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**Economic Commission for Europe**

Inland Transport Committee

**World Forum for Harmonization of Vehicle Regulations**

**Working Party on Pollution and Energy**

**Ninety third session**

Geneva, 14-17 October 2025

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),   
103 (Replacement pollution control devices) and   
154 (Worldwide harmonized Light vehicles Test Procedures (WLTP))**

Proposal for a new Series of amendments to UN Regulation No. 154 (WLTP)

Submitted by the experts from the European Commission and the International Organization of Motor Vehicle Manufacturers [[1]](#footnote-2)\*

This document proposes a new [04] series of amendments to UN Regulation No. 154, as a consolidated version. It is a single series which replaces the previous approach for UN Regulation No. 154, which had separate series for the regional levels and the harmonised procedure, which contained the most stringent procedures/limits subject to full mutual recognition.

This new series introduces new regional requirements from Contracting Parties, in particular the requirements from Euro 7 in the EU. These include, amongst others, new particle number (PN10) provisions, a new SHED limit for evaporative emissions, updated On-board Fuel Consumption Monitoring provisions, as well as other adaptations to technical progress. It introduces new annexes with requirements relating to in-vehicle battery durability and a new test for range of Pure Electric Vehicles at low temperatures.

UN Regulation No. 154

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)

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Introduction

The intention of this Regulation is to establish uniform provisions concerning the approval of motor vehicles with regard to the emissions of light-duty vehicles based on the new World harmonized Light vehicle Test Procedure (WLTP) included in UN GTR No. 15 and the updated Evaporative Emissions test procedure (Type 4 test) which has been developed in UN GTR No. 19. It will enable Contracting Parties (CPs) to issue and accept approvals based on these new type approval tests.

The WLTP Type 1 test replaces both the current Type 1 test in UN Regulation No. 83 and UN Regulation No. 101, whilst the updated Evaporative Emissions test procedure (Type 4 test) replaces that currently in UN Regulation No 83.

In addition, this new Regulation includes an update to the Type 5 test for verifying the durability of pollution control devices and updated On-Board Diagnostic (OBD) requirements. These updates are in order to reflect the changes from the previous NEDC based Type 1 test to the new WLTP Type 1 test.

The 04 series of this Regulation covers three sets of requirements – termed Level 1A, Level 1B and Level 2. Level 1A is based on a four phase test cycle (Low, Medium, High and Extra-High), Level 1B is based on a three phase test cycle (Low, Medium and High), with different type 1 limits applying to these different levels whilst Level 2 includes a harmonised procedure which contains the most stringent procedures/limits which shall be subject to full mutual recognition. The majority of the regulatory text is applicable to all Levels. Where the requirements are specific to either Level 1A, Level 1B or Level 2 the relevant sections are labelled accordingly. Levels 1A and 1B in this series of amendments cover regional requirements and does not require mutual recognition by other Contracting Parties.

A type approval to Level 2 shall however be accepted by all CPs applying this Regulation.

1. Scope

This Regulation provides requirements for three levels of approval. One level requires testing using a 4-phase WLTC (low, medium, high and extra-high as defined in Annex B1) – this is called Level 1A. A second level requires testing using a 3-phase WLTC cycle (low, medium and high as defined in Annex B1) – this is called Level 1B. The third level is a harmonised set of requirements and is called Level 2.

Where the requirements in this Regulation apply to either Level 1A, Level 1B or Level 2 only, the Regulatory text uses "Level 1A only", "Level 1B only" or “Level 2 only” to denote the start of the level specific requirements.

1.1. Scope for Level 1A;

This Regulation applies to the type approval of vehicles of categories M1 and N1 with regard to the WLTP Type 1 test for emissions of gaseous compounds, particulate matter, particle number and to emissions of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric range and to the Type 4 test on evaporative emissions.

In addition, this Regulation lays down rules for verifying the durability of pollution control devices’ On-Board Diagnostic (OBD) systems, On-Board Fuel Consumption Monitoring (OBFCM) devices, battery durability and electric range at low ambient temperatures.

At the request of the manufacturer, for vehicles of category N2 between 3.5 and 5 tonnes maximum mass originating from a type of vehicle of category N1, the approval authority may grant an emission type-approval if the vehicle meets the requirements for a type of vehicle of category N1.

1.2. Scope for Level 1B;

This Regulation applies to the type approval of vehicles of categories M2 and N1 with a technical permissible maximum laden mass not exceeding 3,500 kg and to all vehicles of category M1 with regard to the WLTP Type 1 test for emissions of gaseous compounds, particulate matter, particle number and to emissions of carbon dioxide and fuel efficiency and/or the measurement of electric energy consumption and electric range and to the Type 4 test on evaporative emissions.

In addition, this Regulation lays down rules for verifying the durability of pollution control devices and On-Board Diagnostic (OBD) systems, On-Board Fuel Consumption Monitoring (OBFCM) devices and battery durability.

1.3. Scope for Level 2;

This Regulation applies to the type approval of vehicles of categories M1 and N1 with regard to the WLTP Type 1 test for emissions of gaseous compounds, particulate matter, particle number and to emissions of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric range and to the Type 4 test on evaporative emissions.

In addition, this Regulation lays down rules for verifying the durability of pollution control devices, On-Board Diagnostic (OBD) systems, On-Board Fuel Consumption Monitoring (OBFCM) devices, battery durability and electric range at low ambient temperatures.

~~At the request of the manufacturer, type approval may be granted to N~~~~2~~ ~~vehicles between 3.5 and 5 tonnes maximum mass originating from a type of vehicle of category N~~~~1~~ ~~which meet the conditions laid down in this Regulation.~~

**2. Abbreviations**

2.1. General abbreviations

|  |  |
| --- | --- |
| AC | Alternating current |
| APF | Assigned permeability factor |
| [BMS | Battery Management System] |
| BWC | Butane working capacity |
| CD | Charge-Depleting |
| [CED | Cycle energy demand, considering positive cycle energy] |
| [CEDREESS | Cycle energy demand REESS, considering positive and negative cycle energy] |
| CFD | Computational fluid dynamics |
| CFV | Critical flow venturi |
| CFO | Critical flow orifice |
| CLA | Chemiluminescent analyser |
| CS | Charge-Sustaining |
| CVS | Constant volume sampler |
| DC | Direct current |
| DPR | Declared Performance Requirement |
| EAF | Sum of ethanol, acetaldehyde and formaldehyde |
| ECD | Electron capture detector |
| ET | Evaporation tube |
| Extra High2 | Class 2 WLTC extra high speed phase |
| Extra High3 | Class 3 WLTC extra high speed phase |
| FCHV | Fuel cell hybrid vehicle |
| FID | Flame ionization detector |
| FSD | Full scale deflection |
| GC | Gas chromatograph |
| GFV | Gas Fuelled Vehicle |
| HEPA | High efficiency particulate air (filter) |
| HFID | Heated flame ionization detector |
| High2 | Class 2 WLTC high speed phase |
| High3a | Class 3a WLTC high speed phase |
| High3b | Class 3b WLTC high speed phase |
| ICE | Internal combustion engine |
| [KPER,WLTC,LowTemp | Lowest low temperature pure electrical range ratio of the low temperature range family] |
| LC | Liquid chromatography |
| LoD | Limit of detection |
| LoQ | Limit of quantification |
| Low1 | Class 1 WLTC low speed phase |
| Low2 | Class 2 WLTC low speed phase |
| Low3 | Class 3 WLTC low speed phase |
| LPG | Liquefied petroleum gas |
| Medium1 | Class 1 WLTC medium speed phase |
| Medium2 | Class 2 WLTC medium speed phase |
| Medium3a | Class 3a WLTC medium speed phase |
| Medium3b | Class 3b WLTC medium speed phase |
| MPR | Minimum Performance Requirement |
| NDIR | Non-dispersive infrared (analyser) |
| NDUV | Non-dispersive ultraviolet |
| NG/biomethane | Natural gas/biomethane |
| NMC | Non-methane cutter |
| NOVC-FCHV | Not off-vehicle charging fuel cell hybrid vehicle |
| NOVC  NOVC-HEV | Not off-vehicle charging  Not off-vehicle charging hybrid electric vehicle |
| OBD | On-board Diagnostics |
| OBFCM | On-board fuel and/or energy consumption monitoring |
| OTA | Over the Air |
| OVC-FCHV | Off-vehicle charging fuel cell hybrid vehicle |
| OVC-HEV | Off-vehicle charging hybrid electric vehicle |
| Pa | Particulate mass collected on the background filter |
| Pe | Particulate mass collected on the sample filter |
| PAO | Poly-alpha-olefin |
| PCF | Particle pre-classifier |
| PCRF | Particle concentration reduction factor |
| PDP | Positive displacement pump |
| PER | Pure electric range |
| PF | Permeability factor |
| PLL | Lower limit pressure |
| PM | Particulate matter emissions |
| PN | Particle number emissions |
| PNC | Particle number counter |
| PND1 | First particle number dilution device |
| PND2 | Second particle number dilution device |
| PTS | Particle transfer system |
| PTT | Particle transfer tube |
| QCL-IR | Infrared quantum cascade laser |
| RCDA | Charge-depleting actual range |
| RCB | REESS charge balance |
| REESS | Rechargeable electric energy storage system |
| RRC | Rolling resistance coefficient |
| SOC | State of Charge |
| SOCE | State of Certified Energy |
| SOCR | State of Certified Range |
| SHED | Sealed housing evaporative determination |
| SSV | Subsonic venturi |
| UBE | Usable Battery (REESS) Energy |
| USFM | Ultrasonic flow meter |
| V2G | Vehicle to Grid |
| V2H | Vehicle to Home |
| V2L | Vehicle to Load |
| V2X | Vehicle to Everything |
| VH | Vehicle High |
| VL | Vehicle Low |
| VPR | Volatile particle remover |
| WLTC | Worldwide light-duty test cycle |

