**3. DEFINITIONS**

3.3.XX "Off-vehicle charging Fuel Cell Hybrid vehicle" (OVC-FCHV) means a Fuel Cell hybrid electric vehicle that can be charged from an external source.

**Annex 6**

**Applicable rules for a manufacturer’s declared values (total cycle values)(1)**

| *Vehicle type* | | *MCO2 (2)*  *(g/km)* | *FC (2)*  *(kg/100 km)* | *Electric energy consumption(3)*  *(Wh/km)* | *All electric range /  Pure Electric Range (3)*  *(km)* |
| --- | --- | --- | --- | --- | --- |
| Vehicles tested according to Annex 6 (pure ICE) | | MCO2  Paragraph 3. of Annex 7. | - | - | - |
| NOVC-FCHV | | - | FCCS Paragraph 4.2.1.2.1.  of Annex 8. | - | - |
| NOVC-HEV | | MCO2,CS  Paragraph 4.1.1.  of Annex 8. | - | - | - |
| OVC-HEV | CD | MCO2,CD  Paragraph 4.1.2.  of Annex 8. | - | ECAC,CD  Paragraph 4.3.1.  of Annex 8. | AER  Paragraph 4.4.1.1.  of Annex 8. |
| CS | MCO2,CS  Paragraph 4.1.1.  of Annex 8. | - | - | - |
| PEV | | - | - | ECWLTC  Paragraph 4.3.4.2. of Annex 8. | PERWLTC  Paragraph 4.4.2. of Annex 8. |
| OVC-FCHV | CD | - | FC,CD | ECAC,CD | AER |
| CS | - | FCCS | - | - |

(1) The declared value shall be the value to which the necessary corrections are applied (i.e. Ki correction and the other regional corrections)

(2) Rounding xxx.xx

(3)  Rounding xxx.x

Add:

Table A6/2

**Criteria for number of tests**

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-HEV in CS condition

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

Annex 6 - Appendix 2

Test procedure for rechargeable electric energy storage system monitoring

1. General

In the case that NOVC-HEVs, OVC-HEVs, NOVC-FCHV, OVC-FCHV are tested, Appendices 2 and 3 to Annex 8 shall apply.

Annex 8

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

1. General requirements

In the case of testing NOVC-HEVs, OVC-HEVs and NOVC-FCHVs, OVC-FCHVs Appendix 2 and Appendix 3 to this annex shall replace Appendix 2 to Annex6.

Unless stated otherwise, all requirements in this annex shall apply to vehicles with and without driver-selectable modes. Unless explicitly stated otherwise in this annex, all of the requirements and procedures specified in Annex 6 shall continue to apply for NOVC-HEVs, OVC-HEVs, NOVC-FCHVs, OVC-FCHVs and PEVs.

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.

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

2. Run-in of test vehicle

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

3. Test procedure

3.1. General requirements

3.1.1. For all OVC-HEVs, NOVC-HEVs, PEVs, OVC-FCHVs and NOVC-FCHVs, the following shall apply where applicable:

3.1.1.4. For OVC-HEVs, NOVC-HEVs, NOVC-FCHVs, OVC-FCHVs and PEVs, exhaust emissions sampling and measurement of electric energy consumption shall begin for each applicable test cycle before or at the initiation of the vehicle start procedure and end at the conclusion of each applicable test cycle.

3.2. OVC-HEVs and OVC-FCHVs

3.2.1. Vehicles shall be tested under charge-depleting operating condition (CD condition), and charge-sustaining operating condition (CS condition)

3.2.2. Vehicles may be tested according to four possible test sequences:

3.2.2.1. Option 1: charge-depleting Type 1 test with no subsequent charge-sustaining Type 1 test.

3.2.2.2. Option 2: charge-sustaining Type 1 test with no subsequent charge-depleting Type 1 test.

3.2.2.3. Option 3: charge-depleting Type 1 test with a subsequent charge-sustaining Type 1 test.

3.2.2.4. Option 4: charge-sustaining Type 1 test with a subsequent charge-depleting Type 1 test.

3.5. NOVC-FCHVs and OVC-FCHVs under CS condition

The test sequence, described in paragraphs 3.5.1. to 3.5.3. inclusive of this annex, as well as the corresponding REESS state of charge profile, is shown in Figure A8.App1/5 in Appendix 1 to this annex.

