.2. Charge-depleting CO2 mass emission for OVC-HEVs

For Level 1A

The utility factor-weighted charge-depleting CO2 mass emission MCO2,CD shall be calculated using the following equation:

For Level 1B

The charge-depleting CO2 mass emission MCO2,CD shall be calculated using the following equation:

where:

is the utility factor-weighted charge-depleting CO2 mass emission, g/km;

is the CO2 mass emission determined according to paragraph 3.2.1. of Annex B7 of phase j of the charge-depleting Type 1 test, g/km;

is the utility factor of phase j according to Appendix 5 to this annex;

is the index number of the considered phase;

is the number of phases driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

In the case that the interpolation method is applied, k shall be the number of phases driven up to the end of the transition cycle of vehicle L,

If the transition cycle number driven by vehicle H, , and, if applicable, by an individual vehicle within the vehicle interpolation family, , is lower than the transition cycle number driven by vehicle L, , the confirmation cycle of vehicle H and, if applicable, an individual vehicle shall be included in the calculation. The CO2 mass emission of each phase of the confirmation cycle shall be subsequently corrected to an electric energy consumption of zero by using the CO2 correction coefficient according to Appendix 2 to this annex.

4.1.3. This paragraph is applicable only for Level 1A:

Utility factor-weighted mass emissions of gaseous compounds, particulate matter emission and particle number emission for OVC-HEVs

4.1.3.1. The utility factor-weighted mass emission of gaseous compounds

where:

is the utility factor-weighted mass emission compound i, g/km;

is the index of the considered gaseous emission compound (except CO2);

is the utility factor of phase j according to Appendix 5 to this annex;

is the mass emission of the gaseous emission compound i determined according to paragraph 3.2.1. of Annex B7 of phase j of the charge-depleting Type 1 test, g/km;

is the charge-sustaining mass emission of gaseous emission compound i for the charge-sustaining Type 1 test according to Table A8/5, step No. 6, g/km;

is the index number of the considered phase;

is the number of phases driven until the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

For calculating the utility-factor weighted CO2 mass emission the following equation shall be used:

where:

is the utility-factor weighted charge-depleting CO2 mass emission, g/km.

is the declared charge-depleting CO2 mass emission according to Table A8/8, step no. 14, g/km.

is the declared charge-sustaining CO2 mass emission according to Table A8/5, step no. 7, g/km.

is the average of the sum of utility factors of each charge-depleting test.

j is the index number of the considered phase;

k is the number of phases driven until the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

In the case that the interpolation method is applied for CO2, k shall be the number of phases driven up to the end of the transition cycle of vehicle L for the application of both equations of this paragraph.

If the transition cycle number driven by vehicle H, , and, if applicable, by an individual vehicle within the vehicle interpolation family is lower than the transition cycle number driven by vehicle L, , the confirmation cycle of vehicle H and, if applicable, an individual vehicle shall be included in the calculation. The CO2 mass emission of each phase of the confirmation cycle shall then be corrected to an electric energy consumption of zero ) by using the CO2 correction coefficient according to Appendix 2 to this annex.

4.1.3.2. The utility factor-weighted particle number emission shall be calculated using the following equation:

where:

is the utility factor-weighted particle number emission, particles per kilometre;

is the utility factor of phase j according to Appendix 5 to this annex;

is the particle number emission during phase j determined according to paragraph 4. of Annex B7 for the charge-depleting Type 1 test, particles per kilometre;

is the particle number emission determined according to paragraph 4.1.1. of this annex for the charge-sustaining Type 1 test, particles per kilometre;

is the index number of the considered phase;

is the number of phases driven until the end of transition cycle n according to paragraph 3.2.4.4. of this annex.

4.1.3.3. The utility factor-weighted particulate matter emission shall be calculated using the following equation:

where:

is the utility factor-weighted particulate matter emission, mg/km;

is the utility factor of cycle c according to Appendix 5 to this annex;

is the charge-depleting particulate matter emission during cycle c determined according to paragraph 3.3. of Annex B7 for the charge-depleting Type 1 test, mg/km;

is the particulate matter emission of the charge-sustaining Type 1 test according to paragraph 4.1.1. of this annex, mg/km;

is the index number of the cycle considered;

is the number of applicable WLTP test cycles driven until the end of the transition cycle n according to paragraph 3.2.4.4. of this annex.

4.2. Calculation of fuel consumption and fuel efficiency

4.2.1. Charge-sustaining fuel consumption and fuel efficiency for OVC-HEVs, [OVC-FCHVs,] NOVC-HEVs and NOVC-FCHVs

4.2.1.1. The charge-sustaining fuel consumption and fuel efficiency for OVC-HEVs and NOVC-HEVs shall be calculated stepwise according to Table A8/6.

Table A8/6

**Calculation of final charge-sustaining fuel consumption for OVC-HEVs, NOVC-HEVs**

| *Step No.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Output step 6,  Table A8/5 | , g/km;  , g/km; FECS,declared, | Calculation of fuel consumption FCCS,c according to paragraph 6. of Annex B7 based on MCO2,CS,C,7 and conversion to fuel efficiency FECS,c. for phase value  FECS,c, = FECS,declared,  The calculation of fuel consumption shall be performed separately for the applicable cycle and its phases.  For that purpose: (a) the applicable phase or cycle CO2 values shall be used; (b) the criteria emission over the complete cycle shall be used. | , l/100 km; FECS,c, km/l;   , l/100 km. km/l |
| Output step 7,  Table A8/5 | , g/km; , g/km. |
| 2  Interpolation family result.  If the interpolation method is not applied, step No. 3 is not required and the output of this step is the final result. | Output step 1 | , l/100 km; , l/100 km;  FECS,c,1, km/l. , km/l | For FC and FE, the values derived in step No. 1 of this table shall be used.  In the case that the interpolation method is applied, intermediate rounding shall be applied according to paragraph 6.1.8. of this Regulation.  FC and FE values shall be rounded to three places of decimal.  Output is available for vehicles H and vehicle L and, if applicable, for vehicle M.  In the case that the interpolation method is not applied, final rounding shall be applied according to paragraph 6.1.8. of this Regulation.  FC and FE values shall be rounded to first place of decimal. | , l/100 km; , l/100 km;  FECS,c, km/l. FECS,p, km/l. |
| 3  Result of an individual vehicle.  Final FC and FE result. | Output step 2 | , l/100 km; , l/100 km;  FECS,c, km/l. FECS,p, km/l. | Fuel consumption calculation according to paragraph 4.5.5.1.1. of this annex for individual vehicles in an interpolation family.  Fuel efficiency calculation according to paragraph 4.5.5.1.2. of this annex for individual vehicles in an interpolation family.  Final rounding of individual vehicle values shall be performed according to paragraph 6.1.8. of this Regulation.  FC and FE values shall be rounded to the first place of decimal.  Output is available for each individual vehicle. | , l/100 km; , l/100 km;  FECS,c,ind, km/l. FECS,p,ind, km/l. |

4.2.1.2. Charge-sustaining fuel consumption and fuel efficiency for NOVC-FCHVs [and OVC-FCHVs]

4.2.1.2.1. Stepwise procedure for calculating the final test fuel consumption and fuel efficiency results of the charge-sustaining Type 1 test for NOVC-FCHVs [and OVC-FCHVs]

The results shall be calculated in the order described in Table A8/7. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

For the purpose of this table, the following nomenclature within the equations and results is used:

complete applicable test cycle;

every applicable cycle phase; [for the purpose of EAERcity calculation (as applicable), p shall represent the city driving cycle;]

CS charge-sustaining

Table A8/7

**Calculation of final charge-sustaining fuel consumption for NOVC-FCHVs** [**and OVC-FCHVs**]

Level 1A – all the calculations in this table shall be for the complete cycle only

Level 1B - all the calculations in this table shall be for the complete cycle and also for individual phases; [FE calculation in this table shall be for the complete cycle only]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Step No.* | *Source* | *Input* | *Process* | *Output* |
| 1 | Appendix 7 to this annex. | Non-balanced charge-sustaining fuel consumption  FCCS,nb, kg/100km | Charge-sustaining fuel consumption FCCS,c,1 according to paragraph 2.2.6. of Appendix 7 to this annex.  The calculation of fuel consumption shall be performed separately for the applicable cycle and its phases.  For that purpose, the applicable phase or cycle FC values shall be used;  Phase-specific values according to paragraph 2.2.7. of Appendix 7 to this annex). | , kg/100 km; , kg/100 km. |
| 2 | Output step 1 | , kg/100 km; , kg/100 km. | REESS electric energy change correction.  Paragraphs 4.2.1.2.2. to 4.2.1.2.5. (where applicable) inclusive of this annex. | For Level 1A  , kg/100 km;  For Level 1B  , kg/100 km; , kg/100 km. |
| 3  Result of a single test. | Output step 2 | , kg/100 km; , kg/100 km. | For Level 1B  Conversion of fuel consumption FCCS,c,3 into fuel efficiency FECS,c,3.. | , kg/100 km; , kg/100 km. , km/kg. , km/kg. |
| 4 | Output step 3 | For every test: , kg/100 km; , kg/100 km. , km/kg. , km/kg. | Averaging of tests and declared value according to paragraphs 1.2. to 1.2.3. inclusive of Annex B6. | , kg/100 km; , kg/100 km. , km/kg. , km/kg. |
| 5  [Interpolation family result.  If the interpolation method is not applied, step No. 6 is not required and the output of this step is the final result.]  results of a Type 1 test for a test vehicle [Note: this will be deleted if square brackets above are removed]. | Output step 4 | , kg/100 km; , kg/100 km; , kg/100 km.  , km/kg. , km/kg; , km/ kg. | Alignment of phase values. Paragraph 1.2.4. of Annex B6,  and:  FC and FE values shall be rounded according to paragraph 6.1.8. of this Regulation to the second place of decimal. | , kg/100 km; , kg/100 km FECS,p,5, km/kg. FECS,c,5, km/kg. |
| [6  Result of an individual vehicle.  Final FC and FE result. | Output step 5 | , kg/100 km; , kg/100 km; FECS,c,6, km/kg. | Fuel consumption calculation according to paragraph 4.5.5.1.3. of this annex for individual vehicles in an interpolation family.  Fuel efficiency calculation according to paragraph 4.5.5.1.4. of this annex for individual vehicles in an interpolation family.  Final rounding of individual vehicle values shall be performed according to paragraph 6.1.8. of this Regulation.  FC and FE values shall be rounded to the first place of decimal.  Output is available for each individual vehicle. | , kg/100 km; , kg/100 km; FECS,c,ind, km/kg. FECS,p,ind, km/kg.] |

4.2.1.2.2. In the case that the correction according to paragraph 1.1.4. of Appendix 2 to this annex was not applied, the following charge-sustaining fuel consumption shall be used:

where:

is the charge-sustaining fuel consumption of the charge-sustaining Type 1 test according to Table A8/7, step No. 2, kg/100 km;

is the non-balanced charge-sustaining fuel consumption of the charge-sustaining Type 1 test, not corrected for the energy balance, according to Table A8/7, step No. 1, kg/100 km.