2.2. Chemical symbols and abbreviations

|  |  |
| --- | --- |
| C1 | Carbon 1 equivalent hydrocarbon |
| CH4 | Methane |
| C2H6 | Ethane |
| C2H5OH | Ethanol |
| C3H8 | Propane |
| CH3CHO | Acetaldehyde |
| CO | Carbon monoxide |
| CO2 | Carbon dioxide |
| DOP | Di-octylphthalate |
| H2O | Water |
| HCHO | Formaldehyde |
| NH3 | Ammonia |
| NMHC | Non-methane hydrocarbons |
| NOx | Oxides of nitrogen |
| NO | Nitric oxide |
| NO2 | Nitrogen dioxide |
| N2O | Nitrous oxide |
| THC | Total hydrocarbons |

**3. Definitions**

For the purposes of this Regulation the following definitions shall apply:

3.12. Battery Durability (Annex C1)

3.12.1. "Battery" means, a rechargeable electrical energy storage system (REESS) installed in an electrified vehicle and used mainly for traction purposes.

3.12.2. "Originally installed battery" means the battery that is installed in the vehicle at the time of manufacture, or if the vehicle is manufactured without an installed battery, the battery that is installed in the vehicle when it is first operated on the road.

3.12.3. "Usable battery energy (UBE)" means the energy supplied by the battery from the beginning of the test procedure used for certification until the applicable break-off criterion of the test procedure used for certification is reached.

3.12.4. "Certified usable battery energy" (UBEcertified) refers to the UBE that was determined during the certification of the vehicle, according to Appendix 3 to Annex C1 of this Regulation.

3.12.5. "Measured usable battery energy" (UBEmeasured) means the UBE determined at the present point in the lifetime of the vehicle by the test procedure used for certification, according to Appendix 3 to Annex C1 of this Regulation.

3.12.6. "Electric Range" in Annex C1 refers to the range that would be determined by the range test procedure used for certification of the vehicle, if the test was performed at the present point in the lifetime of the vehicle and with the originally installed battery.

3.12.7. "Certified range" (Rangecertified) refers to the electric driving range that was determined during certification of the vehicle, according to Appendix 3 to Annex C1 of this Regulation.

3.12.8. "Measured range" (Rangemeasured) means the electric range determined at the present point in the lifetime of the vehicle by the test procedure used for certification, according to Appendix 3 to Annex C1 of this Regulation.

[3.12.9. "State of certified energy" (SOCE) means the measured or on-board UBE performance at a specific point in its lifetime, expressed as a percentage of the certified usable battery energy.]

3.12.10. "State of certified range" (SOCR) means the measured or on-board electric range at a specific point in its lifetime, expressed as a percentage of the certified range.

3.12.11. "Minimum Performance Requirement" (MPR) means the minimum durability performance, in terms of SOCE or SOCR at a specific point in the lifetime of the vehicle, that constitutes compliance with the durability provisions of this Regulation.

3.12.12. "Declared Performance Requirement" (DPR) means an SOCE or SOCR value declared by the manufacturer that is greater than that of the corresponding MPR and which then becomes the minimum durability performance that constitutes compliance of that manufacturer with the durability provisions of this Regulation.

3.12.13. "SOCR monitor" means an apparatus installed in the vehicle that maintains an estimate of the state of certified range by means of an algorithm operating on data collected from the vehicle systems.

3.12.14. "SOCE monitor" means an apparatus installed in the vehicle that maintains an estimate of the state of certified energy by means of an algorithm operating on data collected from the vehicle systems.

3.12.15. "On-board SOCR” (SOCRread) means an estimate of state of certified range produced by an SOCR monitor.

3.12.16. "On-board SOCE" (SOCEread) means an estimate of state of certified energy produced by an SOCE monitor.

3.12.17. "Measured SOCR" (SOCRmeasured) means the state of certified range as determined by the measured range divided by the certified range, according to paragraph 3.1.2. of Annex 5 of UN Regulation No. 83.

3.12.18. "Measured SOCE" means the state of certified energy as determined by the measured usable battery energy divided by the certified usable battery energy.

3.12.19. "V2X" means the use of the traction batteries to cover external power and energy demand, such as V2G (Vehicle-to-Grid) for grid stabilization by utilising traction batteries, V2H (Vehicle-to-Home) for utilizing traction batteries as residential storage for local optimisation or emergency power sources in times of power failure, and V2L (Vehicle-to-Load, only connected loads are supplied) for use in times of power failure and/or outdoor activity in normal times.

3.20. "Total discharge energy during V2X" means the total amount of discharged energy during V2X which needs to be provided according to Appendix 2 to Annex C1 of this Regulation.

3.21. "Maximum charging power" means the highest available charging power for the considered [Part B family], as defined in paragraph 6.3.12.2. of this Regulation.

3.22. "Energy throughput " means the total amount of energy in kWh discharged from the battery.

3.23. "Total discharge energy for non-traction purposes" means the total amount of energy in kWh discharged from the battery for purposes other than traction to support the particular use case of a Category N vehicle and do not include air conditioning/heating for the cabin or other uses already present in category M.

3.24. "Odometer" means an instrument which indicates to the driver the total distance recorded by the vehicle since its production.

4. Application for approval

4.1. The application for approval of a vehicle type with regard to the requirements of this Regulation shall be submitted by the vehicle manufacturer or by their authorized representative to the Type Approval Authority.

4.1.1. The application referred to in paragraph 4.1. shall be drawn up in accordance with the model of the information document set out in Annex A1 to this Regulation.

4.1.2. In addition, the manufacturer shall submit the following information:

[(h) Manufacturer’s declarations of compliance covering the following topics:

(a) Regeneration requirements (Annex A2 Appendix 1);

(b) Ambient Temperature Correction Test (ATCT) (Annex A2 Appendix 2);

(c) Reagent requirements (Annex A2 Appendix 3);

(d) Durability for emissions (Type 5 test) (Annex A2 Appendix 4);

(e) OBD requirements (Annex A2 Appendix 5)

[(f) Battery durability]]

5. Approval

5.11. Requirements for type-approval regarding devices for monitoring the consumption of fuel and/or electric energy

5.11.1.

