**Proposal for inclusion of CoP requirements into UNR WLTP**

Author: Iddo Riemersma, Rob Gardner

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**Introductory notes from the authors:**

The text of this document is based on document [190920 - Draft UNR WLTP CoP requirements.docx](https://wiki.unece.org/download/attachments/87624289/190920%20-%20Draft%20UNR%20WLTP%20CoP%20requirements.docx?api=v2) in the CoP Drafting folder on the Wiki page: <https://wiki.unece.org/display/trans/CoP+Drafting>

This document was reviewed by the CoP drafting coordinator and CoP TF leader to improve the text on clarity, coherency and robustness with the text in the GTR 15 and 19 and the work done on the UNR WLTP in the Transposition TF. Then it was complemented with new text for the items on which there was agreement on the concept but for which the text still had to be drafted (these were inserted as text blocks).

To make a clean start and to avoid compromising the readability the changes with respect to the previous document have not been marked by track changes. Any larger modifications that need an approval from the group have received a comment to it or are in [text brackets], but editorial changes to improve the text on clarity, coherency and robustness are not indicated. Comments made earlier which are still relevant for the text have been copied.

Regional specific texts on level 1A is marked in BLUE

Regional specific texts on level 1B is marked in RED

All references will need to be checked/confirmed and are therefore marked in green

NB:

1. The paragraph numbering and associated x-refs within this document are not yet finalised.
2. This document does not include the ‘full package’ for UNR WLTP CoP. Other documents which will include CoP requirements are Annex B8 (in the post-processing tables) and Appendix 8 to Annex B8.
3. The part on evaporative emissions is still under consideration by the EVAP TF and will be added when this has been discussed and agreed.
4. CoP of OBD and OBFCM is not yet clear, currently only a placeholder is included.

8. Conformity of Production (CoP)

8. Introduction

8.1. Every vehicle produced under a type approval according to this Regulation shall conform with regard to the criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption, if applicable, in accordance with table A8/1, and evaporative emissions, if applicable, in accordance with table A8/2to the vehicle type approved. The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/324-E/ECE/TRANS/505/Rev.3), with the following requirements:

8.1.1. The manufacturer shall implement adequate arrangements and documented control plans and carry-out, at intervals specified in this Regulation, the necessary tests to verify continued conformity with the approved type. The manufacturer shall obtain agreement for these arrangements and control plans from the responsible authority. The responsible authority shall perform audits at specific intervals. This audit shall include production and test facilities as part of the product conformity and continued verification arrangements. Where necessary the responsible authority may require additional tests to be conducted.

8.1.2. The manufacturer shall check the conformity of production by conducting the appropriate tests in accordance with Tables A8/1 and A8/2 of this Regulation. Where applicable and if required, the manufacturer shall determine and report the OBFCM device accuracy in accordance with Appendix 4.

The specific procedures for conformity of production are set out in paragraphs 8.2. to 8.4. and Appendices 1 and 2.

Table A8/1

**Type 1 Applicable Type-1 CoP requirements for the different types of vehicle**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of vehicle** | **Criteria emissions** | **CO2 emissions** | **Fuel Efficiency** | **Electric energy consumption** |
| Pure ICE | Level1A and Level 1B | Level 1A | Level 1B | Not Applicable |
| NOVC-HEV | Level 1A and Level 1B | Level 1A | Level 1B | Not Applicable |
| OVC-HEV | Level 1A and Level 1B:  CD\*) and CS | Level 1A: CS only | Level 1B:  CS only | Level1A and Level 1B:  both CD only |
| PEV | Not Applicable | Not Applicable | Not Applicable | Level1A and Level 1B |
| NOVC-FCHV | Not Applicable | Not Applicable | Exempted | Not Applicable |
| OVC-FCHV | Not Applicable | Not Applicable | Exempted | Exempted |

\*) Only if there is combustion engine operation during a valid CD type-1 test for CoP verification

Table A8/2

**Type 4 Applicable Type-4 CoP requirements for the different vehicle types**

|  |  |
| --- | --- |
| **Vehicle type** | **Evaporative emissions** |
| ICE | YES \*) |
| NOVC-HEV | YES \*) |
| OVC-HEV | YES \*) |
| PEV | Not Applicable |
| NOVC-FCHV | Not Applicable |
| OVC-FCHV | Not Applicable |

\*) only for vehicles fuelled by petrol

[placeholder for tables on OBD and OBFCM]

8.1.3. CoP family

If the vehicle production takes place in different production facilities, different CoP families shall be created for each facility. The manufacturer may request to merge these CoP families. The responsible authority shall evaluate on the basis of the supplied evidence by the manufacturer whether such a merge is justified.

The manufacturer is allowed to split the CoP family into smaller CoP families.

8.1.3.1. CoP family for Type 1 test

For the purposes of the manufacturer's conformity of production check on the Type 1 test, including - where applicable and if required - the determination of the OBFCM device accuracy, the family means the conformity of production (CoP) family as specified in paragraphs 8.1.3.1.1 to 8.1.3.1.2.

8.1.3.1.1. For interpolation families as described in paragraph 6.3.2.of this Regulation with a planned vehicle production volume of more than 1,000 vehicles per 12 months, the CoP family for the Type 1 test shall be identical to the interpolation family.