4.2.1.2.3. If the correction of the fuel consumption is required according to paragraph 1.1.3. of Appendix 2 to this annex or in the case that the correction according to paragraph 1.1.4. of Appendix 2 to this annex was applied, the fuel consumption correction coefficient shall be determined according to paragraph 2. of Appendix 2 to this annex. The corrected charge-sustaining fuel consumption shall be determined using the following equation:

where:

is the charge-sustaining fuel consumption of the charge-sustaining Type 1 test according to Table A8/7, step No. 2, kg/100 km;

is the non-balanced fuel consumption of the charge-sustaining Type 1 test, not corrected for the energy balance, according to Table A8/7, step No. 1, kg/100 km;

is the electric energy consumption of the charge-sustaining Type 1 test according to paragraph 4.3. of this annex, Wh/km;

is the fuel consumption correction coefficient according to paragraph 2.3.1. of Appendix 2 to this annex, (kg/100 km)/(Wh/km).

4.2.1.2.4. This paragraph is only applicable for Level 1B;

In the case that phase-specific fuel consumption correction coefficients have not been determined, the phase-specific fuel consumption shall be calculated using the following equation:

where:

is the charge-sustaining fuel consumption of phase p of the charge-sustaining Type 1 test according to Table A8/7, step No. 2, kg/100 km;

is the non-balanced fuel consumption of phase p of the charge-sustaining Type 1 test, not corrected for the energy balance, according to Table A8/7, step No. 1, kg/100 km;

is the electric energy consumption of phase p of the charge-sustaining Type 1 test, determined according to paragraph 4.3. of this annex, Wh/km;

is the fuel consumption correction coefficient according to paragraph 2.3.1. of Appendix 2 to this annex, (kg/100 km)/(Wh/km);

is the index of the individual phase within the applicable WLTP test cycle.

4.2.1.2.5. This paragraph is only applicable for Level 1B;

In the case that phase-specific fuel consumption correction coefficients have been determined, the phase-specific fuel consumption shall be calculated using the following equation:

where:

is the charge-sustaining fuel consumption of phase p of the charge-sustaining Type 1 test according to Table A8/7, step No. 2, kg/100 km;

is the non-balanced fuel consumption of phase p of the charge-sustaining Type 1 test, not corrected for the energy balance, according to Table A8/7, step No. 1, kg/100 km;

is the electric energy consumption of phase p of the charge-sustaining Type 1 test, determined according to paragraph 4.3. of this annex, Wh/km;

is the fuel consumption correction coefficient for the correction of the phase p according to paragraph 2.3.1.2. of Appendix 2 to this annex, (kg/100 km)/(Wh/km);

is the index of the individual phase within the applicable WLTP test cycle.

4.2.2. The charge-depleting fuel consumption for OVC-HEVs [and OVC-FCHVs]

For Level 1A

The utility factor-weighted charge-depleting fuel consumption shall be calculated using the following equation:

where:

is the utility factor weighted charge-depleting fuel consumption, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the fuel consumption for phase j of the charge-depleting Type 1 test, determined according to paragraph 6. of Annex B7, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the utility factor of phase j according to Appendix 5 to this annex;

is the index number for the considered phase;

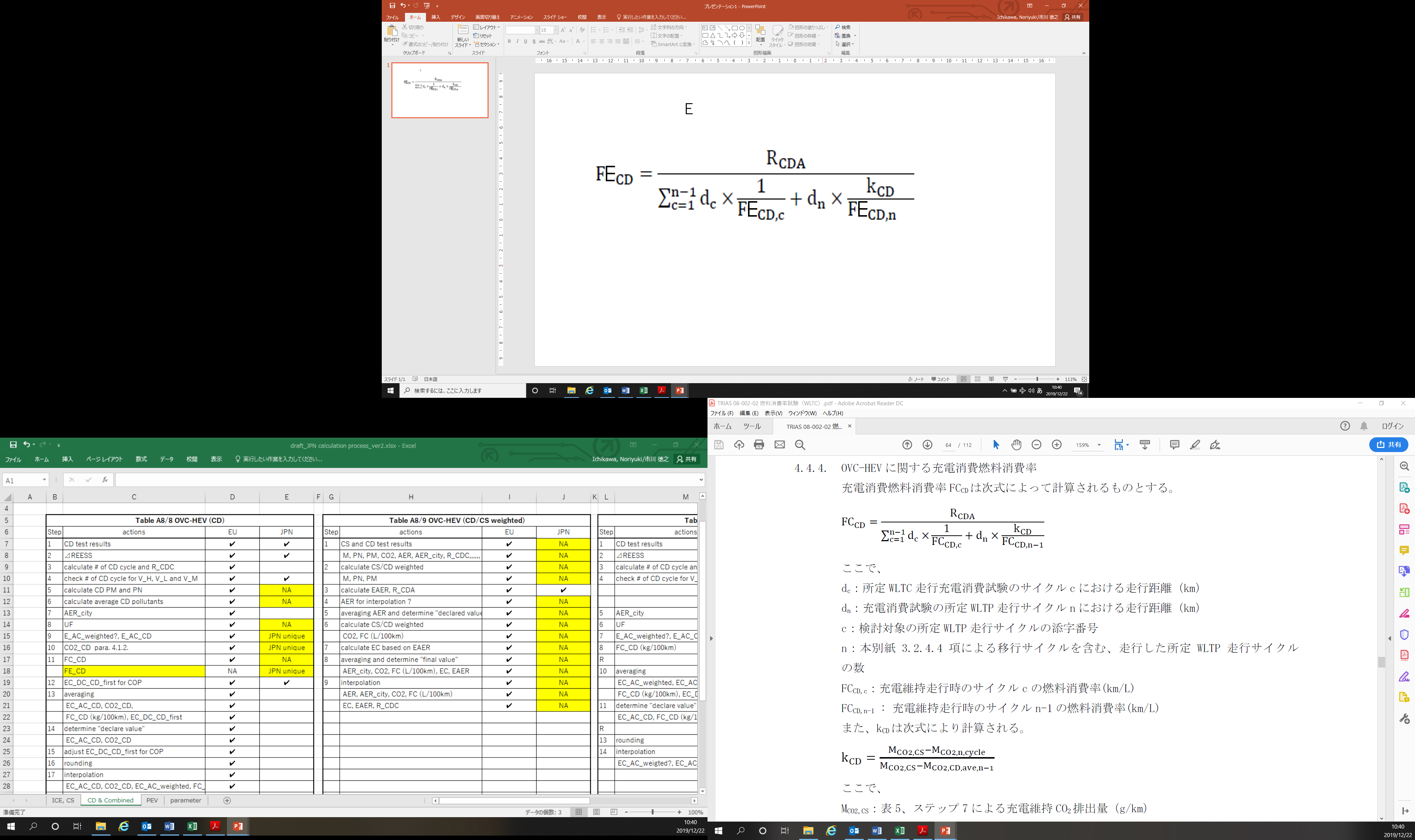
is the number of phases driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

In the case that the interpolation method is applied, k shall be the number of phases driven up to the end of the transition cycle of vehicle L

If the transition cycle number driven by vehicle H, , and, if applicable, by an individual vehicle within the vehicle interpolation family, , is lower than the transition cycle number driven by vehicle L the confirmation cycle of vehicle H and, if applicable, an individual vehicle shall be included in the calculation. The fuel consumption of each phase of the confirmation cycle shall be calculated according to paragraph 6. of Annex B7 with the criteria emission over the complete confirmation cycle and the applicable CO2 phase value which shall be corrected to an electric energy consumption of zero, , by using the CO2 mass correction coefficient (KCO2) according to Appendix 2 to this annex.

For Level 1B

The charge-depleting fuel efficiency shall be calculated using the following equation:

**where:

is the charge-depleting fuel efficiency, km/l;

actual charge-depleting range defined in paragraph 4.4.5. of this Annex, km;

is the fuel efficiency for cycle c of the charge-depleting Type 1 test, determined according to paragraph 6. of Annex B7, km/l;

is the index number for the considered cycle;

n is the number of applicable WLTP test cycles driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex

is the distance driven in the applicable WLTP test cycle c of the charge-depleting Type 1 test, km;

is the distance driven in the applicable WLTP test cycle n of the charge-depleting Type 1 test, km;

4.2.3. This paragraph is applicable only for Level 1A;

Utility factor-weighted fuel consumption for OVC-HEVs [and OVC-FCHVs]

The utility factor-weighted fuel consumption for OVC-HEVs from the charge-depleting and charge-sustaining Type 1 test shall be calculated using the following equation:

where:

is the utility factor-weighted fuel consumption, l/100 km;

is the utility factor of phase jaccording to Appendix 5 to this annex;

is the fuel consumption of phase j of the charge-depleting Type 1 test, determined according to paragraph 6. of Annex B7, l/100 km;

is the declared charge-depleting CO2 mass emission according to Table A8/8, step no. 14, g/km;

is the average charge-depleting CO2 mass emission according to Table A8/8, step no. 13, g/km;

is the fuel consumption determined according to Table A8/6, step No. 1, l/100 km;

is the index number for the considered phase;

is the number of phases driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

[The utility factor-weighted fuel consumption for OVC-FCHVs from the charge-depleting and charge-sustaining Type 1 test shall be calculated using the following equation:

where:

is the utility factor-weighted fuel consumption, kg/100km;

is the utility factor of phase jaccording to Appendix 5 to this annex;

is the fuel consumption of phase j of the charge-depleting Type 1 test, determined according to paragraph 6. of Annex B7, kg/100km;

is the declared charge-depleting fuel consumption according to Table A8/X, step no. 11, kg/100km;

is the average charge-depleting CO2 mass emission according to Table A8/X, step no. 10, kg/100km;

is the fuel consumption determined according to Table A8/7, step No. 1, kg/100km;

is the index number for the considered phase;

is the number of phases driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex.]

In the case that the interpolation method is applied, k shall be the number of phases driven up to the end of the transition cycle of vehicle L

If the transition cycle number driven by vehicle H, , and, if applicable, by an individual vehicle within the vehicle interpolation family is lower than the transition cycle number driven by vehicle L, , the confirmation cycle of vehicle H and, if applicable, an individual vehicle shall be included in the calculation.

The fuel consumption of each phase of the confirmation cycle shall be calculated according to paragraph 6. of Annex B7 with the criteria emission over the complete confirmation cycle and the applicable CO2 phase value which shall be corrected to an electric energy consumption of zero  by using the CO2 mass correction coefficient (KCO2) according to Appendix 2 to this annex.

4.3. Calculation of electric energy consumption

For the determination of the electric energy consumption based on the current and voltage determined according to Appendix 3 to this annex, the following equations shall be used:

where:

is the electric energy consumption over the considered period j based on the REESS depletion, Wh/km;

is the electric energy change of all REESSs during the considered period j, Wh;

is the distance driven in the considered period j, km;

and

where:

is the electric energy change of REESS i during the considered period j, Wh;

and

where:

is the voltage of REESS i during the considered period j determined according to Appendix 3 to this annex, V;

is the time at the beginning of the considered period j, s;

is the time at the end of the considered period j, s;

is the electric current of REESS i during the considered period j determined according to Appendix 3 to this annex, A;

is the index number of the considered REESS;

is the total number of REESS;

is the index for the considered period, where a period can be any combination of phases or cycles;

is the conversion factor from Ws to Wh.