The manufacturer shall ensure that the following vehicles are equipped with a device for determining, storing and making available data on the quantity of fuel and/or electric energy used for the operation of the vehicle:

(a) pure ICE and Not-Off-Vehicle Charging Hybrid Electric vehicles (NOVC-HEVs) powered exclusively by mineral diesel, biodiesel, petrol, ethanol or any combination of these fuels;

(b) Off-Vehicle Charging Hybrid Electric Vehicles (OVC-HEVs) powered by electricity and any of the fuels mentioned in point (a).

[(c) Pure Electric Vehicles (PEVs)]

For Level 1B and Level 2 only:

(d) Not Off-Vehicle Charging Fuel Cell Hybrid Vehicles (NOVC-FCHV), Off-Vehicle Charging Fuel Cell Hybrid Vehicles (OVC-FCHV) and mono-fuel gas vehicles.

5.11.2. The device for monitoring the consumption of fuel and/or electric energy shall comply with the requirements laid down in Appendix 5.

6. Specifications and tests

6.2. Test procedure

Table A specifies the various test requirements for type approval of a vehicle.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Table A* | | | | | | | | | | | | |
| *Application of test requirements for type-approval and extensions* | | | | | | | | | | | | |
| *Vehicle category* | *Vehicles with positive ignition engines including hybrids* | | | | | | | | *Vehicles with compression ignition engines including hybrids* | | *Pure electric vehicles* | *Hydrogen fuel cell vehicles* |
|  | *Mono fuel* | | | | *Bi-fuel3* | | | *Flex-fuel3* | *Mono fuel* | |  |  |
| Reference fuel | Petrol | LPG | NG/ Biomethane | Hydrogen (ICE) | Petrol | Petrol | Petrol | Petrol | Diesel | Petrol | — | Hydrogen (Fuel Cell) |
| LPG | NG/ Biomethane | Hydrogen (ICE) 4 | Ethanol (E85) |
| Type 1 test (for applicability of measured components to fuels and vehicle technology and therefore measurement procedures, see Table 1A and Table 1B) (limits) | Yes | Yes5 | Yes5 | Yes4 | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes | Yes | — | — |
| ATCT 1  (14°C test) | Yes | Yes | Yes | Yes4 | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes | Yes | — | — |
| Evaporative emissions  (Type 4 test) | Yes | Yes 6 | Yes 6 | — | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | — | Yes | — | — |
| Durability1  (Type 5 test) | Yes | Yes | Yes | Yes | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | Yes | Yes | — | — |
| OBD1 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | — | — |
| OBFCM | Yes | Yes7 | Yes7 | — | — | — | — | Yes  (both fuels) | Yes | Yes | Yes7 | Yes7 |
| CO2 emissions, fuel consumption, electric energy consumption and electric range | Yes | Yes | Yes | Yes2 | Yes  (both fuels) | Yes  (both fuels) | Yes (petrol),  Yes2 (hydrogen) | Yes  (both fuels) | Yes | Yes | Yes | Yes8 |
| Low temperature electric range test | — | — | — | — | — | — | — | — | — | — | Yes | — |
| Battery durability | Yes9 | — | — | — | — | — | — | — | — | — | Yes | — |

1 Declaration of compliance by the vehicle manufacturer at type-approval.

2 Only fuel consumption shall be determined when the vehicle is running on hydrogen.

3 When a bi-fuel vehicle is combined with a flex fuel vehicle, both test requirements are applicable.

4 Only NOx emissions shall be determined when the vehicle is running on hydrogen.

5 For Level 1A and Level 2 only - Particulate mass and particle number limits and respective measurement procedures shall not apply. For Level 1B only - In the case that a mono-fuel gas vehicle has a petrol tank it shall also be tested using the applicable petrol reference fuel

6 For Level 1B, if the mono-fuel gas vehicle does have a petrol tank “Yes”, if the mono-fuel gas vehicle does not have a petrol tank “—“, For Level 1A and Level 2 “—“

7 For Level 1B and Level 2 only

8 CO2 emissions do not need to be measured

9 For OVC-HEV vehicles only

6.2.1. Each of the vehicle families specified below shall be attributed a unique identifier of the following format:

FT-nnnnnnnnnnnnnnn-WMI

Where:

FT is an identifier of the family type:

(a) IP = Interpolation family as defined in paragraph 6.3.2. with or without using the interpolation method

(b) RL = Road load family as defined in paragraph 6.3.3.

(c) RM = Road load matrix family as defined in paragraph 6.3.4.

(d) PR = Periodically regenerating systems (Ki) family as defined in paragraph 6.3.5.

(e) AT = ATCT family as defined in paragraph 2. of Annex B6a.

(f) EV = Evaporative emissions family, as defined in paragraph 6.6.3.

(g) DF = Durability family, as defined in paragraph 6.7.5.

(h) OB = OBD family identifier, as defined paragraph 6.8.1.

(i) ER = Exhaust after-treatment system using reagent (ER) family identifier, as defined in paragraph 6.9.2.

(j) GV = Gas Fuelled Vehicle (GFV) family identifier, as defined in paragraph 6.3.6.3.

(k) KC = KCO2 correction factor family identifier, as defined in paragraph 6.3.11.

[(l) [RT] = Low temperature range family identifier, as defined in paragraph 6.10.1.]

[(m) MF = Monitor family as defined in paragraph 6.3.13.1.]

[(n) BD = Battery Durability family as defined in paragraph 6.3.13.2.]

[(o) [VD = virtual distance family as defined in paragraph 6.3.13.3.]]

[(p) Add an identifier for Level 1B Lower limit pressure family for NOVC-FCHVs?]

nnnnnnnnnnnnnnn is a string with a maximum of fifteen characters, restricted to using the characters 0-9, A-Z and the underscore character '\_'.

WMI (world manufacturer identifier) is a code that identifies the manufacturer in a unique manner defined in ISO 3780:2009.

It is the responsibility of the owner of the WMI to ensure that the combination of the string nnnnnnnnnnnnnnn and the WMI is unique to the family and that the string nnnnnnnnnnnnnnn is unique within that WMI to the approval tests performed to obtain the approval.

6.3.9. OBFCM

The OBFCM device shall determine the parameters and store the lifetime values on board the vehicle in accordance with Appendix 5.

[6.3.13. Battery durability families

Vehicles having the same characteristics with respect to their evaluation under Part A or Part B below shall be grouped into vehicle families for the purpose of compliance verification. Families under Part A shall have the same characteristics with respect to verification of the SOCR/SOCE monitors. Families under Part B shall have the same characteristics with respect to verification of battery durability.

Families with the same characteristics with respect to compliance verification shall be defined as follows:

6.3.13.1. For Part A: Verification of Monitors

Only vehicles that are substantially similar with respect to the following elements may be part of the same monitor family:

(a) Algorithm for estimating on-board SOCR and on-board SOCE;

(b) Sensor configuration (for sensors used in determination of SOCR and SOCE estimates);

(c) Characteristics of battery cell which have a non-negligible influence on accuracy of monitor;

(d) Type of vehicle (PEVs or OVC-HEVs).

At the request of the manufacturer, with the approval of the responsible authority and with appropriate technical justification, the manufacturer may deviate from the above criteria for families.

6.3.13.2. For Part B: Verification of Battery Durability

Only vehicles that are substantially similar with respect to the following elements may be part of the same battery durability family:

(a) Type and number of electric machines, including net power, construction type (asynchronous/ synchronous, etc.), and any other characteristics having a non-negligible influence on battery durability;

(b) Type of battery (dimensions, type of cell, including format and chemistry, capacity (Ampere-hour), nominal voltage, nominal power;

(c) Battery management system (BMS) (with regards to battery durability monitoring and estimations);

(d) Passive and active thermal management of the battery;

(e) Type of electric energy converter between the electric machine and battery, between the recharge-plug-in and battery, and any other characteristics having a non-negligible influence on battery durability;

(f) Operation strategy of all components influencing the battery durability;

(g) Declared maximum charging power.