8.1.3.1.2. For interpolation families as described in paragraph 6.3.2. of this Regulation with a planned production volume of 1000 vehicles or less, it is allowed to include other interpolation families into the same CoP family, up to a combined maximum production volume of 5,000 vehicles per 12 months. At the request of the responsible authority the manufacturer shall provide evidence on the justification and technical criteria for merging these interpolation families, ensuring that there is a large similarity between those families,for example in the following cases:

- two or more interpolation families are merged which were split because the maximum interpolation range of 30 g/km CO2 is exceeded;

- interpolation families that were split because there are different engine power ratings of the same engine;

- interpolation families that were split because the n/v ratios are just outside the tolerance of 8%.

8.1.3.2. CoP family for Type 4 test

For the purposes of the manufacturer's conformity of production check on the Type 4 test, the family means the conformity of production (CoP) family, which shall be identical to the evaporative emissions family, as described in paragraph 6.6.3. of this Regulation.

8.1.3.3. [placeholder for OBD family]

8.1.4. Test frequency for the Type 1 test

8.1.4.1. For Level 1A:

The frequency for product verification on the Type 1 test performed by the manufacturer shall be based on a risk assessment methodology consistent with the international standard ISO 31000:2018 — Risk Management — Principles and guidelines, and shall have a minimum frequency per CoP family of one verification per 12 months.

8.1.4.2. If the number of vehicles produced within the CoP family exceeds 7,500 vehicles per 12 months, the minimum verification frequency per CoP family shall be determined by dividing the planned production volume per 12 months by 5,000 and mathematically rounding this number to the nearest integer.

8.1.4.3. If the number of vehicles produced within the CoP family exceeds 17,500 vehicles per 12 months, the minimum frequency per CoP family shall be one verification per 3 months.

XXX

8.1.4.4. The tests of vehicles for product verification shall be evenly distributed over the period of 12 months. The last product verification shall reach a decision within one month after the 12 month period has ended.

8.1.4.5. The planned production volume of the CoP family per a 12 month period shall be monitored by the manufacturer on a monthly basis, and the responsible authority shall be informed if any change in the planned production volume causes changes to either the size of the CoP family or the Type 1 test frequency.

8.1.5. [Placeholder for Type 4 test frequency [and OBD]

8.1.6. Audits by the responsible authority

The responsible authority shall perform audits for verifying the manufacturers arrangements and documented control plans at the facility of the manufacturer, in all cases, with a minimum frequency of [one audit per 12 months].

If the responsible authority is not satisfied with the audit results, physical tests shall directly be carried out on production vehicles as described in paragraphs 8.2. to 8.4 to verify the conformity of the vehicle production.

For Level 1A and Level 2 only:

The manufacturers arrangements and documented control plans shall be based on a risk assessment methodology consistent with the international standard ISO 31000:2009 — Risk Management — Principles and guidelines.

8.1.7. Physical test verifications by the responsible authority

For Level 1A and Level 2:

The normal frequency of physical test verifications by the responsible authority shall be based on the results of the auditing procedure of the manufacturer on a risk assessment methodology and in all cases with a minimum frequency of one verification test per three years. The responsible authority shall conduct these physical emission tests on production vehicles as described in paragraphs 8.2. to 8.4.

In the case that the manufacturer is conducting the physical tests, the responsible authority shall witness these tests at the manufacturer's facility.

For Level 1B:

The normal frequency of physical test verifications by the responsible authority shall be a minimum frequency of one verification test per three years. The responsible authority shall conduct these physical emission tests on production vehicles as described in paragraphs 8.2. to 8.4.

In the case that the manufacturer is conducting the physical tests, the responsible authority shall witness these tests at the manufacturer's facility.

8.1.8. Reporting

The responsible authority shall report the results of all audit checks and physical tests performed on verifying conformity of the manufacturers and file it for a period of a minimum of 10 years. These reports should be available for other responsible authorities.

8.1.9. Non-conformity

In the case that a non-conformity is observed, Article 4 of the 1958 Agreement shall apply.

8.2. Checking the conformity for a Type 1 test

8.2.1. The Type 1 test shall be carried out on a minimum of three production vehicles, which shall be valid members of the CoP family as described in paragraph 8.1.3.

For Level 1A only:

Verification of the interpolation calculation, if applicable, shall be carried out by the responsible authority as part of the audit process described in paragraph 8.1.6.

8.2.2. Vehicles shall be selected at random in the CoP family. The manufacturer shall not undertake any adjustment to the vehicles selected.

In the case that vehicles in the CoP family are assembled in different production facilities, at the request of the responsible authority the manufacturer shall adapt the selection of vehicles from across the different production facilities, without prejudice to the principle of random selection within a production facility.

8.2.3. Type 1 test procedure

8.2.3.1. Where applicable, in accordance with table A8/1, the verification of the criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption, shall be carried out in accordance with the specific requirements and procedures in Appendix 1. Where applicable and if required, the manufacturer shall determine and report the OBFCM device accuracy in accordance with Appendix 4.

8.2.3.2. The statistical procedure for calculating the test criteria and to arrive at a pass or fail decision is described in Appendix 2 and in the flowchart of Figure A8/1A and A8/1B.

Where applicable, in accordance with table A8/1, the production of a CoP family shall be deemed to not conform when a fail decision is reached in accordance with the test criteria in Appendix 2. for one or more of the criteria emissions, CO2 emissions, fuel efficiency or electric energy consumption.

Where applicable, in accordance with table A8/1, the production of a CoP family shall be deemed to conform once a pass decision is reached in accordance with the test criteria in Appendix 2 for all the criteria emissions, CO2 emissions, fuel efficiency or electric energy consumption.