4.3.1. This paragraph is applicable only for Level 1A;

Utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs

The utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains shall be calculated using the following equation:

where:

is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains, Wh/km;

is the utility factor of phase j according to Appendix 5 to this annex;

is the electric energy consumption based on the recharged electric energy from the mains of phase j, Wh/km;

and

where:

is the electric energy consumption based on the REESS depletion of phase j of the charge-depleting Type 1 test according to paragraph 4.3. of this annex, Wh/km;

is the recharged electric energy from the mains determined according to paragraph 3.2.4.6. of this annex, Wh;

is the electric energy change of all REESSs of phase j according to paragraph 4.3. of this annex, Wh;

is the index number for the considered phase;

is the number of phases driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

In the case that the interpolation method is applied, k is the number of phases driven up to the end of the transition cycle of L,nveh\_L.

4.3.2. This paragraph is applicable only for Level 1A;

Utility factor-weighted electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs [and OVC-FCHVs]

The utility factor-weighted electric energy consumption based on the recharged electric energy from the mains shall be calculated using the following equation:

where:

is the utility factor-weighted electric energy consumption based on the recharged electric energy from the mains, Wh/km;

is the utility factor of phase j according to Appendix 5 to this annex;

is the declared charge-depleting electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs according to Table A8/8, step 14 [and for OVC-FCHVs according to [Table A8/X, step 11], Wh/km;

is the index number for the considered phase;

is the number of phases driven up to the end of the transition cycle according to paragraph 3.2.4.4. of this annex.

In the case that the interpolation method is applied, k is the number of phases driven up to the end of the transition cycle of vehicle L, nveh\_L.

4.4.5. Actual charge-depleting range for OVC-HEVs

The actual charge-depleting range shall be calculated using the following equation:

where:

is the actual charge-depleting range, km;

is the charge-sustaining CO2 mass emission according to Table A8/5, step No. 7, g/km;

is the CO2 mass emission of the applicable WLTP test cycle n of the charge-depleting Type 1 test, g/km;

is the arithmetic average CO2 mass emission of the charge-depleting Type 1 test from the beginning up to and including the applicable WLTP test cycle   
(n-1), g/km;

is the distance driven in the applicable WLTP test cycle c of the charge-depleting Type 1 test, km;

is the distance driven in the applicable WLTP test cycle n of the charge-depleting Type 1 test, km;

is the index number of the considered applicable WLTP test cycle;

is the number of applicable WLTP test cycles driven including the transition cycle according to paragraph 3.2.4.4. of this annex;

and:

where:

is the arithmetic average CO2 mass emission of the charge-depleting Type 1 test from the beginning up to and including the applicable WLTP test cycle (n-1), g/km;

is the CO2 mass emission determined according to paragraph 3.2.1. of Annex B7 of the applicable WLTP test cycle c of the charge-depleting Type 1 test, g/km;

is the distance driven in the applicable WLTP test cycle c of the charge-depleting Type 1 test, km;

is the index number of the considered applicable WLTP test cycle;

is the number of applicable WLTP test cycles driven including the transition cycle according to paragraph 3.2.4.4. of this annex.

[4.4.6. Equivalent all-electric range for OVC-FCHVs

4.4.6.1. Determination of cycle-specific equivalent all-electric range

The cycle-specific equivalent all-electric range shall be calculated using the following equation:

where:

is the cycle-specific equivalent all-electric range, km;

is the declared charge-sustaining fuel consumption according to Table A8/7 Step 5, kg/100km;

is the arithmetic average charge-depleting fuel consumption according to the equation below, kg/100km;

is the declared charge-sustaining fuel consumption according to [Table A8/X Step 11], kg/100km;

is the arithmetic average charge-depleting fuel consumption according to the equation below, kg/100km;

is the charge-depleting cycle range according to paragraph 4.4.2. of this annex, km;

and

where:

is the arithmetic average charge-depleting fuel consumption, kg/100 km. In the case of more than one charge-depleting test, the additional average of each test shall be calculated;

is the fuel consumption of phase j of the charge-depleting Type 1 test, kg/100km;

is the distance driven in phase j of the charge-depleting Type 1 test, km;

is the index number of the considered phase;

is the number of phases driven up to the end of the transition cycle n according to paragraph 3.2.4.4. of this annex.

4.4.6.2. Determination of the phase-specific equivalent all-electric range for OVC-FCHV

The phase-specific equivalent all-electric range shall be calculated using the following equation:

where:

is the phase-specific equivalent all-electric range for the considered phase p, km;

is the phase-specific fuel consumption from the charge-sustaining Type 1 test for the considered phase p according to Table A8/7, step No. 5, kg/100km;

is the declared charge-depleting fuel consumption according to [Table A8/X, step no. 11], kg/100km;

is the average charge-depleting fuel consumption according to [Table A8/X, step no. 10], kg/100km;

are the electric energy changes of all REESSs during the considered phase j, Wh. In the case of more than one charge-depleting test, the additional average of each test shall be calculated;

is the electric energy consumption over the considered phase p based on the REESS depletion, Wh/km;

is the index number of the considered phase;

k is the number of phases driven up to the end of the transition cycle n according to paragraph 3.2.4.4 of this annex;

and

where:

is the arithmetic average charge-depleting fuel consumption for the considered phase p, g/km. In the case of more than one charge-depleting test, the additional average of each test shall be calculated, kg/100km;

is the fuel consumption determined according to paragraph 3.2.1. of Annex B7 of phase p in cycle c of the charge-depleting Type 1 test, kg/100km;

is the distance driven in the considered phase p of cycle c of the charge-depleting Type 1 test, km;

is the index number of the considered applicable WLTP test cycle;

is the index of the individual phase within the applicable WLTP test cycle;

is the number of applicable WLTP test cycles driven up to the end of the transition cycle n according to paragraph 3.2.4.4. of this annex;

and:

where:

is the electric energy consumption of the considered phase p based on the REESS depletion of the charge-depleting Type 1 test, Wh/km. In the case of more than one charge-depleting test, the additional average of each test shall be calculated;

is the electric energy consumption of the considered phase p of cycle c based on the REESS depletion of the charge-depleting Type 1 test according to paragraph 4.3. of this annex, Wh/km;

is the distance driven in the considered phase p of cycle c of the charge-depleting Type 1 test, km;

is the index number of the considered applicable WLTP test cycle;

is the index of the individual phase within the applicable WLTP test cycle;

is the number of applicable WLTP test cycles driven up to the end of the transition cycle n according to paragraph 3.2.4.4. of this annex.

For Level 1A;

The considered phase shall be the low phase, medium phase, high phase, extra high phase, and the city driving cycle.

4.4.7. Actual charge-depleting range for OVC-FCHVs

The actual charge-depleting range shall be calculated using the following equation:

where:

is the actual charge-depleting range, km;

is the charge-sustaining fuel consumption according to Table A8/7, step no. 5,, kg/100km;

is the fuel consumption of the applicable WLTP test cycle n of the charge-depleting Type 1 test, kg/100km;

is the arithmetic average fuel consumption of the charge-depleting Type 1 test from the beginning up to and including the applicable WLTP test cycle (n-1), kg/100km;

is the distance driven in the applicable WLTP test cycle c of the charge-depleting Type 1 test, km;

is the distance driven in the applicable WLTP test cycle n of the charge-depleting Type 1 test, km;

is the index number of the considered applicable WLTP test cycle;

is the number of applicable WLTP test cycles driven including the transition cycle according to paragraph 3.2.4.4. of this annex;

and

where

is the arithmetic average fuel consumption of the charge-depleting Type 1 test from the beginning up to and including the applicable WLTP test cycle (n-1), kg/100 km;

is the fuel consumption of the applicable WLTP test cycle c of the charge-depleting Type 1 test, kg/100km;

is the distance driven in the applicable WLTP test cycle c of the charge-depleting Type 1 test, km;

is the index number of the considered applicable WLTP test cycle;

is the number of applicable WLTP test cycles driven including the transition cycle according to paragraph 3.2.4.4. of this annex.]

4.5. Interpolation of individual vehicle values

4.5.4. This paragraph is applicable only for Level 1A:

Interpolation of the CO2 mass emission for individual vehicles

4.5.4.1. Individual charge-sustaining CO2 mass emission for OVC-HEVs and NOVC-HEVs

The charge-sustaining CO2 mass emission for an individual vehicle shall be calculated using the following equation:

where:

is the charge-sustaining CO2 mass emission for an individual vehicle of the considered period p according to Table A8/5, step No. 9, g/km;

is the charge-sustaining CO2 mass emission for vehicle L of the considered period p according to Table A8/5, step No. 8, g/km;

is the charge-sustaining CO2 mass emission for vehicle H of the considered period p according to Table A8/5, step No. 8, g/km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable WLTP test cycle.

The considered periods shall be the low phase, medium phase, high phase, extra high phase and the applicable WLTP test cycle.

4.5.4.2. Individual utility factor-weighted charge-depleting CO2 mass emission for OVC-HEVs

The utility factor-weighted charge-depleting CO2 mass emission for an individual vehicle shall be calculated using the following equation:

where:

is the utility factor-weighted charge-depleting CO2 mass emission for an individual vehicle, g/km;

is the utility factor-weighted charge-depleting CO2 mass emission for vehicle L, g/km;

is the utility factor-weighted charge-depleting CO2 mass emission for vehicle H, g/km;

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.4.3. Individual utility factor-weighted CO2 mass emission for OVC-HEVs

The utility factor-weighted CO2 mass emission for an individual vehicle shall be calculated using the following equation:

where:

is the utility factor-weighted CO2 mass emission for an individual vehicle, g/km;

is the utility factor-weighted CO2 mass emission for vehicle L, g/km;

is the utility factor-weighted CO2 mass emission for vehicle H, g/km**;**

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.5. Interpolation of the fuel consumption and fuel efficiency for individual vehicles

4.5.5.1. Individual charge-sustaining fuel consumption and fuel efficiency for OVC-HEVs and NOVC-HEVs, [NOVC-FCHVs and OVC-FCHVs]

4.5.5.1.1. This paragraph is applicable only for Level 1A:

Individual charge-sustaining fuel consumption for OVC-HEVs and NOVC-HEVs

The charge-sustaining fuel consumption for an individual vehicle shall be calculated using the following equation:

where:

is the charge-sustaining fuel consumption for an individual vehicle of the considered period p according to Table A8/6, step No. 3, l/100 km;

is the charge-sustaining fuel consumption for vehicle L of the considered period p according to Table A8/6, step No. 2, l/100 km;

is the charge-sustaining fuel consumption for vehicle H of the considered period p according to Table A8/6, step No. 2, l/100 km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable WLTP test cycle.

The considered periods shall be the low phase, medium phase, high phase, extra high phase, and the applicable WLTP test cycle.

For Level 1B:

4.5.5.1.2. This paragraph is only applicable for Level 1B:

Individual charge-sustaining fuel efficiency for OVC-HEVs and NOVC-HEVs

The charge-sustaining fuel efficiency for an individual vehicle shall be calculated using the following equation:

where:

is the charge-sustaining fuel consumption for an individual vehicle of the considered period p according to Table A8/6, step No. 3, km/l;

is the charge-sustaining fuel consumption for vehicle L of the considered period p according to Table A8/6, step No. 2, km/l;

is the charge-sustaining fuel consumption for vehicle H of the considered period p according to Table A8/6, step No. 2, km/l;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable WLTP test cycle.