4.2. Calculation of fuel consumption

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

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

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

4.2.XX. Utility factor-weighted charge-depleting fuel consumption for OVC-HEVs and OVC-FCHVs

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 or where applicale kg/100km;

is the fuel consumption for phase j of the charge-depleting Type 1 test, determined according to paragraph 6. of Annex 7, l/100 km or where applicale kg/100km;

4.2.3. Utility factor-weighted fuel consumption for OVC-HEVs and OVC-FCHVs

The utility factor-weighted fuel consumption 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 or where applicale kg/100km;

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

is the fuel consumption of phase j of the charge-depleting Type 1 test, determined according to paragraph 6. of Annex 7, l/100 km or where applicale kg/100km;

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

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

4.3.3. Electric energy consumption for OVC-HEVs and OVC-FCHVs

4.4.1. All-electric ranges AER and for OVC-HEVs and OVC-FCHVs

4.4.1.1. All-electric range AER

The all-electric range AER for OVC-HEVs shall be determined from the charge-depleting Type 1 test described in paragraph 3.2.4.3. of this annex as part of the Option 1 test sequence and is referenced in paragraph 3.2.6.1. of this annex as part of the Option 3 test sequence by driving the applicable WLTP test cycle according to paragraph 1.4.2.1. of this annex. The AER is defined as the distance driven from the beginning of the charge-depleting Type 1 test to the point in time where the combustion engine or Fuel cell system starts consuming fuel.

4.4.1.2. All-electric range city

4.4.1.2.1. The all-electric range city for OVC-HEVs shall be determined from the charge-depleting Type 1 test described in paragraph 3.2.4.3. of this annex as part of the Option 1 test sequence and is referenced in paragraph 3.2.6.1. of this annex as part of the Option 3 test sequence by driving the applicable WLTP city test cycle according to paragraph 1.4.2.2. of this annex. The is defined as the distance driven from the beginning of the charge-depleting Type 1 test to the point in time where the combustion engine or Fuel cell system starts consuming fuel.

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 charge-sustaining fuel consumption according to Table A8/XXX Step XX, 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;

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-HEV

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. x, kg/100km;

is the average charge-depleting fuel consumption according to Table A8/x, step no. x, 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 and Level 2;

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

For Level 1B;

The considered phase shall be the low phase, medium phase and high phase.

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/X, step no. X,, 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.

4.5.5. Interpolation of the fuel consumption 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

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, or where applicale kg/100km;;

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 or where applicale kg/100km;;

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 or where applicale 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.

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. In the case that the Contracting Party requests to exclude the extra high phase, this phase value shall be omitted.

4.5.5.2. Individual utility factor-weighted charge depleting fuel consumption for OVC-HEVs and OVC-FCHVs

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 or where applicale kg/100km;;

is the utility factor-weighted charge-depleting fuel consumption for vehicle L, l/100 km or where applicale kg/100km;;

is the utility factor-weighted charge-depleting fuel consumption for vehicle H, l/100 km or where applicale kg/100km;;

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

4.5.5.3. 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 or where applicale kg/100km;

is the utility factor-weighted fuel consumption for vehicle L, l/100 km or where applicale kg/100km;

is the utility factor-weighted fuel consumption for vehicle H, l/100 km or where applicale kg/100km;

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. 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:

4.5.6.2. 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:

4.5.6.3. Individual electric energy consumption for OVC-HEVs, and 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:

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. In the case that the Contracting Party requests to exclude the extra high phase, this phase value shall be omitted.

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

4.5.7.3. Individual equivalent all-electric range for OVC-HEVs 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.

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. In the case that the Contracting Party requests to exclude the extra high phase, this phase value shall be omitted.

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

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

v

The results shall be calculated in the order described in the Tables 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, 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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Source* | *Input* | *Process* | *Output* | *Step No.* |
| Appendix 7 to this annex. | Non-balanced charge-sustaining fuel consumption  FCCS,nb, kg/100km | Charge-sustaining fuel consumption according to paragraph 2.2.6. of Appendix 7 to this annex (phase-specific values only, if required by the Contracting Party according to paragraph 2.2.7. of Appendix 7 to this annex). | , kg/100 km; , kg/100 km. | 1 |
| Output from step No. 1 of this table. | , kg/100 km; , kg/100 km. | REESS electric energy change correction.  Paragraphs 4.2.1.2.2. to 4.2.1.2.5. inclusive of this annex. | , kg/100 km; , kg/100 km. | 2 |
| Output from step No. 2 of this table. | , kg/100 km; , kg/100 km. | Placeholder for additional corrections, if applicable.  Otherwise: | , kg/100 km; , kg/100 km. | 3  Result of a single test. |
| Output from step No. 3 of this table. | For every test: , kg/100 km; , kg/100 km. | Averaging of tests and declared value according to paragraphs 1.2. to 1.2.3. inclusive of Annex 6. | , kg/100 km; , kg/100 km. | 4 |
| Output from step No. 4 of this table. | , kg/100 km; , kg/100 km; , kg/100 km. | Alignment of phase values. Paragraph 1.2.4. of Annex 6,  and:  FC values shall be rounded according to paragraph 7. of this UN GTR to the second place of decimal. | , kg/100 km; , kg/100 km. | 5  results of a Type 1 test for a test vehicle. |

4.6.3. Stepwise procedure for calculating the final test results of OVC-FCHVs

This annex describe the stepwise calculation of the final charge-depleting as well as the final charge-sustaining and charge-depleting weighted test results.