When a pass decision has been reached for one criteria emission, that decision shall not be changed by any additional tests carried out to reach a decision for the other criteria emissions, CO2 emissions, fuel efficiency or electric energy consumption.

Where applicable, in accordance with table A8/1, if a pass decision is not reached for all the criteria emissions, CO2 emissions, fuel efficiency or electric energy consumption, another vehicle is added to the sample by selecting it according to paragraph 8.2.2. and performing the Type 1 test. The statistical procedure described in Appendix 2 shall be repeated until a pass decision is reached for all the criteria emissions, CO2 emissions, fuel efficiency or electric energy consumption.

The maximum sample size shall be:

For Level 1A: 16 vehicles

For Level 1B and Level 2: 32 vehicles.

Figure A8/1A

This figure is only applicable for Level 1A

**Flowchart of the CoP test procedure for the Type-1 test**



Figure A8/1B

This figure is only applicable for Level 1B and Level 2

**Flowchart of the CoP test procedure for the Type-1 test**



8.2.4. Run-in factors

8.2.4.1. For Level 1A:

At the request of the manufacturer and with the acceptance of the responsible authority, a run-in test procedure may be carried out on a vehicle of the CoP family to establish derived run-in factors for criteria emissions, CO2 emissions and/or electric energy consumption according to the test procedure in Appendix 3 to this Annex.

For Level 1B:

At the request of the manufacturer and with the acceptance of the responsible authority, a run-in test procedure may be carried out on a vehicle of the CoP family to establish derived run-in factors for fuel efficiency and/or electric energy consumption according to the test procedure in Appendix 3 to this Annex.

For Level 2:

At the request of the manufacturer and with the acceptance of the responsible authority, a run-in test procedure may be carried out on a vehicle of the CoP family to establish derived run-in factors for criteria emissions, CO2 emissions, fuel efficiency and/or electric energy consumption according to the test procedure in Appendix 3 to this Annex.

8.2.4.2 For the application of derived run-in factors, the system odometer of the CoP test vehicle Dj shall preferably be within -10 km of the mileage at the start of the 1st test and +10 km of the mileage at the start of the 2nd test on the run-in test vehicle Di, prior to when it was run in.

8.2.4.3 For Level 1A:

At the option of the manufacturer, for CO2 emissions, in g/km an assigned run-in factor of 0.98 may be applied if the system odometer setting at the start of the CoP test is less than or equal to 80 km. If the assigned run-in factor for CO2 emissions is applied, no run-in factors shall be applied for criteria emissions and electric energy consumption.

For Level 1B:

At the option of the manufacturer, for fuel efficiency, in km/l, an assigned run-in factor of 1.02 may be applied if the system odometer setting at the start of the CoP test is less than or equal to 80 km. If the assigned run-in factor for fuel efficiency is applied, no run-in factors shall be applied electric energy consumption.

8.2.4.4. The run-in factor shall be applied to the CoP test result that is calculated according to Step\_4a in TableA7/1 of Annex B7 or Step\_4a in TableA8/5 of Annex B8.

8.2.5. Test fuel

8.2.5.1. For level 1A:

All these tests shall be conducted with commercial fuel. However, at the manufacturer’s request, the reference fuels in accordance with the specifications in Annex B3 may be used.

For level 1B and level 2:

All these tests shall be conducted with reference fuels in accordance with the specifications in Annex B3. However, at the request of the manufacturer the mileage accumulation for the run-in in paragraph 1.7 of Appendix 3 may be conducted with commercial fuel.

8.2.5.2. Tests for conformity of production of vehicles fuelled by LPG or NG/biomethane may be performed with a commercial fuel of which the C3/C4 ratio lies between those of the reference fuels in the case of LPG, or of one of the high or low caloric fuels in the case of NG/biomethane. In all cases a fuel analysis shall be presented to the responsible authority.

8.2.6. Acceptance of Type 1 CoP test

The drive trace indices shall be calculated for all the Type 1 tests according to paragraph 7 to Annex B7 and fulfil the criteria specified in paragraph 7.3 of Annex B7.

8.3 Checking the conformity for a Type 4 test

8.3.1. Once per year a vehicle shall be randomly taken from the CoP family and subjected to the three tests described in paragraph 7 of Annex 7 of UN Regulation 83 (i.e. the test for leakage, the test for venting and the purge test).

8.3.1.1. The production shall be deemed to conform if this vehicle meets the requirements of the tests described in paragraph 7 of Annex 7 of UN Regulation 83.

8.3.1.2. If the vehicle tested does not satisfy the requirements of paragraph 8.3.1.1, a further random sample shall be taken from the same family and subjected to the tests described in Annex VI. The tests may be carried out on vehicles which have completed a minimum mileage of 10,000 km and a maximum mileage of 15,000 km with no modifications to the vehicle other than those described in the test procedure.

8.3.1.3. If the vehicle tested does not satisfy the requirements of Annex VI, a further random sample of four vehicles shall be taken from the same family and subjected to the tests described in Annex VI. The tests may be carried out on vehicles which have completed a minimum mileage of 10,000 km and a maximum mileage of 15,000 km with no modifications to the vehicle other than those described in the test procedure.

8.3.1.4. The production shall be deemed to conform if at least three vehicles meet the requirements of the tests described in Annex VI.