[4.5.5.1.3. Individual charge-sustaining fuel consumption for OVC-FCHVs and NOVC-FCHVs

The charge-sustaining fuel consumption for an individual vehicle shall be calculated using the following equation:

where:

is the charge-sustaining fuel consumption for an individual vehicle of the considered period p according to Table A8/7, step No. 6, kg/100km;

is the charge-sustaining fuel consumption for vehicle L of the considered period p according to Table A8/7, step No. 5, kg/100km;

is the charge-sustaining fuel consumption for vehicle H of the considered period p according to Table A8/7, step No. 5, kg/100km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable WLTP test cycle.

For Level 1A;

The considered periods shall be the low phase, medium phase, high phase, extra high phase, and the applicable WLTP test cycle.

.]

[4.5.5.1.4. This paragraph is only applicable for Level 1B: Individual charge-sustaining fuel efficiency for OVC-FCHVs and NOVC-FCHVs

The charge-sustaining fuel efficiency for an individual vehicle shall be calculated using the following equation:

where:

is the charge-sustaining fuel efficiency for an individual vehicle of the considered period p according to Table A8/7, step No. 6, km/kg;

is the charge-sustaining fuel efficiency for vehicle L of the considered period p according to Table A8/7, step No. 5, km/kg;

is the charge-sustaining fuel efficiency for vehicle H of the considered period p according to Table A8/7, step No. 5, km/kg;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable WLTP test cycle.

The considered period shall be the applicable WLTP test cycle.]

4.5.5.2. Individual charge depleting fuel consumption for OVC-HEVs [and OVC-FCHVs]

For Level 1A

The utility factor-weighted charge-depleting fuel consumption for an individual vehicle shall be calculated using the following equation:

where:

is the utility factor-weighted charge-depleting fuel consumption for an individual vehicle, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the utility factor-weighted charge-depleting fuel consumption for vehicle L, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the utility factor-weighted charge-depleting fuel consumption for vehicle H, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

For Level 1B

The charge-depleting fuel efficiency for an individual vehicle shall be calculated using the following equation:

where:

is the charge-depleting fuel efficiency for an individual vehicle, km/l;

is the charge-depleting fuel efficiency for vehicle L, km/l;

is the charge-depleting fuel efficiency for vehicle H, km/l;

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.5.3. This paragraph is applicable only for Level 1A:

Individual utility factor-weighted fuel consumption for OVC-HEVs [and OVC-FCHVs]

The utility factor-weighted fuel consumption for an individual vehicle shall be calculated using the following equation:

where:

is the utility factor-weighted fuel consumption for an individual vehicle, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the utility factor-weighted fuel consumption for vehicle L, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the utility factor-weighted fuel consumption for vehicle H, l/100 km [in case of OVC-HEVs and kg/100km in case of OVC-FCHVs];

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.6. Interpolation of electric energy consumption for individual vehicles

4.5.6.1. This paragraph is applicable only for Level 1A:

Individual utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs [and OVC-FCHVs]

The utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from for an individual vehicle shall be calculated using the following equation:

where:

is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for an individual vehicle, Wh/km;

is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for vehicle L, Wh/km;

is the utility factor-weighted charge-depleting electric energy consumption based on the recharged electric energy from the mains for vehicle H, Wh/km;

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.6.2. This paragraph is applicable only for Level 1A:

Individual utility factor-weighted electric energy consumption based on the recharged electric energy from the mains for OVC-HEVs [and OVC-FCHVs]

The utility factor-weighted electric energy consumption based on the recharged electric energy from the mains for an individual vehicle shall be calculated using the following equation:

where:

is the utility factor weighted electric energy consumption based on the recharged electric energy from the mains for an individual vehicle, Wh/km;

is the utility factor weighted electric energy consumption based on the recharged electric energy from the mains for vehicle L, Wh/km;

is the utility factor weighted electric energy consumption based on the recharged electric energy from the mains for vehicle H, Wh/km;

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle.

4.5.6.3. Individual electric energy consumption for OVC-HEVs [OVC-FCHVs] and PEVs

The electric energy consumption for an individual vehicle according to paragraph 4.3.3. of this annex in the case of OVC-HEVs and according to paragraph 4.3.4. of this annex in the case of PEVs shall be calculated using the following equation:

where:

is the electric energy consumption for an individual vehicle for the considered period p, Wh/km;

is the electric energy consumption for vehicle L for the considered period p, Wh/km;

is the electric energy consumption for vehicle H for the considered period p, Wh/km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable test cycle.

For Level 1A;

The considered periods shall be the low phase, medium phase, high phase, extra high phase, the applicable WLTP city test cycle and the applicable WLTP test cycle.

For Level 1B;

The considered periods shall be the low phase, medium phase, high phase and the applicable WLTP test cycle.

4.5.7. Interpolation of electric ranges for individual vehicles

4.5.7.1. Individual all-electric range for OVC-HEVs [and OVC-FCHVs]

If the following criterion

where:

is the all-electric range of vehicle L for the applicable WLTP test cycle, km;

is the all-electric range of vehicle H for the applicable WLTP test cycle, km;

is the actual charge-depleting range of vehicle L, km;

is the actual charge-depleting range of vehicle H, km;

is fulfilled, the all-electric range for an individual vehicle shall be calculated using the following equation:

where:

is the all-electric range for an individual vehicle for the considered period p, km;

is the all-electric range for vehicle L for the considered period p, km;

is the all-electric range for vehicle H for the considered period p, km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable test cycle.

For Level 1A

The considered periods shall be the applicable WLTP city test cycle and the applicable WLTP test cycle.

For Level 1B

The considered periods shall be the applicable WLTP test cycle.

If the criterion defined in this paragraph is not fulfilled, the AER determined for vehicle H is applicable to all vehicles within the interpolation family.

4.5.7.2. Individual pure electric range for PEVs

The pure electric range for an individual vehicle shall be calculated using the following equation:

where:

is the pure electric range for an individual vehicle for the considered period p, km;

is the pure electric range for vehicle L for the considered period p, km;

is the pure electric range for vehicle H for the considered period p, km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable test cycle.

For Level 1A;

The considered periods shall be the low phase, medium phase, high phase, extra high phase, the applicable WLTP city test cycle and the applicable WLTP test cycle.

For Level 1B;

The considered periods shall be the applicable WLTP test cycle.

4.5.7.3. Individual equivalent all-electric range for OVC-HEVs [and OVC-FCHVs]

The equivalent all-electric range for an individual vehicle shall be calculated using the following equation:

where:

is the equivalent all-electric range for an individual vehicle for the considered period p, km;

is the equivalent all-electric range for vehicle L for the considered period p, km;

is the equivalent all-electric range for vehicle H for the considered period p, km;

is the interpolation coefficient for the considered individual vehicle for period p;

is the index of the individual period within the applicable test cycle.

For Level 1A;

The considered periods shall be the low phase, medium phase, high phase, extra high phase, the applicable WLTP city test cycle and the applicable WLTP test cycle.

For Level 1B;

The considered periods shall be the applicable WLTP test cycle.

4.5.8. Adjustment of values

The individual EC value determined in accordance with paragraph 4.5.6.3. of this annex may be increased by the OEM. In such cases:

The EC phase values shall be increased by the ratio of the increased EC value divided by the calculated EC value. The individual EAER value shall be modified accordingly. This shall not compensate for technical elements that would effectively require a vehicle to be excluded from the interpolation family.

4.6. Stepwise procedure for calculating the final test results of OVC-HEVs

In addition to the stepwise procedure for calculating the final charge-sustaining test results for gaseous emission compounds according to paragraph 4.1.1.1. of this annex and for fuel consumption and fuel consumption according to paragraph 4.2.1.1. of this annex, paragraphs 4.6.1. and 4.6.2. of this annex describe the stepwise calculation of the final charge-depleting as well as the final charge-sustaining and charge-depleting weighted test results.

4.6.1. Stepwise procedure for calculating the final test results of the charge-depleting Type 1 test for OVC-HEVs

The results shall be calculated in the order described in Table A8/8. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

For the purpose of Table A8/8, the following nomenclature within the equations and results is used:

c complete applicable test cycle;

p every applicable cycle phase; for the purpose of city test cycle calculation (as applicable), p shall represent the city driving cycle;

i applicable criteria emission component;

CS charge-sustaining;

CO2 CO2 mass emission.