At the request of the manufacturer, with the approval of the responsible authority and with appropriate technical justification, the manufacturer may deviate from the above criteria for families.

6.3.13.3. For Part C: Verification of reported virtual distance

Only vehicles that are substantially similar with respect to the following elements may be part of the same monitor family:

(a) Algorithm for reported virtual distance;

(b) Sensor configuration (for sensors used in determination of virtual distance);

(c) Characteristics of battery cell which have a non-negligible influence on accuracy of monitor;

(d) Type of vehicle (PEVs or OVC-HEVs).

At the request of the manufacturer, with the approval of the responsible authority and with appropriate technical justification, the manufacturer may deviate from the above criteria for families. ]

7.  Modification and extension of the type approval

7.1. Every modification of the vehicle type shall be notified to the Type Approval Authority that approved the vehicle type. The Type Approval Authority may then either:

7.1.1. Consider that the modifications made are contained within the families covered by the approval or are unlikely to have an appreciable adverse effect on the values of CO2 and fuel consumption or electric energy consumption and that, in this case, the original approval will be valid for the modified vehicle type; or

7.1.2. Require a further test report from the Technical Service responsible for conducting the tests.

7.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 5.3. to the Contracting Parties to the Agreement which apply this Regulation.

7.3. The Type Approval Authority issuing the extension of approval shall assign a series number to the extension and inform thereof the other Contracting Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex A2 to this Regulation.

7.4. Extensions for tailpipe emissions (Type 1 test) and OBFCM

7.4.1. The type-approval shall be extended without the need for further testing to vehicles if they conform to the criteria of paragraph 3.0.1. (a) and (c).

Additionally to the criteria above, in the cases when the Interpolation Family Vehicle High and/ or Vehicle Low are changed, the new Vehicle High and/or Vehicle Low shall be tested and the CO2 emission values of the tested vehicle resulting from the table below shall be less than or equal to the CO2 emission which lies on a straight line through the CO2 values of the original Vehicles Low and High when plotted against cycle energy and corresponding to the cycle energy demand of the tested vehicle.

|  |  |  |
| --- | --- | --- |
|  | For Level 1A and 4-phase WLTP test in Level 2 | For Level 1B and 3-phase WLTP test in Level 2 |
| Vehicles tested according to the Annex B6 | step 9 of Table A7/1 of Annex B7 | step 6 of Table A7/1 of Annex B7 |
| Vehicles tested according to the Annex B8 | step 8 of Table A8/5 in Annex B8 | step 6 of Table A8/5 in Annex B8 |

The measured criteria emissions shall respect the limits set out in paragraph 6.3.10.

The accuracy of the OBFCM shall be calculated for any Type 1 tests performed in order to gain an extension and shall respect the criteria set out in paragraph 4.2 of Appendix 5.

7.4.1.1. If the type-approval has been granted only in relation to Vehicle High, it shall only be extended under the circumstances (a), (b) or (c) below:

(a) To include additional vehicles which conform to the criteria of paragraph 3.0.1. (a) and (c) and have a cycle energy lower than that of Vehicle High.

(b) To create an interpolation family by testing Vehicle Low (preferably using the vehicle which was tested as Vehicle High for the original approval). In this case all vehicles covered by the extended approval shall conform to the criteria of paragraph 3.0.1. (a), (b) and (c).

(c) To create an interpolation family by renaming Vehicle High as Vehicle Low and testing Vehicle High (preferably using the vehicle which was tested as Vehicle High for the original approval). In this case all vehicles covered by the extended approval shall conform to the criteria of paragraph 3.0.1. (a), (b) and (c).

8. Conformity of production (COP)

8.1. Every vehicle produced under a type approval according to this Regulation shall conform with regard to the vehicle type approved. The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (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 Table 8/1 and Table 8/2 and with the OBD requirements, where applicable according to Table A in paragraph 6. Where applicable and if required according to Table A, the manufacturer shall determine and report the OBFCM device accuracy in accordance with Appendix 5.

The specific procedures for conformity of production are set out in paragraphs 8.2. to 8.4. and Appendices 1 to 4.

Table 8/1

**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* | *[OBFCM accuracy* |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| Pure ICE | yes | Level 1A and Level 2 as applicable | Level 1B and Level 2 as applicable | Not Applicable | yes |
| NOVC-HEV | yes | Level 1A and Level 2 as applicable | Level 1B and Level 2 as applicable | Not Applicable | yes |
| OVC-HEV | yes:  CD*(1)* and CS | Level 1A and Level 2 as applicable: CS only | Level 1B and Level 2 as applicable:  CS only | yes:  CD only | yes: CS*(2)* only |
| PEV | Not Applicable | Not Applicable | Not Applicable | Yes | Level 1A and Level 2 |
| NOVC-FCHV | Not Applicable | Not Applicable | Exempted | Not Applicable | Not Applicable |
| OVC-FCHV | Not Applicable | Not Applicable | Exempted | Exempted | Not Applicable] |

*(1)* Only if there is combustion engine operation during a valid CD Type 1 test for CoP verification

*(2)* For Level 1A and Level 2 only the vehicle energy charged is assessed in accordance with paragraph 3.4. of Appendix 2

8.1.3. CoP family

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

If the vehicle production takes place in different production facilities, different CoP families shall be created for each facility. An interpolation family can be represented in one or more CoP families.

For Level 1A:

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.

For Level 1B:

At the request of the manufacturer, CoP families from different production facilities may be merged. For Type 1 testing this is only permitted if the planned annual production volume of each production plant is less than 1,000.

For Level 2:

The manufacturer may request to merge these CoP families.

At the request of the manufacturer, CoP families from different production facilities may be merged. For Type 1 testing this is only permitted if the planned annual production volume of each production plant is less than 1,000. The responsible authority shall evaluate on the basis of the supplied evidence by the manufacturer whether such a merge is justified.

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 check of the OBFCM device accuracy, the family means the conformity of production (CoP) family as specified in paragraphs 8.1.3.1.1 and 8.1.3.1.2.

8.1.4. Test frequency for the Type 1 test

8.1.4.1. For Level 1A and Level 2:

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.

For Level 1B:

The frequency for product verification on the Type 1 test performed by the manufacturer 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. For Level 1A:

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

For Level 1B and Level 2:

If the number of vehicles produced within the CoP family exceeds 5,000 vehicles per month, the frequency per CoP family shall be at least one verification per month.

8.1.4.4. The product verifications shall be evenly distributed over the period of 12 months or over the production period in the case that this is less than 12 months. The last product verification shall reach a decision within 12 months unless the manufacturer can justify that an extension of a maximum of one month is necessary.

8.1.4.5. The planned production volume of the CoP family per 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.

[8.5. Conformity of production for battery durability

8.5.1. Vehicles approved under this Regulation shall be so manufactured as to conform to the type approved. The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3)..]

11.  Introductory provisions

11.1. Reserved

12. Transitional and special provisions

12.1. [To be developed]

[Add transitional provisions to cover the introduction dates for OBFCM specified in Appendix 5 to this Regulation]

**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 8/1 of this Regulation, 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 8/1 of this Regulation, 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.

2. Criteria emissions

2.1. Statistical procedure and pass/fail criteria

2.1.1. For Level 1A and the criteria emissions from the 4 phases of a WLTP test in Level 2:

For the total number of tests (N) 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 total 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 Table 1A in paragraph 6.3.10. of this Regulation:

(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.

2.1.2. For Level 1B and the criteria emissions from the first 3 phases of a WLTP test in Level 2:

**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 0.1 (consumer's risk   
= 10 per cent).

For each of the criteria emissions given in Table 1B of paragraph 6.3.10. of this Regulation, the following procedure is used (see Figure 8/1 in paragraph 8.2.3.2. of this Regulation) where:

L = the natural logarithm of the limit value for the criteria emission,

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:

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If the test statistic is greater than the pass decision number for the sample size given in Table A2/1, the criteria emission is passed;

If the test statistic is less than the fail decision number for the sample size given in Table A2/1, 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 A2/1

**Pass/fail decision** **criteria 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 0.1 (consumer's risk = 10 per cent).