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

The results shall be calculated in the order described in Table A8/XX. 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 considered period is the applicable cycle phase; for the purpose of EAERcity calculation, p shall represent the city driving cycle;

CS charge-sustaining;

Table A8/X

**Calculation of final charge-depleting values** for OVC-FCHVs

| *Step no.* | *Source* | *Input* | *Process* | *Output* |  |
| --- | --- | --- | --- | --- | --- |
| 1 | Annex 8 | Charge-depleting test results | Results measured according to Appendix 3 to this annex, pre-calculated according to paragraph 4.3. of this annex.  Usable battery energy according to paragraph 4.4.1.2.2. of this annex.  Recharged electric energy according to paragraph 3.2.4.6. of this annex.  Cycle energy according to paragraph 5. of Annex 7.  CO2 mass emission according to paragraph 3.2.1. of Annex 7.  All-electric range determined according to paragraph 4.4.1.1. 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.  H2 fuel consumption Kfuel,FCVH correction coefficient might be necessary according to Appendix 2 to this annex.  Output is available for each test. | ΔEREESS,j, Wh;  dj, km;  UBEcity, Wh;  EAC, Wh;  Ecycle, Ws;  FCCD,j, kg/100 km;  AER, km;  AERcity, km.  Kfuel,FCHV,  (kg/100km)/(Wh/100km). |  |
| 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. | REECi. |  |
| 3 | Output step 2 | REECi. | Determination of the transition and confirmation cycle according to paragraph 3.2.4.4. of this annex.  Determination of the charge-depleting cycle range according to paragraph 4.4.3. of this annex.  Output is available for each test. | nveh;  RCDC; km. |  |
| 5 | 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. | AERcity, km;  AERcity,ave, km. |  |
| 6 | Output step 1  Output step 3 | dj, km;  nveh; | Phase-specific and cycle-specific UF calculation.  Output is available for each test. | UFphase,j;  UFcycle,c. |  |
| 7 | Output step 1  Output step 3  Output step 6 | ΔEREESS,j, Wh;  dj, km;  EAC, Wh;  nveh;  UFphase,j; | Calculation of the electric energy consumption based on the recharged energy according. to paragraphs 4.3.1. and 4.3.2. of this annex.  Output is available for each test. | ECAC,weighted, Wh/km;  ECAC,CD, Wh/km; | 7 |
| 8 | Output step 1  Output step 3  Output step 4  Output step 6 | FCCD,j, l/100 km  Kfuel,FCHV, (kg/100km)/(Wh/100km);  ΔEREESS,j, Wh;  dj, km;  nveh;  UFphase,j. | Calculation of the charge-depleting fuel consumtion according to paragraph XXX of this annex.  Output is available for each test. | FCCD, kg/100km; |  |
| 10 | Output step 9 | ECAC,weighted, Wh/km;  ECAC,CD, Wh/km;  FCCD, kg/100 km;  ECDC,CD,first, Wh/km. | Averaging of tests for each vehicle. | ECAC,weighted,ave, Wh/km;  ECAC,CD,ave, Wh/km;  FCCD,ave, kg/100 km;  ECDC,CD,first,ave, Wh/km |  |
| 11 | Output step 10 | ECAC,CD,ave, Wh/km;  FCCD,ave, kg/100 km; | Declaration of charge-depleting electric energy consumption and fuel consumption for each vehicle. | ECAC,CD,dec, Wh/km;  FCCD,dec, kg/100 km; |  |
| 13  Final result | Output step 11  Output step 10 | ECAC,CD,dec, Wh/km;  ECAC,weighted,ave, Wh/km;  FCCD,ave, kg/100 km; | final rounding shall be applied according to paragraph 7. of this UN GTR.  ECAC,CD , ECAC,weighted and MCO2,CD shall be rounded to the nearest whole number.    . | ECAC,CD,final, Wh/km;  ECAC,weighted,final, Wh/km;  FCCD,final, kg/100 km; | final result. |

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

The results shall be calculated in the order described in Table A8/X. 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;

considered period is the applicable cycle phase;

j index for the considered period;

CS charge-sustaining;

CD charge-depleting;

REESS Rechargeable Electric Energy Storage System.