Table A8/8

**Calculation of final charge-depleting values**

| *Step no.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Annex B8 | Charge-depleting test results | Results measured according to Appendix 3 to this annex, pre-calculated according to paragraph 4.3. of this annex.  Recharged electric energy according to paragraph 3.2.4.6. of this annex.  Cycle energy according to paragraph 5. of Annex B7.  CO2 mass emission according to paragraph 3.2.1. of Annex B7.  Mass of gaseous emission compound i according to paragraph 4.1.3.1.. of Annex B8.  All-electric range determined according to paragraph 4.4.1.1. of this annex.  CO2 mass emission KCO2 correction coefficient might be necessary according to Appendix 2 to this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output (except of KCO2) is available for vehicle H, L and, if applicable, M. | ΔEREESS,j, Wh;  dj, km;  EAC, Wh;  Ecycle, Ws;  MCO2,CD,j, g/km;  Mi,CD,j, g/km;  AER, km;  KCO2,  (g/km)/(Wh/km). |
|  | For Level 1A  Annex B8 |  | Usable battery energy according to paragraph 4.4.1.2.2. of this annex.  In the case that the applicable WLTC city test cycle was driven: all- electric range city according to paragraph 4.4.1.2.1. of this annex.  Particle number emissions (if applicable) according to paragraph 4. of Annex B7.  Particulate matter emissions according to paragraph 4. of Annex B7. | UBEcity, Wh;  AERcity, km.  PNCD,j, particles per kilometer;  PMCD,c, mg/km; |
| 2 | Output step 1 | ΔEREESS,j, Wh;  Ecycle, Ws. | Calculation of relative electric energy change for each cycle according to paragraph 3.2.4.5.2. of this annex.  Output is available for each test and each applicable WLTP test cycle.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | REECi. |
| 3 | Output step 2 | REECi. | Determination of the transition and confirmation cycle according to paragraph 3.2.4.4. of this annex.  In the case that more than one charge-depleting test is available for one vehicle, for the purpose of averaging, each test shall have the same transition cycle number nveh.  Determination of the charge-depleting cycle range according to paragraph 4.4.3. of this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | nveh;  RCDC; km. |
| 4 | Output step 3 | nveh; | In the case that the interpolation method is used, the transition cycle shall be determined for vehicle H, L and, if applicable, M.  Check whether the interpolation criterion according to paragraph 6.3.2.2. (d) of this Regulation is fulfilled. | nveh,L;  nveh,H;  if applicable  nveh,M. |
| For Level 1A  5 | Output step 1 | PMCD,c, mg/km;  PNCD,j, particles per kilometer. | Calculation of combined values for emissions for nveh cycles; in the case of interpolation for nveh,L cycles for each vehicle.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | PMCD,c, mg/km;  PNCD,c, particles per kilometer. |
| For Level 1A  6 | Output step 5 | Mi,CD,c, g/km;  PMCD,c, mg/km;  PNCD,c, particles per kilometer. | Emission averaging of tests for each applicable WLTP test cycle within the charge-depleting Type 1 test and check with the limits according to Table A6/2 of Annex B6. | Mi,CD,c,ave, g/km;  PMCD,c,ave, mg/km;  PNCD,c,ave, particles per kilometer. |
| For Level 1A  7 | Output step 1 | ΔEREESS,j, Wh;  dj, km;  UBEcity, Wh. | In the case that AERcity is derived from the Type 1 test by driving the applicable WLTP test cycles, the value shall be calculated according to paragraph 4.4.1.2.2. of this annex.  In the case of more than one test,  ncity,pe shall be equal for each test.  Output available for each test.  Averaging of AERcity.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | AERcity, km;  AERcity,ave, km. |
| For Level 1A  8 | Output step 1 | dj, km; | Phase-specific and cycle-specific UF calculation.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | UFphase,j;  UFcycle,c. |
| Output step 3 | nveh; |
| Output step 4 | nveh,L; |
| For Level 1A  9 | Output step 1 | ΔEREESS,j, Wh;  dj, km;  EAC, Wh; | Calculation of the electric energy consumption based on the recharged energy according. to paragraphs 4.3.1. of this annex.  In the case of interpolation, nveh,L cycles shall be used. Therefore, due to the required correction of the CO2 mass emission, the electric energy consumption of the confirmation cycle and its phases shall be set to zero.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | ECAC,CD, Wh/km; |
| Output step 3 | nveh; |
| Output step 4 | nveh,L; |
| Output step 8 | UFphase,j; |
| 10 | Output step 1 | MCO2,CD,j, g/km;  KCO2, (g/km)/(Wh/km);  ΔEREESS,j, Wh;  dj, km;  nveh;  nveh,L;  UFphase,j. | Calculation of the charge-depleting CO2 mass emission according to paragraph 4.1.2. of this annex.  In the case that the interpolation method is applied, nveh,L cycles shall be used. With reference to paragraph 4.1.2. of this annex, the confirmation cycle shall be corrected according to Appendix 2 to this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | MCO2,CD, g/km; |
| Output step 3 | dj, km; |
| Output step 4 | nveh; |
| Output step 8 | nveh,L;  UFphase,j. |
| 11 | Output step 1 | MCO2,CD,j, g/km;  Mi,CD,j, g/km;  KCO2, (g/km)/(Wh/km).  nveh;  nveh,L;  UFphase,j; | Calculation of the charge-depleting fuel consumption and fuel efficiency according to paragraph 4.2.2. of this annex.  In the case that the interpolation method is applied, nveh,L cycles shall be used. With reference to paragraph 4.1.2. of this annex, MCO2,CD,j of the confirmation cycle shall be corrected according to Appendix 2 to this annex.  For Level 1A, the phase-specific fuel consumption FCCD,j shall be calculated using the corrected CO2 mass emission according to paragraph 6. of Annex B7.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | For Level 1A,  FCCD,j, l/100 km;  FCCD, l/100 km.  For Level 1B,  FECD, km/l. |
| Output step 3 | nveh; |
| Output step 4 | nveh,L; |
| Output step 8 | UFphase,j; |
| 12 | Output step 1 | ΔEREESS,j, Wh;  dj, km; | If applicable, calculation of the electric energy consumption from the first applicable WLTP test cycle as described in Appendix 8, Paragraph 2.1. to this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H, L and, if applicable, M. | ECDC,CD,first, Wh/km |
| 13 | Output step 9 | ECAC,CD, Wh/km; | Averaging of tests for each vehicle.  In the case that the interpolation method is applied, the output is available for each vehicle H, L and, if applicable, M. | If applicable:  ECDC,CD,first,ave, Wh/km  For Level 1A,  ECAC,CD,ave, Wh/km;  MCO2,CD,ave, g/km;  FCCD,ave, l/100 km;  For Level 1B,  FECD,ave, km/l. |
| Output step 10 | MCO2,CD, g/km; |
| Output step 11 | FCCD, l/100 km; FECD, km/l. |
| Output step 12 | If applicable:  ECDC,CD,first, Wh/km. |
| 14 | Output step 13 | ECAC,CD,ave, Wh/km;  MCO2,CD,ave, g/km.  FECD,ave, km/l. | Declaration of charge-depleting electric energy consumption, fuel efficiency and CO2 mass emission for each vehicle.  Calculation of ECAC,weighted according to paragraph 4.3.2. of this annex.  In the case that the interpolation method is applied, the output is available for each vehicle H, L and, if applicable, M. | For Level 1A,  ECAC,CD,declared, Wh/km;  ECAC,weighted, Wh/km;  MCO2,CD,declared, g/km.    For Level 1B,  FECD,declared, km/l. |
| 15 | Output step 13 | ECAC,CD,ave, Wh/km;  If applicable:  ECDC,CD,first,ave, Wh/km; | If applicable:  Adjustment of electric energy consumption for the purpose of COP as decribed in Appendix 8, paragraph 2.1. to this annex.  In the case that the interpolation method is applied, the output is available for each vehicle H, L and, if applicable, M. | ECDC,CD,COP, Wh/km; |
| Output step 14 | ECAC,CD,declared, Wh/km; |
| 16  Interpola-tion family result.  If the interpola-tion method is not applied, step No. 17 is not required and the output of this step is the final result. | Output step 15 | If applicable: ECDC,CD,COP, Wh/km; | In the case that the interpolation method is applied, intermediate rounding shall be performed according to paragraph 6.1.8. of this Regulation:  MCO2,CD shall be rounded to the second place of decimal.  ECAC,CD,final and ECAC,weighted,final shall be rounded to the first place of decimal.  If applicable:  ECDC,CD,COP shall be rounded to the first place of decimal.  FCCD and FECD shall be rounded to the third place of decimal.  Output is available for vehicles H and for vehicle L and, if applicable, for vehicle M.  In case that the interpolation method is not applied, final rounding shall be applied according to paragraph 6.1.8. of this Regulation:  ECAC,CD , ECAC,weighted and MCO2,CD shall be rounded to the nearest whole number.    If applicable:  ECDC,CD,COP shall be rounded to the nearest whole number.    FCCD and FECD shall be rounded to the first place of decimal. | If applicable: ECDC,CD,COP,final, Wh/km;  For Level 1A, ECAC,CD,final, Wh/km;  MCO2,CD,final, g/km;  ECAC,weighted,final, Wh/km;  FCCD,final, l/100 km;  For Level 1B,  FECD,final, km/l; |
| Output step 14 | ECAC,CD,declared, Wh/km;  ECAC,weighted, Wh/km;  FECD,declared, km/l. |
| Output step 13 | MCO2,CD,declared, g/km;  FCCD,ave, l/100 km; |
| 17  Result of an individual vehicle.  Final test result. | Output step 16 | If applicable: ECDC,CD,COP,final, Wh/km;  ECAC,CD,final, Wh/km;  MCO2,CD,final, g/km;  ECAC,weighted,final, Wh/km;  FCCD,final, l/100 km; FECD,final, km/l; | Interpolation of individual values based on input from vehicles H and L and, if applicable, vehicle M.  Final rounding of individual vehicle values shall be performed according to paragraph 6.1.8. of this Regulation.  ECAC,CD , ECAC,weighted and MCO2,CD shall be rounded to the nearest whole number.  If applicable:  ECDC,CD,COP shall be rounded to the nearest whole number.    FCCD shall be rounded to the first place of decimal.  Output is available for each individual vehicle. | If applicable: ECDC,CD,COP,ind, Wh/km;  For Level 1A,  ECAC,CD,ind, Wh/km;  MCO2,CD,ind, g/km;  ECAC,weighted,ind, Wh/km;  FCCD,ind, l/100 km;  For Level 1B,  FECD,ind, km/l; |

4.6.2. Stepwise procedure for calculating the final charge-sustaining and charge-depleting weighted test results of the Type 1 test

The results shall be calculated in the order described in Table A8/9. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

For the purpose of this table, the following nomenclature within the equations and results is used:

considered period is the complete applicable test cycle;

every applicable cycle phase; for the purpose of EAERcity calculation (as applicable), p shall represent the city driving cycle;

applicable criteria emission component (except for CO2);

j index for the considered period;

CS charge-sustaining;

CD charge-depleting;

CO2 CO2 mass emission;

REESS Rechargeable Electric Energy Storage System.