8.4 Checking the conformity for OBD [PM]

**Appendix 1**

**Type 1 test CoP verification for specific vehicle types**

1. Verifying CoP on the criteria emissions for pure ICE vehicles, NOVC-HEVs and OVC-HEVs

The test results shall be the values calculated according to Step XX of TableA7/1 of Annex B7 or Step\_XX of TableA8/5 of Annex B8. Conformity against the applicable criteria emissions limits shall be checked using the pass/fail criteria specified in Table xxx in paragraph xxx.

Where the interpolation method is used, verification of the interpolation calculation may be carried out by, or at the request of, the responsible authority as part of the audit process described in paragraph 8.1.6

2. Verification of CoP on CO2 mass emissions/ fuel efficiency of pure ICE vehicles

2.1. The vehicle shall be tested according to the Type 1 test procedure described in Annex B6.

2.2. For Level 1A:

During this test, the CO2 mass emission MCO2,C,6 shall be determined according to step 6 of Table A7/1 of Annex B7.

For Level 1B:

During this test, the fuel efficiency FCC,COP shall be determined according to step 7 of Table A7/1 of Annex B7.

2.3. For Level 1A:

The conformity of production with regard to CO2 mass emissions shall be verified on the basis of the values for the tested vehicle as described in paragraph 2.3.1. and applying a run-in factor as defined in paragraph 8.2.4. of this Annex.

For Level 1B: The conformity of production with regard to fuel efficiency shall be verified on the basis of the values for the tested vehicle as described in paragraph 1.3.1. and applying a run-in factor as defined in paragraph 8.2.4. of this Annex.

2.3.1. CO2 mass emission values for CoP / Fuel efficiency values for CoP

For Level 1A:

In the case the interpolation method is not applied, the CO2 mass emission value according to step 7 of Table A7/1 of Annex B7 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the CO2 mass emission value MCO2,c,,ind for the individual vehicle according to step 10 of Table A7/1 shall be used for verifying the conformity of production.

For Level 1B:

In the case the interpolation method is not applied, the fuel efficiency value FCC,8 according to step 8 of Table A7/1 of Annex B7 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the fuel efficiency value FCc,,ind for the individual vehicle according to step 10 of Table A7/1 shall be used for verifying the conformity of production.

3. Verification of CoP on CO2 mass emissions/ fuel efficiency of NOVC-HEVs

3.1. The vehicle shall be tested as described in paragraph 3.3. of Annex B8.

3.2. For Level 1A:

During this test, the CO2 mass emission MCO2,CS,c,6 of the NOVC-HEV shall be determined according to step 6 of Table A8/5 of Annex 8.

For Level 1B:

During this test, the fuel efficiency FCCS,COP of the NOVC-HEV shall be determined according to step 1 of Table A8/6 of Annex 8.

3.3. The conformity of production with regard to CO2 mass emissions or fuel efficiency, as applicable, shall be verified on the basis of the values for the tested vehicle as described in paragraph 3.3.1. and applying a run-in factor as defined in paragraph 8.2.4. of this Annex.

3.3.1. CO2 mass emission values for CoP / Fuel efficiency values for CoP

For Level 1A:

In the case the interpolation method is not applied, the charge-sustaining CO2 mass emission value according to step 7 of Table A8/5 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the charge-sustaining CO2 mass emission value for the individual vehicle according to step 9 of Table A8/5 of Annex B8 shall be used for verifying the conformity of production.

For Level 1B:

In the case the interpolation method is not applied, the charge-sustaining fuel efficiency value FCCS,c,1 according to step 1 of Table A8/6 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the charge-sustaining fuel efficiency value FCCS,c,ind for the individual vehicle according to step 3 of Table A8/6 of Annex B8 shall be used for verifying the conformity of production.

4. Verification of CoP on electric energy consumption of PEVs

4.1. The vehicle shall be tested as described in paragraph 3.4. of Annex B8. During the conformity of production verification, the break-off criterion for the Type 1 test procedure according to paragraph 3.4.4.1.3 of Annex B8 (consecutive cycle procedure) and paragraph 3.4.4.2.3. of Annex B8 (Shortened Test Procedure) shall be considered reached when having finished the first applicable WLTP test cycle.

During this test cycle, the DC energy from the REESS(s) shall be determined according to paragraph 4.3 of Annex B8 where dj shall be the actual driven distance.

4.2. The conformity of production with regard to electric energy consumption (EC) shall be verified on the basis of the values for the tested vehicle as described in paragraph 4.2.1. in the case that the type approval was conducted with the consecutive cycle Type 1 test procedure and in paragraph 3.2.2.in case that the type approval was conducted using the shortened Type 1 test procedure.

4.2.1. Consecutive cycle Type 1 test procedure values for CoP

In the case the interpolation method is not applied, the electric energy consumption value according to step 9 of Table A8/10 of Annex B8 shall be used for verifying the conformity of production.

In the case that the interpolation method is applied, the electric energy consumption value for the individual vehicle according to step 10 of Table A8/10 of Annex B8 shall be used for verifying the conformity of production.

4.2.2. Shortened Type 1 Test Procedure values for CoP

In the case the interpolation method is not applied, the electric energy consumption value according to step 8 of Table A8/11 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the electric energy consumption value for the individual vehicle according to step 9 of Table A8/11 of Annex B8 shall be used for verifying the conformity of production.

5. Verification of CoP on CO2 mass emissions / fuel efficiency of OVC-HEVs

5.1. At the request of the manufacturer it is allowed to use different test vehicles for the charge-sustaining test and charge-depleting test.