The measurements of the criteria emissions given in Table 1B 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 A2/2

**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 |

Table A2/2 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:

3.CO2 emissions, fuel efficiency and electric energy consumption

3.1. Statistical procedure

3.1.1. For Level 1A and the CO2 emissions and electric energy consumption from the 4 phases of a WLTP test in Level 2:

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

and

3.1.2. For Level 1B and the fuel efficiency and electric energy consumption from the first 3 phases of a WLTP test in Level 2:

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

and

3.2. Statistical evaluation

3.2.1. For Level 1A and the CO2 emissions and electric energy consumption from the 4 phases of a WLTP test in Level 2:

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

where:

CO2 test-i is the CO2 emission test value for the individual vehicle i determined according to Appendix 1 of this Regulation

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

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

3.2.2. For Level 1B and the fuel efficiency and electric energy consumption from the first 3 phases of a WLTP test in Level 2:

For the evaluation of fuel efficiency the normalised values shall be calculated as follows:

where:

FE test-i is the fuel efficiency test value for individual vehicle i determined according to Appendix 1 of this Regulation

FE declared-i is the reference fuel efficiency value as declared for the individual vehicle

3.2.3. For Level 1A and Level 1B and for 3-phase and 4-phase WLTP tests in Level 2

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

where:

ECtest-i is the electric energy consumption test value for individual vehicle i determined according to Appendix 1 of this Regulation.

EC COP-i is the reference electric energy consumption as declared for the individual vehicle i determined according to Appendix 1 of this Regulation.

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

3.3. Pass/fail criteria

3.3.1. Evaluation of CO2 emissions and electric energy consumption

For Level 1A and 4-phase WLTP test in Level 2 only:

For each total 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 A2/3.

Table A2/3

**Pass/fail decision** **criteria for the sample size**

|  | *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 |

3.3.2. Evaluation of fuel efficiency and electric energy consumption

For Level 1B and the first 3 phases of a WLTP test in Level 2 only:

3.3.2.1. For the evaluation of FE (Fuel Efficiency in km/L) the following provisions apply:

(a) If 3 ≤ N\_Evaluation ≤ 10

(i) Pass the family if

(ii) Take another measurement if

(b) If N = 11

(i) Pass the family if all the following decisions can be reached

a.

b.

c.

(ii) Fail the family if one of the following decisions can be reached

a.

b.

c.

where:

N\_Evaluation is the total number of vehicles tested during the applicable evaluation

N\_CoP family is the total number of vehicles tested in the CoP family during the year

(e.g. If the total number of vehicles tested for the first evaluation is 11 and the total number of vehicles tested for the second evaluation is 4, N\_ Evaluation=4 and N\_CoP family=15)

In any case, if N\_CoP family > 10, shall be satisfied.

3.3.2.2. For the evaluation of EC (Electric consumption in Wh/km) the following provisions apply:

(a) If 3 ≤ N\_Evaluation ≤ 10

(i) Pass the family if

(ii) Take another measurement if

(b) If N = 11

(i) Pass the family if all the following decisions can be reached

a.

b.

c.

(ii) Fail the family if one of the following decisions can be reached

a.

b.

c.

where:

N\_Evaluation is the total number of vehicles tested during the applicable evaluation

N\_CoP family is the total number of vehicles tested in the CoP family during the year

(e.g. If the vehicle tested for the first evaluation is 11 and the vehicle tested for the second evaluation is 4, N\_ Evaluation=4 and N\_CoP family=15)

In any case, if N\_CoP family > 10, shall be satisfied.

3.3.2.3. If the number of vehicles produced within the CoP family exceeds 7,500 vehicles per 12 months, for the second or later evaluation, “a. If 3 ≤ N\_Evaluation ≤ 10” may be replaced by “a. If N\_Evaluation = 3” and “b. If N\_Evaluation = 11” may be replaced by “b. If N\_Evaluation = 4”. For the second or later year, this provision shall not be used for the first evaluation for the CoP family in the year.

shall be determined from the test result of first 10 tested vehicles after start of production for each CoP family. shall not be changed once σ is determined for the CoP family even for the second or later years. At the request of the manufacturer and with the approval of the responsible authority, and with reasonable evidence and appropriate data, may be changed.

3.4. [For vehicles referred to in paragraphs 5.11.1. and 5.11.2. (a) – (b) of this Regulation the conformity of production of OBFCM devices as defined in paragraph 4.2. of Appendix 5 shall be evaluated as follows:]

(1) For each single test i performed for the purposes of paragraph 3. of this appendix the value xi shall be set equal to:

1 / (1 - Accuracy)

where the Accuracy of the OBFCM device shall be determined in accordance with paragraph 4.2. of Appendix 5. [For PEVs and OVC-HEVs the accuracy regarding the vehicle energy shall be calculated using Vehicle\_energy\_chargedREESS\_charging, measured at the mains during the application of a normal charge of the preconditioning as defined in paragraph 2.2.3 and 3.1.2 of Appendix 4 to Annex B8, and Vehicle\_energy\_chargedOBFCM, determined for the same normal charge using the differentials of the parameter "Total grid energy into the vehicle (lifetime) (kWh)"]**.**

[(2) The conformity of production of the OBFCM devices shall be evaluated according to the requirements of paragraph 3.3.1., but applying a factor A value of 1.0526.]

[(3) If for the last test N performed for the purposes of paragraph 3. the decision (iii) of paragraph 3.3.1. with regard to the conformity of production of the OBFCM devices is reached, the sequence of tests shall be continued until a final decision (i) or (ii) of paragraph 3.3.1. is reached.]

The Type Approval authority shall keep a record of the determined accuracies of OBFCM device at each test as well as the decision according to paragraph 3.3.1. after each test.

**[Appendix 5**

Devices for monitoring on board the vehicle the consumption of fuel and/or electric energy

1. Introduction

This appendix sets out the definitions and requirements applicable to the devices for monitoring on board the vehicle the consumption of fuel and/or electric energy.

[2. Definitions

2.1. "*On-board Fuel and/or Energy Consumption Monitoring Device*" ("OBFCM device") means any element of design, either software and/or hardware, which senses and uses vehicle, engine, fuel and/or electric energy parameters to determine and make available at least the information laid down in paragraph 3 of this appendix, and store the lifetime values on board the vehicle.

2.2. "*Lifetime*" value of a certain quantity determined and stored at a time *t* shall be the values of this quantity accumulated since the completion of production of the vehicle until time *t*.

2.3. "*Engine fuel rate*" means the amount of fuel injected into the engine per unit of time. It does not include fuel injected directly into the pollution control device.

2.4. "*Vehicle fuel rate*" means the amount of fuel injected into the engine and directly into the pollution control device per unit of time. It does not include the fuel used by a fuel operated heater.

2.5. "*Total Fuel Consumed (lifetime)*" means the accumulation of the calculated amount of fuel injected into the engine and the calculated amount of fuel injected directly into the pollution control device. It does not include the fuel used by a fuel operated heater.

2.6. "*Total Distance Travelled (lifetime)*" means the accumulation of the distance travelled using the same data source that the vehicle odometer uses.

[2.7. "*Grid energy*" means, for OVC-HEVs, the electric energy flowing into the battery when the vehicle is connected to an external power supply and the engine is turned off. It shall not include electrical losses between the external power source and the battery.]

[2.7. bis "Total grid energy into the battery (lifetime)" means the accumulation of the calculated amount of electric energy flowing into the battery when the vehicle is connected to an external power supply and the engine is turned off. It shall not include electrical losses between the external power source and the battery.]

2.8. "*Charge-sustaining operation*" means, for OVC-HEVs, the state of vehicle operation when the REESS state of charge (SOC) may fluctuate but the intent of the vehicle control system is to maintain, on average, the current state of charge.

2.9. "*Charge-depleting operation*" means, for OVC-HEVs, the state of vehicle operation when the current REESS SOC is higher than the charge-sustaining target SOC value and, while it may fluctuate, the intent of the vehicle control system is to deplete the SOC from a higher level down to the charge-sustaining target SOC value.