Table A8/9

**Calculation of final charge-depleting and charge-sustaining weighted values**

| *Step no.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Output step 1, Table A8/8 | Mi,CD,j, g/km;  PNCD,j, particles per kilometer;  PMCD,c, mg/km;  MCO2,CD,j, g/km;  ΔEREESS,j, Wh;  dj, km;  AER, km;  EAC, Wh; | Input from CD and CS post processing.  Output in the case of CD is available for each CD test. Output in the case of CS is available once due to CS test averaged values.  In the case that the interpolation method is applied, the output (except of KCO2) is available for vehicle H, L and, if applicable, M.  CO2 mass emission correction coefficient KCO2 might be necessary according to Appendix 2 to this annex. | MCO2,CD,j, g/km;  AER, km;  EAC, Wh;  MCO2,CS,declared, g/km;  MCO2,CD,declared, g/km;  MCO2,CD,ave, g/km;  For Level 1A  Mi,CD,j, g/km;  PNCD,j, particles per kilometer;  PMCD,c, mg/km;  ΔEREESS,j, Wh;  dj, km;  AERcity,ave, km;  nveh;  RCDC, km;  nveh,L;  nveh,H;  UFphase,j;  UFcycle,c;  Mi,CS,c,6, g/km;  MCO2,CS,p  KCO2,  (g/km)/(Wh/km). |
| Output step 7, Table A8/8 | AERcity,ave, km; |
| Output step 3, Table A8/8 | nveh;  RCDC, km; |
| Output step 4, Table A8/8 | nveh,L;  nveh,H; |
| Output step 8, Table A8/8 | UFphase,j;  UFcycle,c; |
| Output step 6, Table A8/5 | Mi,CS,c,6, g/km; |
| Output step 7, Table A8/5 | MCO2,CS,declared, g/km;  MCO2,CS,p |
| Output step 14, Table A8/8 | MCO2,CD,declared, g/km; |
| Output step 13, Table A8/8 | MCO2,CD,ave, g/km; |
|  | KCO2,  (g/km)/(Wh/km). |
| For Level 1A  2 | Output step 1 | Mi,CD,j, g/km;  PNCD,j, particles per kilometer;  PMCD,c, mg/km;  nveh;  nveh,L;  UFphase,j;  UFcycle,c;  Mi,CS,c,6, g/km; | Calculation of weighted emission (except MCO2,weighted) compounds according to paragraphs 4.1.3.1. to 4.1.3.3. inclusive of this annex.  Remark:  Mi,CS,c,6 includes PNCS,c and PMCS,c.  Output is available for each CD test.  In the case that the interpolation method is applied, the output is available for each vehicle L, H and, if applicable, M. | Mi,weighted, g/km;  PNweighted, particles per kilometer;  PMweighted, mg/km; |
| 3 | Output step 1 | MCO2,CD,j, g/km;  ΔEREESS,j, Wh;  dj, km;  nveh;  RCDC, km  MCO2,CS,declared, g/km;  MCO2,CS,p | Calculation of equivalent all-electric range according to paragraphs 4.4.4.1. and 4.4.4.2. of this annex, and actual charge-depleting range according to paragraph 4.4.5. of this annex.  Output is available for each CD test.  RCDA shall be rounded according to paragraph 6.1.8. of this Regulation to the nearest whole number.  In the case that the interpolation method is applied, the output is available for each vehicle L, H and, if applicable, M. | EAER, km;  EAERp, km;  RCDA, km. |
| 4 | Output step 1 | AER, km; | Output is available for each CD test.  In the case that the interpolation method is applied, check the availability of AER interpolation between vehicle H, L and, if applicable, M according to paragraph 4.5.7.1. of this annex.  If the interpolation method is used, each test shall fulfil the requirement. | AER-interpolation availability. |
| Output step 3 | RCDA, km. |
| 5  Interpolation family result.  If the interpolation method is not applied, step No. 9 is not required and the output of this step is the final result. | Output step 1 | AER, km. | Averaging AER and AER declaration.  The declared AER shall be rounded according to paragraph 6.1.8. of this Regulation to the number of decimal places specified in Table A6/1 of Annex B6.  In the case that the interpolation method is applied and the AER interpolation availability criterion is fulfilled, AERshall be rounded according to paragraph 6.1.8. of this Regulation to the first place of decimal.  The output is available for each vehicles H and L and, if applicable, for vehicle M.  If the case that the interpolation method is applied but the criterion is not fulfilled, AER of vehicle H shall be applied for the whole interpolation family and shall be rounded according to paragraph 6.1.8. of this Regulation to the nearest whole number.  In the case that the interpolation method is not applied, AERshall be rounded according to paragraph 6.1.8. of this Regulation to the nearest whole number. | AERave, km;  For Level 1A  AERdec, km. |
| For Level 1A,  6 | Output step 1 | Mi,CD,j, g/km;  MCO2,CD,j, g/km;  nveh;  nveh,L;  UFphase,j;  Mi,CS,c,6, g/km;  MCO2,CS,declared, g/km.  MCO2,CD,declared, g/km;  MCO2,CD,ave, g/km; | Calculation of weighted CO2 mass emission and fuel consumption according to paragraphs 4.1.3.1. and 4.2.3. of this annex.  Output is available for each CD test.  In the case that the interpolation method is applied, nveh,L cycles shall be used. With reference to paragraph 4.1.2. of this annex, MCO2,CD,j of the confirmation cycle shall be corrected according to Appendix 2 to this annex.  In the case that the interpolation method is applied, the output is available for each vehicle H, vehicle L and, if applicable, vehicle M. | MCO2,weighted, g/km;  FCweighted, l/100 km; |
| 7 | Output step 1 | EAC, Wh; | Calculation of the electric energy consumption based in EAER according to paragraphs 4.3.3.1. and 4.3.3.2. of this annex.  Output is available for each CD test.  In the case that the interpolation method is applied, the output is available for each vehicle H, vehicle L and, if applicable, vehicle M. | EC, Wh/km;  ECp, Wh/km; |
| Output step 3 | EAER, km;  EAERp, km; |
| 8  Interpolation family result.  If the interpolation method is not applied, step No. 9 is not required and the output of this step is the final result. | Output step 1 | AERcity, ave, km; | For Level 1B  Averaging EC and EC declaration.  For Level 1A and Level 1B  Averaging and intermediate rounding according to paragraph 6.1.8. of this Regulation.  In the case that the interpolation method is applied, intermediate rounding shall be performed according to paragraph 6.1.8. of this Regulation.  AERcity,ave, EAER and EAERp shall be rounded to the first place of decimal.  MCO2,weighted shall be rounded to the second place of decimal.  FCweighted shall be rounded to the third place of decimal.  EC and ECp shall be rounded to the first place of decimal.  The output is available for each vehicle H, vehicle L and, if applicable, vehicle M.  In case that the interpolation method is not applied, final rounding of the test results shall be applied according to paragraph 6.1.8. of this Regulation.  AERcity,ave, EAER and EAERp shall be rounded to the nearest whole number.  MCO2,weighted shall be rounded to the nearest whole number.  FCweighted shall be rounded to the first place of decimal.  EC and ECp shall be rounded to the nearest whole number. | For Level 1B  ECdec, Wh/km;  ECp,final, Wh/km;  EAERfinal, km;  For Level 1A  AERcity,final, km;  MCO2,weighted,final, g/km;  FCweighted,final, l/100 km;  ECfinal, Wh/km;  ECp,final, Wh/km; |
| Output step 6 | MCO2,weighted, g/km;  FCweighted, l/100 km; |
| Output step 7 | EC, Wh/km;  ECp, Wh/km; |
| Output step 3 | EAER, km;  EAERp, km; |
| Output step 5 | AERdec, km;  AERave, km.. |
| 9  Result of an individual vehicle.  Final test result. | Output step 5 | AERdec, 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 according to paragraph 6.1.8. of this Regulation.  AERind,AERcity,ind, EAERind and EAERp,ind shall be rounded to the nearest whole number.  MCO2,weighted,ind shall be rounded to the nearest whole number.  ECweighted,ind shall be rounded to the first place of decimal.  FCweighted,ind shall be rounded to the first place of decimal.  ECind and ECp,ind shall be rounded to the nearest whole number.  Output available for each individual vehicles.  RCDC shall be rounded according to paragraph 6.1.8. of this Regulation to the nearest whole number. | ECind, Wh/km;  ECp,ind, Wh/km;  AERind, km;  For Level 1A,  AERcity,ind, km;  MCO2,weighted,ind, g/km;  FCweighted,ind, l/100 km;  EAERind, km;  EAERp,ind, km.  RCDC,final |
| Output step 8 | AERcity,final, km;  MCO2,weighted,final, g/km;  FCweighted,final, l/100 km;  ECfinal, Wh/km;  ECp,final, Wh/km;  EAERfinal, km;  EAERp,final, km; |
| Output step 4 | AER-interpolation availability |
| Output step 1 | RCDC |

4.7. Stepwise procedure for calculating the final test results of PEVs

The results shall be calculated in the order described in Table A8/10 of the consecutive cycle procedure and in the order described in Table A8/11 in the case of the shortened test procedure. All applicable results in the column "Output" shall be recorded. The column "Process" describes the paragraphs to be used for calculation or contains additional calculations.

4.7.1. Stepwise procedure for calculating the final test results of PEVs in case of the consecutive cycles procedure

For the purpose of this table, the following nomenclature within the questions and results is used:

j index for the considered period.

Table A8/10

**Calculation of final PEV values determined by application of the consecutive cycle Type 1 procedure**

For Level 1A;

The considered periods shall be the low phase, medium phase, high phase, extra high phase, the applicable WLTP city test cycle and the applicable WLTP test cycle.

For Level 1B;

The considered periods shall be the low phase, medium phase, high phase and the applicable WLTP test cycle.

| *Step no.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Annex B8 | Test results | Results measured according to Appendix 3 to this annex and pre-calculated according to paragraph 4.3. of this annex.  Usable battery energy according to paragraph 4.4.2.2.1. of this annex.  Recharged electric energy according to paragraph 3.4.4.3. of this annex.  Output available for each test.  EAC shall be rounded according to paragraph 6.1.8. of this Regulation to the first place of decimal. In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ΔEREESS,j, Wh;  dj, km;  UBECCP, Wh;  EAC, Wh. |
| 2 | Output step 1 | ΔEREESS,j, Wh;  UBECCP, Wh. | Determination of the number of completely driven applicable WLTC phases and cycles according to paragraph 4.4.2.2. of this annex.  Output available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | nWLTC;  ncity;  nlow;  nmed;  nhigh;  nexHigh. |
| 3 | Output step 1 | ΔEREESS,j, Wh;  UBECCP, Wh. | Calculation of weighting factors according to paragraph 4.4.2.2. of this annex.  Note: The number of weighting factors depends on the applicable cycle that was used (3- or 4-phase WLTC). In the case of 4-phase WLTCs, the output in brackets might be needed in addition.  Output available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | KWLTC,1  KWLTC,2  KWLTC,3  (KWLTC,4)  Kcity,1  Kcity,2  Kcity,3  (Kcity,4)  Klow,1  Klow,2  Klow,3  (Klow,4)  Kmed,1  Kmed,2  Kmed,3  (Kmed,4)  Khigh,1  Khigh,2  Khigh,3  (Khigh,4)  KexHigh,1  KexHigh,2  KexHigh,3  (KexHigh,4) |
| Output step 2 | nWLTC;  ncity;  nlow;  nmed;  nhigh;  nexHigh. |
| 4 | Output step 1 | ΔEREESS,j, Wh;  dj, km;  UBECCP, Wh. | Calculation of electric energy consumption at the REESSs according to paragraph 4.4.2.2. of this annex.  Calculation of the electric energy consumption from the first applicable WLTP test cycle ECDC,first as described in Appendix 8, paragraph 1.1. to this annex.  Output available for each test.    In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ECDC,WLTC, Wh/km;  ECDC,city, Wh/km;  ECDC,low, Wh/km;  ECDC,med, Wh/km;  ECDC,high, Wh/km;  ECDC,exHigh, Wh/km;  ECDC,first, Wh/km. |
| Output step 2 | nWLTC;  ncity;  nlow;  nmed;  nhigh;  nexHigh. |
| Output step 3 | All weighting  factors |
| 5 | Output step 1 | UBECCP, Wh; | Calculation of pure electric range according to paragraph 4.4.2.2. of this annex.  Output available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | PERWLTC, km;  PERcity, km;  PERlow, km;  PERmed, km;  PERhigh, km;  PERexHigh, km. |
| Output step 4 | ECDC,WLTC, Wh/km;  ECDC,city, Wh/km;  ECDC,low, Wh/km;  ECDC,med, Wh/km;  ECDC,high, Wh/km;  ECDC,exHigh, Wh/km. |
| 6 | Output step 1 | EAC, Wh; | Calculation of electric energy consumption at the mains according to paragraph 4.3.4. of this annex.  Output available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ECWLTC, Wh/km;  ECcity, Wh/km;  EClow, Wh/km;  ECmed, Wh/km;  EChigh, Wh/km;  ECexHigh, Wh/km. |
| Output step 5 | PERWLTC, km;  PERcity, km;  PERlow, km;  PERmed, km;  PERhigh, km;  PERexHigh, km. |
| 7  If the interpolation method is not applied, step No. 10 is not required and the output of this step for PERWLTC,dec and ECWLTC,dec is the final result. | Output step 5 | PERWLTC, km;  PERcity, km;  PERlow, km;  PERmed, km;  PERhigh, km;  PERexHigh, km; | Averaging of tests for all input values.  Declaration of PERWLTC,dec and ECWLTC,dec based on PERWLTC,ave and ECWLTC,ave.  Alignment of PER in case of city, low, med, high and exHigh based on the ratio between PERWLTC,dec and PERWLTC,ave:  Alignment of EC in case of city, low, med, high and exHigh based on the ratio between ECWLTC,dec and ECWLTC,ave:  In the case that the interpolation method is applied, the output is available for vehicles H and vehicle L. PERWLTC,dec as well as ECWLTC,dec shall be rounded according to paragraph 6.1.8. of this Regulation to the number of places of decimal as specified in Table A6/1 of Annex B6.  In the case that the interpolation method is not applied, PERWLTC,dec and ECWLTC,dec shall be rounded according to paragraph 6.1.8. of this Regulation to the nearest whole number.  . | PERWLTC,dec, km;  PERWLTC,ave, km;  PERcity,ave, km;  PERlow,ave, km;  PERmed,ave, km;  PERhigh,ave, km;  PERexHigh,ave, km;  ECWLTC,dec, Wh/km;  ECWLTC,ave, Wh/km;  ECcity,ave, Wh/km;  EClow,ave, Wh/km;  ECmed,ave, Wh/km;  EChigh,ave, Wh/km;  ECexHigh,ave, Wh/km;  ECDC,first,ave, Wh/km. |
| Output step 6 | ECWLTC, Wh/km;  ECcity, Wh/km;  EClow, Wh/km;  ECmed, Wh/km;  EChigh, Wh/km;  ECexHigh, Wh/km. |
| Output step 4 | ECDC,first, Wh/km. |
| 8 | Output step 7 | ECWLTC,dec, Wh/km;  ECWLTC,ave, Wh/km;  ECDC,first,ave, Wh/km. | Adjustment of the electric energy consumption for the purpose of COP as described in Appendix 8, paragraph 1.1. to this annex.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ECDC,COP, Wh/km. |
| 9  If the interpolation method is not applied, step No. 10 is not required and the output of this step is the final result. | Output step 7 | PERcity,ave, km;  PERlow,ave, km;  PERmed,ave, km;  PERhigh,ave, km;  PERexHigh,ave, km;  ECcity,ave, Wh/km;  EClow,ave, Wh/km;  ECmed,ave, Wh/km;  EChigh,ave, Wh/km;  ECexHigh,ave, Wh/km; | Intermediate rounding according to paragraph 6.1.8. of this Regulation.  In the case that the interpolation method is applied, intermediate rounding shall be performed according to paragraph 6.1.8. of this Regulation:  PERcity and PERp shall be rounded to the first place of decimal.  ECcity and ECp shall be rounded to the first place of decimal.  ECDC,COP shall be rounded to the first place of decimal.  The output is available for vehicle H and vehicle L.  In case that the interpolation method is not applied, final rounding of the test results according to paragraph 6.1.8. of this Regulation:  PERcity and PERp shall be rounded to the nearest whole number.  ECcity and ECp shall be rounded to the nearest whole number.  ECDC,COP shall be rounded to the nearest whole number. | PERcity,final, km;  PERlow,final, km;  PERmed,final, km;  PERhigh,final, km;  PERexHigh,final, km;  ECcity,final, Wh/km;  EClow,final, Wh/km;  ECmed,final, Wh/km;  EChigh,final, Wh/km;  ECexHigh,final, Wh/km;  ECDC,COP,final, Wh/km. |
| Output step 8 | ECDC,COP, Wh/km. |
| 10  Result of an individual vehicle.  Final test result. | Output step 7 | PERWLTC,dec, km;  ECWLTC,dec, Wh/km | Interpolation of individual values based on input from vehicle H and vehicle L according to paragraph 4.5. of this annex, and final rounding according to paragraph 6.1.8. of this Regulation.  PERind, PERcity,ind, and PERp,ind shall be rounded to the nearest whole number.  ECind, ECcity and ECp,ind shall be rounded to the nearest whole number.  ECDC,COP,ind shall be rounded to the nearest whole number.  The output is available for each individual vehicle. | PERWLTC,ind, km;  PERcity,ind, km;  PERlow,ind, km;  PERmed,ind, km;  PERhigh,ind, km;  PERexHigh,ind, km;  ECWLTC,ind, Wh/km;  ECcity,ind, Wh/km;  EClow,ind, Wh/km;  ECmed,ind, Wh/km;  EChigh,ind, Wh/km;  ECexHigh,ind, Wh/km;  ECDC,COP,ind, Wh/km. |
| Output step 9 | PERcity,final, km;  PERlow,final, km;  PERmed,final, km;  PERhigh,final, km;  PERexHigh,final, km;  ECcity,final, Wh/km;  EClow,final, Wh/km;  ECmed,final, Wh/km;  EChigh,final, Wh/km;  ECexHigh,final, Wh/km;  ECDC,COP,final, Wh/km. |