Table A8/Y

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

| *Step no.* | *Source* | *Input* | *Process* | *Output* |  |
| --- | --- | --- | --- | --- | --- |
| 1 | Output step 1, Table A8/X  Output step 5, Table A8/X  Output step 3, Table A8/X  Output step 6, Table A8/X | FCCD,j, kg/100 km  ΔEREESS,j, Wh;  dj, km;  AER, km;  EAC, Wh;  AERcity,ave, km;  nveh;  RCDC, km;  UFphase,j;  UFcycle,c;  Kfuel,FCHV,  (kg/100km)/(Wh/100km). | Input from CD and CS postprocessing.  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.  H2 correction coefficient Kfuel,FCHV might be necessary according to Appendix 2 to this annex. | FCCD,j, kg/100 km;  ΔEREESS,j, Wh;  dj, km;  AER, km;  EAC, Wh;  AERcity,ave, km;  nveh;  RCDC, km;  UFphase,j;  UFcycle,c;  Kfuel,FCHV,  (kg/100km)/(Wh/100km). |  |
| 2 | Output step 1, | FCCD,j, kg/100 km;  ΔEREESS,j, Wh;  dj, km;  nveh;  RCDC, km | 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 7. of this UN GTR to the nearest whole number. | EAER, km;  EAERp, km;  RCDA, km. |  |
| 4  Final result | Output step 1 | AER, km. | Averaging AER and AER declaration.  The declared AER shall be rounded according to paragraph 7. of this UN GTR to the number of decimal places specified in Table A6/1 of Annex 6.  Averaged AERshall be rounded according to paragraph 7. of this UN GTR to the nearest whole number. | AERave, km;  AERdec, km. |  |
| 5 | Output step 1 | FCCD,j, kg/100 km  nveh;  UFphase,j; | 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. | FCweighted, kg/100 km; |  |
| 6 | Output step 1  Output step 2 | EAC, Wh;  EAER, km;  EAERp, km; | 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. | EC, Wh/km;  ECp, Wh/km; |  |
| 7 | Output step 1  Output step 5  Output step 6  Output step 3 | AERcity, ave, km;  FCweighted, kg/100 km;  EC, Wh/km;  ECp, Wh/km;  EAER, km;  EAERp, km. | Averaging and intermediate rounding according to paragraph 7. of this UN GTR.  final rounding of the test results shall be applied according to paragraph 7. of this UN GTR.  AERcity,ave, EAER and EAERp shall be rounded to the nearest whole number.  FCweighted shall be rounded to the third place of decimal.  EC and ECp shall be rounded to the nearest whole number. | AERcity,final, km;FCweighted,final, kg/100 km;  ECfinal, Wh/km;  ECp,final, Wh/km;  EAERfinal, km;  EAERp,final, km. |  |

Annex 8 - Appendix 1

**REESS state of charge profile**

1. Test sequences and REESS profiles: OVC-HEVs and OVC-FCHV, charge-depleting and charge-sustaining test

1.1. Test sequence OVC-HEVs and OVC-FCHV according to option 1

Charge-depleting type 1 test with no subsequent charge-sustaining Type 1 test (Figure A8.App1/1)

# Figure A8.App1/1

# **OVC-HEVs and OVC-FCHVs, charge-depleting Type 1 test**



1.2. Test sequence OVC-HEVs and OVC-FCHV according to option 2

Charge-sustaining Type 1 test with no subsequent charge-depleting   
Type 1 test (Figure A8.App1/2).

# Figure A8.App1/2

# **OVC-HEVs and OVC-FCHVs, charge-sustaining Type 1 test**



1.3. Test sequence OVC-HEVs and OVC-FCHV according to option 3

Charge-depleting Type 1 test with subsequent charge-sustaining Type 1 test (Figure A8.App1/3).

# Figure A8.App1/3

# **OVC-HEVs,** and OVC-FCHV **charge-depleting type 1 test with subsequent charge-sustaining Type 1 test**



1.4. Test sequence OVC-HEVs and OVC-FCHV according to option 4

Charge-sustaining Type 1 test with subsequent charge-depleting Type 1 test (Figure A8.App1/4)

Figure A8.App1/4

**OVC-HEVs** and OVC-FCHV**, charge-sustaining Type 1 test with subsequent charge-depleting Type 1 test**



2. Test sequence NOVC-HEVs and NOVC-FCHVs

Charge-sustaining Type 1 test (Figure A8.App1/5)

# Figure A8.App1/5

# **NOVC-HEVs and NOVC-FCHVs, charge-sustaining Type 1 test**



Annex 8 - 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 phase-specific fuel consumption for NOVC-FCHVs, and the CO2 mass emission for NOVC-HEVs and OVC-HEVs and OVC-FCHV shall be corrected.