2.10. "*Driver-selectable charge-increasing operation*" means, for OVC-HEVs, the operating condition in which the driver has selected a mode of operation, with the intention to increase the REESS SOC.

2.11. "*Battery*" means one or several rechargeable electrical energy storage systems (REESS) installed in an electrified vehicle and used mainly for traction purposes.

[2.12. "*Total electric energy into the vehicle (lifetime)*" means the electric energy flowing into the vehicle from an external power supply connected via any charging interface the vehicle is equipped with.]

[2.12. bis "*Total grid energy into the vehicle (lifetime)*" means the accumulation of the electric energy flowing into the vehicle from an external power supply connected via any charging interface the vehicle is equipped with. ]

[2.xx. “*Total grid energy into the vehicle from off-board AC charging (lifetime)*” means the accumulation of the electric energy flowing into the vehicle from an AC external power supply connected via any charging interface the vehicle is equipped with.]

[2.13. "*Total electric energy out of the battery*" means for vehicles equipped with V2X capabilities [or any *Grid energy* unit], the accumulation of the calculated amount of electric energy flowing out of the battery and used for V2X applications [or consumed from any ePTO unit].]

[2.13. bis "*Total battery energy supplied to an off-board usage (lifetime)*" means for vehicles equipped with V2X capabilities, the accumulation of the calculated amount of electric energy flowing out of the REESS and used for V2X applications.]

[2.xx. "*Total energy supplied to non-propulsion usage (lifetime)*" means, for vehicles equipped with any PTO or ePTO unit, the battery energy supplied to a non-propulsion usage through a mechanical or electrical interface.]

[2.14. "*Full charging event*" means a full charge of the battery after break-off criterion is reached until the end-of-charge criterion is reached, as set out in the Type 1 test procedure.]

[2.15. "*V2X*" means the use of the battery to cover external power and energy demand.]

[2.15. bis "Vehicle-to-everything (V2X)” means the use of the traction batteries to cover external power and energy demand, such as V2G (Vehicle-to-Grid) for grid stabilization by utilising traction batteries, V2H (Vehicle-to-Home) for utilizing traction batteries as residential storage for local optimisation or emergency power sources in times of power failure, and V2L (Vehicle-to-Load, only connected loads are supplied) for use in times of power failure and/or outdoor activity in normal times.]

[2.16. "*Electric power take-off (ePTO) unit*" means any vehicle-mounted electrical unit using energy stored in the battery for the purpose of operating auxiliary equipment outside of the normal vehicle operation. To this extent, energy consumed for thermal comfort of the passengers, cabin conditioning and thermal management of the battery are to be considered part of the normal operation of the vehicle and shall not be included as energy for ePTO units.]

2.17. "*Total gaseous fuel consumed (lifetime)*" means the accumulation of the calculated amount of fuel injected into the engine and the calculated amount of fuel injected directly into the pollution control device, in kilograms. It does not include the fuel used by a fuel operated heater.

2.18. "*Total fuel consumed in petrol mode (lifetime)*" means the accumulation of the calculated amount of fuel injected into the engine and the calculated amount of fuel injected directly into the pollution control device when the vehicle operates in petrol mode, in litres. It does not include the fuel used by a fuel operated heater.

2.19. "*Total distance travelled in gas fuel mode (lifetime)*" means the accumulation of the distance travelled using the same data source that the vehicle odometer uses, while the vehicle is using LPG, NG/biomethane, or hydrogen as fuel.

2.20. "*Total distance travelled in petrol mode (lifetime)*" means the accumulation of the distance travelled using the same data source that the vehicle odometer uses, while the vehicle operates in petrol mode.

[2.21. "*Total Fuel Cell Fuel Consumed (lifetime)*" means the accumulation of the calculated amount of fuel injected into the fuel cell in kilograms."]

[2.22. "*Energy consumption rate*" means the amount of energy consumed for vehicle propulsion per unit of time.]

[2.23. "*Battery SOCE*" - see paragraph 3.12.9. of this Regulation.]

[2.24. "*Battery SOCR*" - see paragraph 3.12.10. of this Regulation.]

[2.25. "*Vehicle Identification Number*" means Vehicle identification number (VIN) prescribed in ISO 3779, chassis number or those equivalent to these]

[2.26. "*Lifetime value retention status*" means the status "0" in which Lifetime values are preserved as specified in paragraph 5.2. and the status "1" in which Lifetime values are no longer preserved as specified in paragraph 5.5.]

3. Information to be determined, stored and made available

The OBFCM device shall determine at least the following parameters and store the lifetime values on board the vehicle. The parameters shall be calculated and scaled according to the standards referred to in paragraph 6.5.3.2. (a) or (e) or (f) or (g) of Appendix 1 to Annex C5 and shall be made available as signals through the serial port connector referred to in paragraph 6.5.3.2. (c) of Appendix 1 to Annex C5.

3.1. For pure ICE, NOVC-HEVs powered exclusively by mineral diesel, biodiesel, petrol, ethanol or any combination of those fuels: and LPG for Level 1B and Level 2 only::

(a) Total fuel consumed (lifetime) (litres);

(b) Total distance travelled (lifetime) (kilometres);

(c) Engine fuel rate (grams/second);

(d) Engine fuel rate (litres/hour);

(e) Vehicle fuel rate (grams/second);

(f) Vehicle speed (kilometres/hour);

For Level 1B and Level 2 only:

(g) Vehicle Identification Number;

[(h) Lifetime value retention status;]

[3.2. For OVC-HEVs:

(a) Total fuel consumed (lifetime) (litres);

(b) Total fuel consumed in charge-depleting operation (lifetime) (litres);

(c) Total fuel consumed in driver-selectable charge-increasing operation (lifetime) (litres);

(d) Total distance travelled (lifetime) (kilometres);

(e) Total distance travelled in charge-depleting operation with engine off (lifetime) (kilometres);

(f) Total distance travelled in charge-depleting operation with engine running (lifetime) (kilometres);

(g) Total distance travelled in driver-selectable charge-increasing operation (lifetime) (kilometres);

(h) Engine fuel rate (grams/second);

(i) Engine fuel rate (litres/hour);

(j) Vehicle fuel rate (grams/second);

(k) Vehicle speed (kilometres/hour);

(l) Total grid energy into the battery (lifetime) (kWh);

[(u) Elapsed time since last charged by more than 50 per cent SOC swing [days];]

[(v) Average battery temperature while propulsion system is active, during charging and (if equipped) during non-usage of the vehicles (i.e. non-propulsion system active, non-charging);]

(w) Virtual distance (lifetime) (km) ;

(y) Total discharge energy in V2X (lifetime) (kWh);

(z) Total discharge energy for non-traction purposes (lifetime) (kWh) [applicable to category N vehicles only and if requested by the manufacturer ];

(aa) Energy throughput (lifetime) (kWh);

For Level 1A and Level 2 only:

[(m) Total [grid] electric energy into the vehicle (lifetime) (kWh) )[as of 1 January 2030] ~~[applicable to Level 1A and Level 2 only]~~;]

[(n) Total grid energy into the vehicle from off-board AC charging (lifetime) (kWh)[, as of 1 January 2030]. ~~[applicable to Level 1A and Level 2 only]~~]

For Level 1B and Level 2 only:

[(o) Energy consumption rate per second (Wh/second) ~~[applicable to Level 1B and Level 2 only]; ]~~

[(p) Battery SOCE (%) ~~[applicable to Level 1B and Level 2 only];]~~

[(q) Battery SOCR (%) ~~[applicable to Level 1B and Level 2 only];]~~

(r) Vehicle Identification Number ~~[applicable to Level 1B and Level 2 only];~~

[(s) Lifetime value retention status ~~[applicable to Level 1B and Level 2 only];]]~~

(t) Date of manufacture of the vehicle;

(x) Worst case certified energy consumption of PART B family (Wh/km);

[3.3. For PEVs:

(a) Total distance travelled (lifetime) (kilometres);

(b) Total grid energy into the battery (lifetime) (kWh);

(c) Vehicle speed (kilometres/hour);

[(d) Elapsed time since last charged by more than 50 per cent SOC swing [days];]

[(e) Average battery temperature while propulsion system is active, during charging and (if equipped) during non-usage of the vehicles (i.e. non-propulsion system active, non-charging);]

(f) Virtual distance (lifetime) (km);

(g) Total discharge energy in V2X (lifetime) (kWh);

(h) Total discharge energy for non-traction purposes (lifetime) (kWh) [applicable to category N vehicles only and if requested by the manufacturer];

(i) Energy throughput (lifetime) (kWh);

(j) REESS Current (A);

(k) REESS Voltage (V);

(l) REESS state of charge (%).