4.7.2. Stepwise procedure for calculating the final test results of PEVs in case of the shortened test procedure

For the purpose of this table, the following nomenclature within the questions and results is used:

j index for the considered period.

Table A8/11

**Calculation of final PEV values determined by application the shortened Type 1 test procedure**

For Level 1A;

The considered periods shall be the low phase, medium phase, high phase, extra high phase, the applicable WLTP city test cycle and the applicable WLTP test cycle.

For Level 1B;

The considered periods shall be the low phase, medium phase, high phase and the applicable WLTP test cycle.

| *Step no.* | *Source* | *Input* | *Process* | *Output* |
| --- | --- | --- | --- | --- |
| 1 | Annex B8 | Test results | Results measured according to Appendix 3 to this annex, and pre-calculated according to paragraph 4.3. of this annex.  Usable battery energy according to paragraph 4.4.2.1.1. of this annex.  Recharged electric energy according to paragraph 3.4.4.3. of this annex.  Output is available for each test.  EAC shall be rounded according to paragraph 6.1.8. of this Regulation to the first place of decimal.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ΔEREESS,j, Wh;  dj, km;  UBESTP, Wh;  EAC, Wh. |
| 2 | Output step 1 | ΔEREESS,j, Wh;  UBESTP, Wh. | Calculation of weighting factors according to paragraph 4.4.2.1. of this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | KWLTC,1  KWLTC,2  Kcity,1  Kcity,2  Kcity,3  Kcity,4  Klow,1  Klow,2  Klow,3  Klow,4  Kmed,1  Kmed,2  Kmed,3  Kmed,4  Khigh,1  Khigh,2  KexHigh,1  KexHigh,2 |
| 3 | Output step 1  Output step 2 | ΔEREESS,j, Wh;  dj, km;  UBESTP, Wh.  All weighting factors | Calculation of electric energy consumption at the REESSs according to paragraph 4.4.2.1. of this annex.  Calculation of the electric energy consumption from the first applicable WLTP test cycleECDC,first as described in Appendix 8, paragraph 1.1. to this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ECDC,WLTC, Wh/km;  ECDC,city, Wh/km;  ECDC,low, Wh/km;  ECDC, med, Wh/km;  ECDC,high, Wh/km;  ECDC,exHigh, Wh/km;  ECDC,first, Wh/km. |
| 4 | Output step 1 | UBESTP, Wh; | Calculation of pure electric range according to paragraph 4.4.2.1. of this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | PERWLTC, km;  PERcity, km;  PERlow, km;  PERmed, km;  PERhigh, km;  PERexHigh, km. |
| Output step 3 | ECDC,WLTC, Wh/km;  ECDC,city, Wh/km;  ECDC,low, Wh/km;  ECDC, med, Wh/km;  ECDC,high, Wh/km;  ECDC,exHigh,  Wh/km. |
| 5 | Output step 1 | EAC, Wh; | Calculation of electric energy consumption at the mains according to paragraph 4.3.4. of this annex.  Output is available for each test.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ECWLTC, Wh/km;  ECcity, Wh/km;  EClow, Wh/km;  ECmed, Wh/km;  EChigh, Wh/km;  ECexHigh, Wh/km. |
| Output step 4 | PERWLTC, km;  PERcity, km;  PERlow, km;  PERmed, km;  PERhigh, km;  PERexHigh, km. |
| 6  If the interpolation method is not applied, step No. 9 is not required and the output of this step for PERWLTC,dec and ECWLTC,dec is the final result. | Output step 4 | PERWLTC, km;  PERcity, km;  PERlow, km;  PERmed, km;  PERhigh, km;  PERexHigh, km; | Averaging of tests for all input values.  Declaration of PERWLTC,dec and ECWLTC,dec based on PERWLTC,ave and ECWLTC,ave.  Alignment of PER in case of city, low, med, high and exHigh based on the ratio between PERWLTC,dec and PERWLTC,ave:  Alignment of EC in case of city, low, med, high and exHigh based on the ratio between ECWLTC,dec and ECWLTC,ave:    In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. PERWLTC,dec as well as ECWLTC,dec shall be rounded according to paragraph 6.1.8. of this Regulation to the number of places of decimal specified in Table A6/1 of Annex B6.  In the case that the interpolation method is not applied, PERWLTC,dec and ECWLTC,dec shall be rounded according to paragraph 6.1.8. of this Regulation to the nearest whole number. | PERWLTC,dec, km;  PERWLTC,ave, km;  PERcity,ave, km;  PERlow,ave, km;  PERmed,ave, km;  PERhigh,ave, km;  PERexHigh,ave, km;  ECWLTC,dec, Wh/km;  ECWLTC,ave, Wh/km;  ECcity,ave, Wh/km;  EClow,ave, Wh/km;  ECmed,ave, Wh/km;  EChigh,ave, Wh/km;  ECexHigh,ave, Wh/km;  ECDC,first,ave, Wh/km. |
| Output step 5 | ECWLTC, Wh/km;  ECcity, Wh/km;  EClow, Wh/km;  ECmed, Wh/km;  EChigh, Wh/km;  ECexHigh, Wh/km. |
| Output step 3 | ECDC,first, Wh/km. |
| 7 | Output step 6 | ECWLTC,dec, Wh/km;  ECWLTC,ave, Wh/km;  ECDC,first,ave, Wh/km. | Adjustment of the electric energy consumption for the purpose of COP as described in Appendix 8, Paragraph 1.1. to this annex.  In the case that the interpolation method is applied, the output is available for vehicle H and vehicle L. | ECDC,COP, Wh/km. |
| 8  Interpolation family result.  If the interpolation method is not applied, step No. 9 is not required and the output of this step is the final result. | Output step 6 | PERcity,ave, km;  PERlow,ave, km;  PERmed,ave, km;  PERhigh,ave, km;  PERexHigh,ave, km;  ECcity,ave, Wh/km;  EClow,ave, Wh/km;  ECmed,ave, Wh/km;  EChigh,ave, Wh/km;  ECexHigh,ave, Wh/km; | Intermediate rounding according to paragraph 6.1.8. of this Regulation.  In the case that the interpolation method is applied, intermediate rounding shall be performed according to paragraph 6.1.8. of this Regulation:  PERcity and PERp shall be rounded to the first place of decimal.  ECcity and ECp shall be rounded to the first place of decimal.  ECDC,COP shall be rounded to the first place of decimal.  The output is available for vehicle H and vehicle L.  In case that the interpolation method is not applied, final rounding of the test results according to paragraph 6.1.8. of this Regulation shall apply:  PERcity and PERp shall be rounded to the nearest whole number.  ECcity and ECp shall be rounded to the nearest whole number.  ECDC,COP shall be rounded to the nearest whole number. | PERcity,final, km;  PERlow,final, km;  PERmed,final, km;  PERhigh,final, km;  PERexHigh,final, km;  ECcity,final, Wh/km;  EClow,final, Wh/km;  ECmed,final, Wh/km;  EChigh,final, Wh/km;  ECexHigh,final, Wh/km;  ECDC,COP,final, Wh/km. |
| Output step 7 | ECDC,COP, Wh/km. |
| 9  Result of an individual vehicle.  Final test result. | Output step 6 | PERWLTC,dec, km;  ECWLTC,dec, Wh/km; | Interpolation of individual values based on input from vehicle H and vehicle L according to paragraph 4.5. of this annex, and final rounding according to paragraph 6.1.8. of this Regulation.  PERind, PERcity,ind, and PERp,ind shall be rounded to the nearest whole number.  ECind, ECcity and ECp,ind shall be rounded to the nearest whole number.  ECDC,COP,ind shall be rounded to the nearest whole number.  Output available for each individual vehicle. | PERWLTC,ind, km;  PERcity,ind, km;  PERlow,ind, km;  PERmed,ind, km;  PERhigh,ind, km;  PERexHigh,ind, km;  ECWLTC,ind, Wh/km;  ECcity,ind, Wh/km;  EClow,ind, Wh/km;  ECmed,ind, Wh/km;  EChigh,ind, Wh/km;  ECexHigh,ind, Wh/km;  ECDC,COP,ind, Wh/km. |
| Output step 8 | PERcity,final, km;  PERlow,final, km;  PERmed,final, km;  PERhigh,final, km;  PERexHigh,final, km;  ECcity,final, Wh/km;  EClow,final, Wh/km;  ECmed,final, Wh/km;  EChigh,final, Wh/km;  ECexHigh,final, Wh/km;  ECDC,COP,final, Wh/km. |

Annex B8 - Appendix 2

REESS energy change-based correction procedure

This Appendix describes the procedure to correct the charge-sustaining Type 1 test CO2 mass emission for NOVC-HEVs and OVC-HEVs, and the fuel consumption for NOVC-FCHVs as a function of the electric energy change of all REESSs.