5.2. Verification of the charge-sustaining CO2 mass emissions / fuel efficiency, as applicable, for conformity of production

5.2.1. The vehicle shall be tested according to the charge-sustaining Type 1 test as described in paragraph 3.2.5. of Annex B8.

5.2.2. For Level 1A:

During this test, the charge-sustaining CO2 mass emission MCO2,CS,c,6 shall be determined according to step 6 of Table A8/5 of Annex B8.

For Level 1B:

During this test, the charge-sustaining fuel efficiency FCCS,c,COP shall be determined according to step 1 of Table A8/6 of Annex 8.

5.2.3. For Level 1A:

The conformity of production with regard to charge-sustaining CO2 mass emissions shall be verified on the basis of the values for the tested vehicle as described in paragraph 5.2.3.1. for charge-sustaining CO2 mass emissions, and applying a run-in factor as defined in paragraph 8.2.4. of this Annex.

For Level 1B:

The conformity of production with regard to charge-sustaining fuel efficiency shall be verified on the basis of the values for the tested vehicle as described in paragraph 5.2.3.1. for charge-sustaining fuel efficiency, and applying a run-in factor as defined in paragraph 8.2.4. of this Annex.

5.2.3.1. Charge-Sustaining CO2 mass emission / fuel efficiency values for CoP

For Level 1A:

In the case the interpolation method is not applied, the charge-sustaining CO2 mass emission value M­­CO2,CS,c,7 according to step 7 of Table A8/5 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the charge-sustaining CO2 mass emission value MCO2,CS,c,ind for the individual vehicle according to step 9 of Table A8/5 of Annex B8 shall be used for verifying the conformity of production.

For Level 1B:

In the case the interpolation method is not applied, the charge-sustaining fuel consumption value FCCS,c,1 according to step 1 of Table A8/6 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the charge-sustaining fuel efficiency FCCS,c,ind for the individual vehicle according to step 3 of Table A8/6 of Annex B8 shall be used for verifying the conformity of production.

5.3. Verification of CoP on charge-depleting electric energy consumption of OVC-HEVs

5.3.1. The vehicle shall be tested during conformity of production according to paragraph 4.3.1.1. If there is no engine start during the first cycle of the type approval procedure of this vehicle, at the option of the manufacturer the vehicle may be tested according to paragraph 5.3.1.2.

5.3.1.1. Charge-Depleting Type 1 test procedure

The vehicle shall be tested according to the charge-depleting Type 1 test procedure as described in paragraph 3.2.4. of Annex B8. During this test, the electric energy consumption ECAC,CD shall be determined according to step 9 of Table A8/8 of Annex B8.

5.3.1.2. First cycle of the Charge-Depleting Type 1 Test

5.3.1.2.1. The vehicle shall be tested according to the charge-depleting Type 1 test as described in paragraph 3.2.4. of Annex B8 while the break-off criterion of the charge-depleting Type 1 test procedure shall be considered reached when having finished the first applicable WLTP test cycle and replace the break-off criterion of the charge-depleting Type 1 test procedure according to paragraph 3.2.4.4. of Annex B8.

During this test cycle, the DC energy from the REESS(s) shall be determined according to paragraph 4.3 of Annex B8 where dj shall be the actual driven distance.

5.3.1.2.2. In this cycle, there is no engine operation allowed. If there is engine operation, the test during conformity of production shall be considered as void.

5.3.2. The conformity of production with regard to the charge-depleting electric energy consumption shall be verified on the basis of the values for the tested vehicle as described in paragraph 5.3.2.1. in the case that the vehicle is tested according to paragraph 5.3.1.1. and as described in paragraph 5.4.2.2 in the case that the vehicle is tested according to paragraph 5.3.1.2

5.3.2.1. Conformity of production for a test according to paragraph 5.3.1.1.

In the case that the interpolation method is not applied, the charge-depleting electric energy consumption value ECAC,CD,final according to step 16 of Table A8/8 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the charge-depleting electric energy consumption value ECAC,CD,ind for the individual vehicle according to step 17 of Table A8/8 shall be used for verifying the conformity of production.

5.3.2.2. Conformity of production for a test according to paragraph 5.3.1.2.

In the case the interpolation method is not applied, the charge-depleting electric energy consumption value according to step 16 of Table A8/8 of Annex B8 shall be used for verifying the conformity of production.

In the case the interpolation method is applied, the charge-depleting electric energy consumption value for the individual vehicle according to step 17 of Table A8/8 of Annex B8 shall be used for verifying the conformity of production.

**Appendix 2**

Verification of conformity of production for Type 1 test—statistical method

1. This Appendix describes the procedure to be used to verify the production conformity requirements for the Type 1 test for criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption, as applicable and in accordance with table A8/1, for pure ICE, NOVC-HEV, PEV and OVC-HEV and, where applicable, to determine the OBFCM device accuracy.

Measurements of the criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption, as applicable and in accordance with table A8/1, shall be carried out on a minimum number of 3 vehicles, and consecutively increase until a pass or fail decision is reached. Where applicable, the OBFCM device accuracy shall be determined for each of the N tests.

* 1. Each vehicle shall be tested on the chassis dynamometer set with the specific mass inertia setting and road load parameters of the individual vehicle.
  2. The applicable test cycle is the same used for the type approval of the interpolation family to which the vehicle belongs.

1.3. The preconditioning test shall be carried out according to the provisions of paragraph 2.6. of Annex B6, or of Appendix 4 to Annex B8, as applicable.