For Level 1A and Level 2 only:

(m) Total grid energy into the vehicle (lifetime) (kWh);

(n) Total grid energy into the vehicle from off-board AC charging (lifetime) (kWh);

(o) Total battery energy supplied to an off-board usage (lifetime) (kWh);

(p) Total energy supplied to non-propulsion usage (lifetime) (kWh), if applicable;

For Level 1B and Level 2 only:

(q) Energy consumption rate per second (Wh/s);

[(r) Battery SOCE (%);]

[(s) Battery SOCR (%);]

(t) Date of manufacture of the vehicle

(u) Worst case certified energy consumption of PART B family (Wh/km);

(v) Vehicle Identification Number;

(w) Lifetime value retention status

[3.4. For NOVC-FCHVs,[ applicable to Level 1B and Level 2 only]:

[(a) Total fuel consumed (lifetime) (kilograms);]

[(b) Total distance travelled (lifetime) (kilometres);]

[(c) Vehicle fuel rate (grams/second);]

[(d) Vehicle speed (km/h);]

[(e) Vehicle Identification Number;]

[(f) Lifetime value retention status;]]

[3.5. For OVC-FCHVs, [applicable to Level 1B and Level 2 only]:

[(a) Total fuel consumed (lifetime) (kilograms);]

[(b) Total fuel consumed in charge-depleting operation (lifetime) (kilograms);]

[(c) Total fuel consumed in driver-selectable charge-increasing operation (lifetime) (kilograms);]

[(d) Total distance travelled (lifetime) (kilometres);]

[(e) Total distance travelled in charge-depleting operation with fuel cell system off (lifetime) (kilometres);]

[(f) Total distance travelled in charge-depleting operation with fuel-cell active (lifetime) (kilometres);]

[(g) Total distance travelled in driver-selectable charge-increasing operation (lifetime) (kilometres);]

[(h) Total grid energy into the battery (lifetime) (kWh);]

[(i) Total electric energy into the vehicle (lifetime) (kWh); ]

[(j) Vehicle fuel rate (grams/second);]

[(k) Vehicle speed (kilometres/hour);]

[(l) Battery Current (A);]

[(m) Battery Voltage (V);]

[(n) Battery state of charge (%);]

[(o) Energy consumption rate per second (Wh/ second);]

[(p) Vehicle Identification Number;]

[(q) Lifetime value retention status;]]

[3.6. For mono-fuel gas vehicles:, [applicable to Level 1B and Level 2 only]

(a) Total gaseous fuel consumed (lifetime) (kilograms or litres);

(b) Total distance travelled (lifetime) (kilometres);

(c) Engine fuel rate (grams/second);

(e) Vehicle fuel rate (grams/second);

(f) Vehicle speed (kilometres/hour);

(g) Vehicle Identification Number;

[(h) Lifetime value retention status;]]

~~[3.7. For bi-fuel gas vehicles:, [applicable to Level 1B and Level 2 only]~~

~~[(a) Total gaseous fuel consumed (lifetime) (kilograms);]~~

~~[(b) Total fuel consumed in petrol mode (lifetime) (litres);]~~

~~[(c) Total distance travelled (lifetime) (kilometres);]~~

~~[(d) Total distance travelled in gas fuel mode (lifetime) (kilometres);]~~

~~[(e) Engine fuel rate (grams/second);]~~

~~[(f) Vehicle fuel rate (grams/second);]~~

~~[(g) Vehicle speed (kilometres/hour);]~~

~~[(h) Vehicle Identification Number]~~

~~[(i) Lifetime value retention status]]~~

4. Accuracy

4.1. With regard to the information specified in paragraph 3., the manufacturer shall ensure that the OBFCM device provides the most accurate values that can be achieved by the measurement and calculation system of the engine control unit.

[4.2. Notwithstanding paragraph 4.1., the manufacturer shall ensure that the accuracy is higher than - 0.05 and lower than 0.05 calculated with three decimals using the following formula:

For pure ICEs and NOVC-HEVs powered exclusively by mineral diesel, biodiesel, petrol, ethanol or any combination of those fuels, and for OVC-HEVs:

P2753#yIS1

Where:

Fuel\_ConsumedWLTP (litres) is the fuel consumption determined at the first test carried out in accordance with paragraph 1.2. of Annex B6, calculated in accordance with paragraph 6. of Annex B7, using emission results over the total cycle before applying corrections (output of step 2 in Table A7/1 of Annex B7), multiplied by the actual distance driven and divided by 100. For OVC-HEVs the charge-sustaining Type 1 test shall be used.

Fuel\_ConsumedOBFCM (litres) is the fuel consumption determined for the same test using the differentials of the parameter ‘Total fuel consumed (lifetime)’ as provided by the OBFCM device.

[For PEVs, OVC-HEVs, and OVC-FCHVs accuracy, to be measured as of [dates to be included in paragraph 12. ‘Transitional Provisions’.] and accuracy requirement of -0.05 to 0.05 to apply as of [date to be included in paragraph 12. ‘Transitional Provisions’]:

[



]

[Where:

Vehicle\_energy\_chargedREESS\_charging (kWh) is total energy obtained from measuring the full charging event in type-1 test according to paragraph 3.4.4.3. of Annex B8.

Vehicle\_energy\_chargedOBFCM (kWh) is the total energy as the differential in the ""Total electric energy into the vehicle (lifetime) (kWh)"" for the same full charging event.]

[For mono-fuel gas vehicles, bi-fuel gas vehicles, NOVC-FCHVs, and OVC-FCHVs, as regards gaseous fuels:]

[]

[Where:

Fuel\_ConsumedWLTP (kg) is the fuel consumption determined at the first test carried out in accordance with paragraph 1.2. of Annex B6, calculated in accordance with paragraph 6. of Annex B7, using emission results over the total cycle before applying corrections (output of step 2 in Table A7/1 of Annex B7), multiplied by the actual distance driven and divided by 100. For OVC-FCHVs the charge-sustaining Type 1 test shall be used.

Fuel\_ConsumedOBFCM (kg) is the fuel consumption determined for the same test using the differentials of the parameter ""Total gaseous fuel consumed (lifetime)""as provided by the OBFCM device."]

[4.2.1. If the accuracy requirements set out in paragraph 4.2. are not met, the accuracy shall be recalculated for subsequent Type 1 tests performed in accordance with paragraph 1.2. of Annex B6, in accordance with the formulae in paragraph 4.2., using the fuel consumed, or the vehicle energy charged, determined and accumulated over all performed tests. The accuracy requirement shall be deemed to be fulfilled once the accuracy is higher than - 0.05 and lower than 0.05.]

[4.2.2. If the accuracy requirements set out in paragraph 4.2.1. are not met following the subsequent tests pursuant to this point, additional tests may be performed for the purpose of determining the accuracy, however, the total number of tests shall not exceed three tests for a vehicle tested without using the interpolation method (vehicle H), and six tests for a vehicle tested using the interpolation method (three tests for vehicle H and three tests for vehicle L). The accuracy shall be recalculated for the additional subsequent Type 1 tests in accordance with the formulae in paragraph 4.2., using the fuel consumed, or the vehicle energy charged determined and accumulated over all performed tests. The requirement shall be deemed to be fulfilled once the accuracy is higher than - 0.05 and lower than 0.05. Where the tests have been performed only for the purpose of determining the accuracy of the OBFCM device, the results of the additional tests shall not be taken into account for any other purposes.]