1. General requirements

1.1. Applicability of this appendix

1.1.1. The correction shall be applied on the phase-specific fuel consumptions for NOVC-FCHVs [and if applicable for OVC-FCHVs of the charge-sustaining Type 1 test], and on the phase-specific CO2 mass emissions for NOVC-HEVs and OVC-HEVs of the charge-sustaining Type 1 test.

1.1.2. The application of the correction over the total cycle on the fuel consumption for NOVC-FCHVs [and OVC-FCHVs], on the CO2 mass emission for NOVC-HEVs and OVC-HEVs is based on the charge-sustaining REESS energy change of the charge-sustaining Type 1 test and the correction criterion c.

For the calculation of , paragraph 4.3. of this annex shall be used. The considered period j used in paragraph 4.3. of this annex is defined by the charge-sustaining Type 1 test. The correction criterion c shall be determined according to paragraph 1.2. of this Appendix.

1.1.3. The correction over the total cycle shall be applied on the fuel consumption for NOVC-FCHVs [and OVC-FCHVs], the CO2 mass emission for NOVC-HEVs and OVC-HEVs if is negative which corresponds to REESS discharging and the correction criterion c calculated in paragraph 1.2. of this appendix is greater than the applicable threshold according to Table A8.App2/1.

1.1.4. The correction over the total cycle may be omitted on the fuel consumption for NOVC-FCHVs [and OVC-FCHVs], the CO2 mass emission for NOVC-HEVs and OVC-HEVs and uncorrected values may be used if:

(a) is positive which corresponds to REESS charging and the correction criterion c calculated in paragraph 1.2. of this appendix is greater than the applicable threshold according to Table A8.App2/1;

(b) The correction criterion c calculated in paragraph 1.2. of this appendix is smaller than the applicable threshold according to Table A8.App2/1;

(c) The manufacturer can prove to the responsible authority by measurement that there is no relation between and charge-sustaining CO2 mass emission and and fuel consumption respectively.

1.2. The correction criterion c is the ratio between the absolute value of the REESS electric energy change and the fuel energy and shall be calculated as follows:

where:

is the charge-sustaining REESS energy change according to paragraph 1.1.2. of this appendix, Wh;

is the charge-sustaining energy content of the consumed fuel according to paragraph 1.2.1. of this appendix in the case of NOVC-HEVs and OVC-HEVs, and according to paragraph 1.2.2. of this appendix in the case of NOVC-FCHVs [and OVC-FCHVs], Wh.

1.2.1. Charge-sustaining fuel energy for NOVC-HEVs and OVC-HEVs

The charge-sustaining energy content of the consumed fuel for NOVC-HEVs and OVC-HEVs shall be calculated using the following equation:

where:

is the charge-sustaining energy content of the consumed fuel of the applicable WLTP test cycle of the charge-sustaining Type 1 test, Wh;

is the heating value according to Table A6.App2/1, kWh/l;

is the non-balanced charge-sustaining fuel consumption of the charge-sustaining Type 1 test, not corrected for the energy balance, determined according to paragraph 6. of Annex B7, using the gaseous emission compound values according to Table A8/5, step No. 2, l/100 km;

is the distance driven over the corresponding applicable WLTP test cycle, km;

conversion factor to Wh.

1.2.2. Charge-sustaining fuel energy for NOVC-FCHVs [and OVC-FCHVs]

The charge-sustaining energy content of the consumed fuel for NOVC-FCHVs [and OVC-FCHVs] shall be calculated using the following equation:

where:

is the charge-sustaining energy content of the consumed fuel of the applicable WLTP test cycle of the charge-sustaining Type 1 test, Wh;

is the lower heating value of hydrogen, MJ/kg;

is the non-balanced charge-sustaining fuel consumption of the charge-sustaining Type 1 test, not corrected for the energy balance, determined according to Table A8/7, step No. 1, kg/100 km;

is the distance driven over the corresponding applicable WLTP test cycle, km;

conversion factor to Wh.

Table A8.App2/1

**RCB correction criteria thresholds**

| *Applicable Type 1 test cycle* | *Low + Medium* | *Low + Medium +*  *High* | *Low + Medium +*  *High + Extra High* |
| --- | --- | --- | --- |
| Thresholds for correction criterion c | 0.015 | 0.01 | 0.005 |

2. Calculation of correction coefficients

2.1. The CO2 mass emission correction coefficient KCO2, the fuel consumption correction coefficients Kfuel,FCHV, as well as, if required by the manufacturer, the phase-specific correction coefficients KCO2,p and Kfuel,FCHV,p shall be developed based on the applicable charge-sustaining Type 1 test cycles.

In the case that vehicle H was tested for the development of the correction coefficient for CO2 mass emission for NOVC-HEVs and OVC-HEVs, the coefficient may be applied within the interpolation family definition.

Annex B8 - Appendix 8

Calculation of additional values required for checking the Conformity of Production of electric energy consumption of PEVs and OVC-HEVs

For the conformity of production, specific values are required to be provided and of which the calculation is described in this Appendix.

1. Calculation of electric energy consumption values of PEVs for conformity of production

1.1. The following value shall be declared and used for verifying the conformity of production with respect to the electric energy consumption of PEVs:

where:

i is representing – in the case the interpolation method is applied – the index L for vehicle L and the index H for vehicle H. In the case the interpolation method is not applied, index i is representing the vehicle tested and paragraph 1.2. of this appendix shall be omitted.

is the electric energy consumption of vehicle i based on the REESS depletion of the first applicable WLTC test cycle provided for the verification during the conformity of production test procedure;

is the electric energy consumption of vehicle i based on the REESS depletion of the first applicable WLTC test cycle according to paragraph 4.3. of this annex, in Wh/km;

is the adjustment factor of vehicle i which compensates the difference between the charge-depleting electric energy consumption value declared after having performed the Type 1 test procedure during type approval and the measured test result determined during the conformity of production procedure

and

where

is the declared electric energy consumption of vehicle i for PEVs according to paragraph 1.2.3. of Annex B6 .

is the measured electric energy consumption of vehicle i according to paragraph 4.3.4.2. of this annex.

In the case, the interpolation method is applied, the values declared and used for verifying the conformity of production with respect to the electric energy consumption of vehicle H and vehicle L shall be the input values for the interpolation of the individual electric energy consumption values according to paragraph 1.2. of this appendix.

1.2. Interpolation of the individual electric energy consumption value of PEVs

This paragraph shall only be applied in the case the interpolation method is applied. The interpolated electric energy consumption value shall be declared and used for verifying the conformity of production with respect to the electric energy consumption of the individual vehicle:

where:

is the electric energy consumption of an individual vehicle for the conformity of production, Wh/km;

is the electric energy consumption of vehicle L for the conformity of production determined according to paragraph 1.1. of this appendix, Wh/km;

is the electric energy consumption of vehicle H for the conformity of production determined according to paragraph 1.1. of this appendix, Wh/km**;**

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle, according to paragraph 4.5.3. of this annex.

2. Calculation of electric energy consumption values of OVC-HEVs for conformity of production

This paragraph shall only be applied if there is no engine start in the first cycle of the charge-depleting Type 1 test during Type Approval. In the case there is an engine start, this paragraph shall be omitted.

2.1. The following value shall be declared and used for verifying the conformity of production with respect to electric energy consumption value of OVC-HEVs:

where:

i is representing – in the case the interpolation method is applied – the index L for vehicle L and the index H for vehicle H. In the case the interpolation method is not applied, index i is representing the vehicle tested and paragraph 2.2. of this appendix shall be omitted.

is the charge-depleting electric energy consumption based on the REESS depletion of the first applicable WLTC test cycle of the charge-depleting Type 1 test provided for the verification during the conformity of production test procedure;

is the charge-depleting electric energy consumption of vehicle i based on the REESS depletion of the first applicable WLTC test cycle of the charge-depleting Type 1 test according to paragraph 4.3. of this annex, Wh/km;

is the adjustment factor of vehicle i for the charge-depleting electric energy consumption which compensates the difference between the value declared after having performed the Type 1 test procedure during type approval and the measured test result determined during the conformity of production procedure.

and

For Level 1A

where

is the declared charge-depleting electric energy consumption of vehicle i of the charge-depleting Type 1 test according to paragraph 1.2.3. of Annex B6.

is the measured charge-depleting electric energy consumption of vehicle i of the charge-depleting Type 1 test according to paragraph 4.3.1. of this annex.

For Level 1B

where

is the declared electric energy consumption of vehicle i of the charge-depleting Type 1 test according to paragraph 1.2.3. of Annex B6.

is the measured electric energy consumption of vehicle i of the charge-depleting Type 1 test according to paragraph 4.3.3.1. of this annex.

In the case, the interpolation method is applied, the values declared and used for verifying the conformity of production with respect to the electric energy consumption of vehicle H and vehicle L shall be the input values for the interpolation of the individual electric energy consumption values according to paragraph 2.2. of this appendix.

2.2. Interpolation of the individual charge-depleting electric energy consumption value

This paragraph shall only be applied in the case the interpolation method is applied. The interpolated electric energy consumption value shall be declared and used for verifying the conformity of production with respect to the electric energy consumption value of the individual vehicle:

where:

is the charge-depleting electric energy consumption of an individual vehicle for the conformity of production, Wh/km;

is the charge-depleting electric energy consumption of vehicle L for the conformity of production determined according to paragraph 2.1. of this appendix, Wh/km;

is the charge-depleting electric energy consumption of vehicle H for the conformity of production determined according to paragraph 2.1. of this appendix, Wh/km**;**

is the interpolation coefficient for the considered individual vehicle for the applicable WLTP test cycle, according to paragraph 4.5.3. of this annex.

1. \* \* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate. [↑](#footnote-ref-2)