1.1.2. In the case that a correction of fuel consumption for NOVC-FCHVs or a correction of CO2 mass emission for NOVC-HEVs,OVC-HEVs and OVC-FCHV measured over the whole cycle according to paragraph 1.1.3. or paragraph 1.1.4. of this appendix is applied, paragraph 4.3. of this annex shall be used to calculate the charge-sustaining REESS energy change of the charge-sustaining Type 1 test. The considered period j used in paragraph 4.3. of this annex is defined by the charge-sustaining Type 1 test.

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

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

3.1. OVC-HEVs and OVC-FCHV

For OVC-HEVs and OVC-FCHV, one of the following test sequences according to Figure A8.App2/1 shall be used to measure all values that are necessary for the determination of the correction coefficients according to paragraph 2. of this appendix.

of paragraphs 3.2.2.2. and 3.2.2.3. of this appendix.

Annex 8 - Appendix 3

Determination of REESS current and REESS voltage for NOVC-HEVs, OVC-HEVs, OVC-FCHV, PEVs and NOVC-FCHVs

1. Introduction

1.1. This appendix defines the method and required instrumentation to determine the REESS current and the REESS voltage of NOVC-HEVs, OVC-HEVs, OVC-FCHV, PEVs and NOVC-FCHVs.

Annex 8 - Appendix 4

Preconditioning, soaking and REESS charging conditions of PEVs and OVC-HEVs

1. This appendix describes the test procedure for REESS and combustion engine preconditioning in preparation for:

(a) Electric range, charge-depleting and charge-sustaining measurements when testing OVC-HEVs; and

(b) Electric range measurements as well as electric energy consumption measurements when testing PEVs.

2. OVC-HEV, and OVC-FCHV preconditioning and soaking

2.1. Preconditioning and soaking when the test procedure starts with a charge-sustaining test

2.2.1. OVC-HEVs and OVC-FCHV shall be driven over at least one applicable WLTP test cycle. During each driven preconditioning cycle, the charging balance of the REESS shall be determined. The preconditioning shall be stopped at the end of the applicable WLTP test cycle during which the break-off criterion is fulfilled according to paragraph 3.2.4.5. of this annex.

2.2.2. Soaking of the vehicle shall be performed according to paragraph 2.7. of Annex 6. Forced cooling down shall not be applied to vehicles preconditioned for the Type 1 test. During soak, the REESS shall be charged using the normal charging procedure as defined in paragraph 2.2.3. of this appendix.

Annex 8 - Appendix 5

Utility factors (UF) for OVC-HEVs and OVC-FCHV

1. Each Contracting Party may develop its own UFs.

Annex 8 - Appendix 6

Selection of driver-selectable modes

1. General requirement

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

1.2. The manufacturer shall provide evidence to the responsible authority concerning:

(a) The availability of a predominant mode under the considered conditions;

(b) The maximum speed of the considered vehicle;

and if required:

(c) The best and worst case mode identified by the evidence on the fuel consumption and, if applicable, on the CO2 mass emission/fuel consumption in all modes. See paragraph 2.6.6.3. in Annex 6;

(d) The highest electric energy consuming mode;

(e) The cycle energy demand (according to Annex 7, paragraph 5. where the target speed is replaced by the actual speed).

1.3. Dedicated driver-selectable modes, such as "mountain mode" or "maintenance mode" which are not intended for normal daily operation but only for special limited purposes, shall not be considered.

2. OVC-HEV and OVC-FCHV equipped with a driver-selectable mode under charge-depleting operating condition

For vehicles equipped with a driver-selectable mode, the mode for the charge-depleting Type 1 test shall be selected according to the following conditions.

# The flow chart in Figure A8.App6/1 illustrates the mode selection according to this paragraph.

# Figure A8.App6/1

# **Selection of driver-selectable mode for OVC-HEVs** and OVC-FCHV **under charge-depleting operating condition**

3. OVC-HEVs, NOVC-HEVs, OVC-FCHV and NOVC-FCHVs equipped with a driver- selectable mode under charge-sustaining operating condition

For vehicles equipped with a driver-selectable mode, the mode for the charge-sustaining Type 1 test shall be selected according to the following conditions.

# Figure A8.App6/2

**Selection of a driver-selectable mode for OVC-HEVs, NOVC-HEVs,** OVC-FCHV **and NOVC- FCHVs under charge-sustaining operating condition**