2. Criteria emissions

2.1 For Level 1A:

For the total number of N tests and the measurement results of the tested vehicles, x1, x2, … xN, the average Xtests and the variance VAR shall be determined:

and

For OVC-HEV, in case of complete charge-depleting type 1 test, the average emissions over the complete test of an individual vehicle shall be considered as a single value xi.

For each number of tests, one of the three following decisions can be reached for criteria emissions, based on the criteria emission limit value L according to [insert reference, same as used in 8.2.1.]:

(i) Pass the family if

(ii) Fail the family if

(iii) Take another measurement if:

For the measurement of criteria emissions the factor A is set at 1.05.

For Level 1b: Apply UNR 83 statistical method

For level 1B: [PM]

**Case A**: the manufacturer's production standard deviation is satisfactory.

With a minimum sample size of 3, the sampling procedure is set so that the probability of a lot passing a test with 40 per cent of the production defective is 0.95 (producer's risk = 5 per cent) while the probability of a lot being accepted with 65 per cent of the production defective is 0.l (consumer's risk   
= 10 per cent).

For each of the pollutants given in Table 1 of paragraph 6.3.10. of this Regulation, the following procedure is used (see Figure A8/1B in paragraph 8.2.3.).

Taking:

L = the natural logarithm of the limit value for the pollutant,

xi = the natural logarithm of the measurement for the i-th vehicle of the sample,

s = an estimate of the production standard deviation (after taking the natural logarithm of the measurements),

n = the current sample number.

Compute for the sample the test statistic quantifying the sum of the standard deviations from the limit and defined as:



Then:

If the test statistic is greater than the pass decision number for the sample size given in Table App1/1, the pollutant is passed;

If the test statistic is less than the fail decision number for the sample size given in Table App1/1, the pollutant is failed; otherwise, an additional vehicle is tested and the calculation reapplied to the sample with a sample size one unit greater.

# Table App1/1

**Pass decision number for the sample size**

|  |  |  |
| --- | --- | --- |
| *Cumulative number of tested vehicles (current sample size)* | *Pass decision threshold* | *Fail decision threshold* |
| 3 | 3.327 | -4.724 |
| 4 | 3.261 | -4.79 |
| 5 | 3.195 | -4.856 |
| 6 | 3.129 | -4.922 |
| 7 | 3.063 | -4.988 |
| 8 | 2.997 | -5.054 |
| 9 | 2.931 | -5.12 |
| 10 | 2.865 | -5.185 |
| 11 | 2.799 | -5.251 |
| 12 | 2.733 | -5.317 |
| 13 | 2.667 | -5.383 |
| 14 | 2.601 | -5.449 |
| 15 | 2.535 | -5.515 |
| 16 | 2.469 | -5.581 |
| 17 | 2.403 | -5.647 |
| 18 | 2.337 | -5.713 |
| 19 | 2.271 | -5.779 |
| 20 | 2.205 | -5.845 |
| 21 | 2.139 | -5.911 |
| 22 | 2.073 | -5.977 |
| 23 | 2.007 | -6.043 |
| 24 | 1.941 | -6.109 |
| 25 | 1.875 | -6.175 |
| 26 | 1.809 | -6.241 |
| 27 | 1.743 | -6.307 |
| 28 | 1.677 | -6.373 |
| 29 | 1.611 | -6.439 |
| 30 | 1.545 | -6.505 |
| 31 | 1.479 | -6.571 |
| 32 | -2.112 | -2.112 |

**Case B**: the manufacturer's evidence of production standard deviation is either not satisfactory or not available.

With a minimum sample size of 3, the sampling procedure is set so that the probability of a lot passing a test with 40 per cent of the production defective is 0.95 (producer's risk = 5 per cent) while the probability of a lot being accepted with 65 per cent of the production defective is 0.l (consumer's risk = 10 per cent).

The measurements of the pollutants given in Table 1 of paragraph 6.3.10. of this Regulation are considered to be log normally distributed and shall first be transformed by taking their natural logarithms. Let m0 and m denote the minimum and maximum sample sizes respectively (m0= 3 and m = 32) and let n denote the current sample number.

If the natural logarithms of the measurements in the series are x1, x2 ..., xi and L is the natural logarithm of the limit value for the pollutant, then define:

d1 = x1 – L



and



Table App2/1 shows values of the pass (An) and fail (Bn) decision numbers against current sample number. The test statistic is the ratio /Vn and shall be used to determine whether the series has passed or failed as follows:

For mo ≤ n ≤ m

(i) Pass the series if 

(ii) Fail the series if 

(iii) Take another measurement if 

Remarks

The following recursive formulae are useful for computing successive values of the test statistic:



# Table App2/1

**Minimum sample size = 3**

|  |  |  |
| --- | --- | --- |
| *Sample size (n)* | *Pass decision threshold (An)* | *Fail decision threshold (Bn)* |
| 3 | -0.80381 | 16.64743 |
| 4 | -0.76339 | 7.68627 |
| 5 | -0.72982 | 4.67136 |
| 6 | -0.69962 | 3.25573 |
| 7 | -0.67129 | 2.45431 |
| 8 | -0.64406 | 1.94369 |
| 9 | -0.61750 | 1.59105 |
| 10 | -0.59135 | 1.33295 |
| 11 | -0.56542 | 1.13566 |
| 12 | -0.53960 | 0.97970 |
| 13 | -0.51379 | 0.85307 |
| 14 | -0.48791 | 0.74801 |
| 15 | -0.46191 | 0.65928 |
| 16 | -0.43573 | 0.58321 |
| 17 | -0.40933 | 0.51718 |
| 18 | -0.38266 | 0.45922 |
| 19 | -0.35570 | 0.40788 |
| 20 | -0.32840 | 0.36203 |
| 21 | -0.30072 | 0.32078 |
| 22 | -0.27263 | 0.28343 |
| 23 | -0.24410 | 0.24943 |
| 24 | -0.21509 | 0.21831 |
| 25 | -0.18557 | 0.18970 |
| 26 | -0.15550 | 0.16328 |
| 27 | -0.12483 | 0.13880 |
| 28 | -0.09354 | 0.11603 |
| 29 | -0.06159 | 0.09480 |
| 30 | -0.02892 | 0.07493 |
| 31 | 0.00449 | 0.05629 |
| 32 | 0.03876 | 0.03876 |

For level 2:

A pass is reached only if a pass decision has been reached both for Level 1a and Level 1b.

If a pass decision has been reached only for Level 1a, the testing and statistical evaluation shall only continue for the Level 1b until a pass decision has been reached.

If a pass decision has been reached only for Level 1b, the testing and statistical evaluation shall only continue for the Level 1a until a pass decision has been reached.

3.CO2 emissions, fuel efficiency and electric energy consumption

3.1. For Level 1A:

For the total number of N tests and the measurement results of the tested vehicles, x1, x2, … xN, the average Xtests and the standard deviation s shall be determined:

and

For level 1B: [PM]

3.2. For Level 1A:

For the evaluation of CO2 emissions the normalised values shall be calculated as follows:

where:

CO2 test-i is the CO2 emission measured for individual vehicle i

CO2 declared-i is the declared CO2 value for the individual vehicle

For the evaluation of electric energy consumption EC the normalised values shall be calculated as follows:

where:

ECtest-i is the electric energy consumption measured for individual vehicle i. In the case that the complete charge-depleting type 1 test has been applied, ECtest-i shall be determined according to paragraph 4.3.1.1. of Appendix 1. In the case that only the first cycle is tested for verification of CoP, ECtest-i shall be determined according to paragraph 4.3.1.2. of Appendix 1.

ECDC, COP-i is the declared electric energy consumption for the individual vehicle i, according to Appendix 8 to Annex B8. In the case that the complete charge-depleting type 1 test has been applied, ECDC,COP,i shall be determined according to paragraph 4.3.2.1. of Appendix 1. In the case that only the first cycle is tested for verification of CoP, ECCOP,i shall be determined according to 4.3.2.2 of Appendix 1.

The normalised xi values shall be used to determine the parameters Xtests and s according to paragraph 3.1.

For Level 1B [PM]

3.3. For Level 1A:

For each number of tests, one of the three following decisions can be reached, where the factor A shall be set at 1.01:

(i) Pass the family if

(ii) Fail the family if

(iii) Take another measurement if:

where:

parameters tP1,i, tP2,i, tF1,i, andtF2 are taken from the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **PASS** | | **FAIL** | |
| **Tests (i)** | **tP1,i** | **tP2,i** | **tF1,i** | **tF2** |
| **3** | 1.686 | 0.438 | 1.686 | 0.438 |
| **4** | 1.125 | 0.425 | 1.177 | 0.438 |
| **5** | 0.850 | 0.401 | 0.953 | 0.438 |
| **6** | 0.673 | 0.370 | 0.823 | 0.438 |
| **7** | 0.544 | 0.335 | 0.734 | 0.438 |
| **8** | 0.443 | 0.299 | 0.670 | 0.438 |
| **9** | 0.361 | 0.263 | 0.620 | 0.438 |
| **10** | 0.292 | 0.226 | 0.580 | 0.438 |
| **11** | 0.232 | 0.190 | 0.546 | 0.438 |
| **12** | 0.178 | 0.153 | 0.518 | 0.438 |
| **13** | 0.129 | 0.116 | 0.494 | 0.438 |
| **14** | 0.083 | 0.078 | 0.473 | 0.438 |
| **15** | 0.040 | 0.038 | 0.455 | 0.438 |
| **16** | 0.000 | 0.000 | 0.438 | 0.438 |

For Level 1B:

For the evaluation of FC and EC the following provisions apply:

If N ≤ 10

* + Pass if Xtests ≥ Declared Value
  + Test more if not pass

If N > 10

Pass if all the following criteria are satisfactory:

i. Year average criteria: Xtests of yearly production of CoP family > DV – 3sigma / √yearly sampling volume of CoP family

ii. COP family criteria: Xtests of COP family > DV – 3sigma / √yearly sampling volume of COP family

iii. individual criteria: xi of individual vehicle > DV – 3sigma

Fail if one of the criteria is not satisfactory

ii. shall be judged only when IP family and COP family are different.

For Level 2:

A pass is reached only if a pass decision has been reached both for Level 1a and Level 1b.

If a pass decision has been reached only for Level 1a, the testing and statistical evaluation shall only continue for the Level 1b until a pass decision has been reached.

If a pass decision has been reached only for Level 1b, the testing and statistical evaluation shall only continue for the Level 1a until a pass decision has been reached.

3.4. For Level 1a and Level 2:

For vehicles referred to in paragraph 5.11. of this Regulation the accuracy xi,OBFCM of the OBFCM device shall be determined for each single test i in accordance with the formulae in paragraph 4.2 of Appendix 4.

The Type Approval authority shall keep a record of the determined accuracies for each CoP family tested.

**Appendix 3**

**Run-in test procedure to determine run-in factors**

1. Description of the run-in test procedure for the determination of the run-in factors

1.1 The run-in test procedure shall be conducted by the manufacturer, who shall not make any adjustments to the test vehicles that have an impact on the criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption. The hardware and ECU calibration of the test vehicle shall conform to the homologation vehicle. All the relevant hardware that has an impact on the criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption shall have had no operation prior to the run-in test procedure.

1.2 The test vehicle shall be configured as vehicle H within the CoP family or -if the CoP family has multiple interpolation families- the interpolation family with the highest expected production volume within the CoP family. At the request of the manufacturer, and with approval of the responsible authority a different test vehicle may be selected.

1.3 The test vehicle shall be a new vehicle, or a used test vehicle for which at least all of the following components are newly installed simultaneously:

* + internal combustion engine;
  + driveline components (at least, but not limited to, transmission, tyre, axles, etc.);
  + brake components;
  + REESSs for EVs;
  + Exhaust system.

and any other component that has a non-negligible influence on criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption.

For the new vehicle, or the used vehicle for which the above mentioned components have been replaced, the system odometer of the test vehicle Ds shall recorded.

1.4 At the request of the manufacturer and with approval by the responsible authority, it is allowed to perform the run-in procedure on multiple test vehicles. In this case, the test results of all tested vehicles shall be considered for the determination of the run-in factors.

1.5 The chassis dynamometer shall be set to the target road load for the test vehicle, according to the procedure specified in paragraph 7. of Annex B4.

1.6 Before the run-in, the test vehicle shall be tested according to the Type 1 test procedure specified in Annex B6. The test shall be repeated until three valid test results have been obtained. Drive trace indexes shall be calculated according to paragraph 7. of Annex B7 and these shall fulfil the specified criteria in paragraph 7.3. The signal of the throttle shall be recorded during all tests at a sampling frequency of 10 Hz. The responsible authority may request to evaluate this signal to ensure that the test result is performed correctly.  
The system odometer setting Di shall be recorded prior to each test. The measured criteria emissions, CO2 emissions and electric energy consumption shall be calculated according to Annex7 TableA7/1 \_Step\_4a or Annex8 TableA8/5 \_Step\_4a.

1.7 After the initial tests, the test vehicle shall be run-in under normal driving conditions. The driving pattern and test conditions during the run-in shall be in accordance with the manufacturer’s engineering judgement. The run-in distance shall be less than or equivalent to the distance driven during the run-in of the vehicle which was tested for the type approval of the interpolation family, in accordance with paragraph 2.3.3. of Annex B6 or paragraph 2. Annex B8.

1.8 After the run-in, the test vehicle shall be tested according to the Type 1 test procedure specified in Annex B6. The test shall be repeated until three valid test results have been obtained. Drive trace indexes shall be calculated according to paragraph 7. of Annex B7 and these shall fulfil the specified criteria in paragraph 7.3.   
These tests shall be performed in the same test cell as used for the tests prior to the run-in and by applying the same chassis dynamometer setting method. The system odometer setting Di shall be recorded prior to each test. The measured criteria emissions, CO2 emissions, fuel efficiency and electric energy consumption, as applicable and in accordance with paragraph 8.2.4.1., shall be calculated according to Annex7 TableA7/1 \_Step\_4a or Annex B8 TableA8/5 \_Step\_4a.

1.9 For the determination of the run-in factor for the CO2 emissions, the coefficients CRI and Cconst in the following equation shall be calculated by a least squares regression analysis to four significant digits on all valid tests before and after the run-in:

where:

MCO2,i is the measured CO2 mass emission for test i, g/km

CRI is the slope of the logarithmic regression line, g/km2

Cconst is the constant value of the logarithmic regression line, g/km

The manufacturer will provide statistical evidence to the responsible authority that the fit is sufficiently statistically justified.

1.10 The run-in factor RICO2(j) for CO2 emissions of CoP test vehicle j shall be determined by the following equation:

where:

Dk is the average distance of the valid tests after the run-in, km

Dj is the system odometer setting of the CoP test vehicle, km

MCO2,j is the mass CO2 emission measured on the CoP test vehicle, g/km

In the case that Dj is lower than the minimum Di, Dj shall be replaced by the minimum Di.

1.11 For the determination of the run-in factor for all applicable criteria emissions, the coefficients CRI,c and Cconst, c shall be calculated with a least squares regression analysis to four significant digits on all valid tests before and after the run-in:

where:

MC,i is the measured mass criteria emission component C

CRI,c is the slope of the linear regression line, g/km2

Cconst,c is the constant value of the linear regression line, g/km

The manufacturer will provide statistical evidence to the responsible authority that the fit is sufficiently statistically justified.

1.12 For Level 1A only:

The run-in factor RIC(j) for criteria emission component C of CoP test vehicle j shall be determined by the following equation:

where:

Dk is the average distance of the valid tests after the run-in, km

Dj is the system odometer setting of the CoP test vehicle, km

MC,j is the mass emission of component C on the CoP test vehicle, g/km

In the case that Dj is lower than the minimum Di, Dj shall be replaced by the minimum Di.

1.13 The run-in factor RIEC(j) for electric energy consumption shall be determined according to the procedure specified in paragraphs 1.9 and 1.10, where CO2 in the formulae is replaced by EC.