[4.3. This paragraph is applicable to Level 1B and Level 2 only for PEVs and OVC-HEVs, and have an originally installed battery as defined in this Regulation.:

Notwithstanding paragraph 4.1., the manufacturer shall ensure that the accuracy of Battery SOCE comply with the rules specified in paragraph 3.1.3. of Annex 5 of UN Regulation No. 83.]

5. Access to the information provided by the OBFCM device

5.1. The OBFCM device shall provide for standardised and unrestricted access of the information specified in paragraph 3. and shall conform to the standards referred to in paragraphs 6.5.3.1. (a) and 6.5.3.2. (a) or (e) or (f) or (g) of Appendix 1 to Annex C5.

5.2. By way of exemption from the reset conditions specified in the standards referred to in paragraph 5.1. and notwithstanding paragraph 5.4., once the vehicle has entered into service the values of the lifetime counters shall be preserved.

5.3. The values of the lifetime counters may be reset only for those vehicles for which the memory type of the engine control unit is unable to preserve data when not powered by electricity. For those vehicles the values may be reset simultaneously only in the case the battery is disconnected from the vehicle.

5.4. In the case of malfunctioning affecting the values of the lifetime counters, or replacement of the engine control unit, the counters may be reset simultaneously to ensure that the values remain fully synchronised.

[5.5. [This paragraph is applicable to Level 1B and Level 2 only]

In cases where the lifetime values are no longer preserved [notwithstanding the provisions of paragraph 5.2.], the fact that they are no longer preserved shall be recorded in the [ECU] [relevant control unit] and the record concerned shall not be deleted easily.]

[5.6. Manufacturers shall provide functions to deter modifications to on-board fuel and power consumption measurement devices other than modifications approved by the manufacturer. Manufacturers shall permit modifications when such modifications are necessary for vehicle diagnosis, maintenance, inspection, retrofitting or repair. Removable calibration memory chips shall be embedded, contained in a sealed container or protected by an electronic algorithm and shall not be altered without specialized tools or procedures. Vehicle manufacturers that use programmable computer code systems, such as electrically erasable and programmable read-only memory, EEPROMs, etc., shall deter unauthorized reprogramming. Automobile manufacturers shall employ robust tamper-resistant measures and write-protection features that require electronic access to an off-site computer maintained by the automobile manufacturer.]]

Annexes Part A

The Type Approval requirements and documentation included in Annexes Part A are common to Level 1A and Level 1B. This means that certain elements may not be required for the level of approval being sought. In such an instance the element may be omitted.

Where relevant, the Type Approval requirements and documentation included in Annexes Part A provide separate reporting tables/fields for the results after 3-phases and the results after 4-phases.

Annex A1

Engine and vehicle characteristics and information concerning the conduct of tests (‘information document’)

Annex A1 - Appendix 1

WLTP Test Report

**Test Reports**

A Test Report is the report issued by the technical service responsible for conducting the tests according this regulation.

Annexes Part C

[The annexes in Annexes Part C describe the procedures for determining the durability of batteries for electrified vehicles, the Type 4 and Type 5 test procedures, and provisions regarding On-Board Diagnostics (OBD).]

[Annex C1

Battery Durability

[This Regulation applies to vehicles of categories M1 and N1 that (a) are PEV or OVC-HEV vehicles, and (b) have an originally installed battery as defined in this Regulation.

This Annex applies to

(a) PEV or OVC-HEV vehicles, and

(b) have an originally installed battery as defined in this Regulation.

While manufacturers commonly estimate or publicise other range-based metrics for informational purposes (such as, for example, an in-use range under real driving conditions, or the remaining range available before the next charging event), the range-related provisions of this Regulation are concerned only with the certified range as would be measured by the applicable certification test procedure.]

1. Requirements

1.1. State-of-Certified Range and State-of Certified Energy (SOCR and SOCE) monitors

1.1.1. The manufacturer shall install SOCR and SOCE monitors that operate during the life of the vehicle. The SOCR monitor shall maintain an estimate of the state of certified range (on-board SOCR), and the SOCE monitor shall maintain an estimate of the state of certified energy (on-board SOCE).

The manufacturer shall determine the algorithms by which on-board SOCR and on-board SOCE are determined for the vehicles they produce. The manufacturer shall update the on-board SOCR and SOCE with sufficient frequency as to maintain the necessary degree of accuracy during all normal vehicle operation.

The on-board SOCR and SOCE shall have at least a resolution of 1 part in 100 and be used for the purposes of verification as the nearest whole number from 0 to 100.

1.1.2. The manufacturer shall make available the most recently determined values of the on-board SOCR and on-board SOCE and these parameters defined in paragraph 3.3. (a), (d), (e), (f), (g) ,(h), (i), (r), (s), (t), (u) of Appendix 5 shall conform to the standards referred to in paragraphs 6.5.3.1. (a) and 6.5.3.2. (a) or (e) or (f) or (g) of Appendix 1 to Annex C5.

For Level 1A and Level 2 only

The manufacturer shall make available the most recently determined values of the on-board SOCR and on-board SOCE via over-the-air (OTA).

1.1.3. For the purposes of consumer information, the manufacturer shall make easily available to the owner of the vehicle the most recently determined value of the SOCE monitor via at least one appropriate method. The method for the customer values shall be determined in agreement with the authorities. For example:

(a) dashboard indicator;

(b) infotainment system;

(c) remote access (such as via mobile-phone applications). The SOCE value for the purpose of consumer information shall have a resolution of 1 part in 100 as the nearest whole number from 0 to 100.

1.2. Battery Performance Requirements

The battery durability requirements of this Regulation are defined in terms of Minimum Performance Requirements (MPRi), which represent minimum allowable values for SOCE and SOCR at specific points in the lifetime of the vehicle. Vehicles falling under the categories of OVC-HEVs and PEVs shall meet both of the Minimum Performance Requirements in Tables 1 and 2 below. The MPRs may differ depending on the category of the vehicle and type of propulsion.

Table 1

**Battery Energy based (SOCE) MPR**

|  |  |  |
| --- | --- | --- |
| *Vehicle age/km for category M in the scope of this Regulation* | *OVC-HEV* | *PEV* |
| From start of life to 5 years or 100,000 km, whichever comes first | 80 per cent | 80 per cent |
| Vehicles more than 5 years or 100,000 km, and up to whichever comes first of 8 years or 160,000 km | 72 per cent | 72 per cent |
| *Vehicle age/km for category N in the scope of this Regulation* | *OVC-HEV* | *PEV* |
| From start of life to 5 years or 100,000 km, whichever comes first | 75 per cent | 75 per cent |
| Vehicles more than 5 years or 100,000 km, and up to whichever comes first of 8 years or 160,000 km | 67 per cent | 67 per cent |

Table 2

**Range based (SOCR) MPR**

|  |  |  |
| --- | --- | --- |
| *Vehicle age/km for category M in the scope of this Regulation* | *OVC-HEV* | *PEV* |
| From start of life to 5 years or 100,000 km, whichever comes first | (Reserved) | (Reserved) |
| Vehicles more than 5 years or 100,000 km, and up to whichever comes first of 8 years or 160,000 km | (Reserved) | (Reserved) |
| *Vehicle age/km for category N in the scope of this Regulation* | *OVC-HEV* | *PEV* |
| From start of life to 5 years or 100,000 km, whichever comes first | (Reserved) | (Reserved) |
| Vehicles more than 5 years or 100,000 km, and up to whichever comes first of 8 years or 160,000 km | (Reserved) | (Reserved) |

SOCR monitors of vehicles of category M1 and N1 vehicles shall be installed and their values monitored in view of setting the values in the tables for Part B verification of battery durability in paragraph 4. of Annex 7 of UN Regulation No. 83 as well as accuracy requirements in paragraph 3. of Annex 5 of UN Regulation No. 83 of Part A verification of SOCE/SOCRmonitors in a future amendment of this Regulation.

A manufacturer may elect to declare a Declared Performance Requirement (DPRi) having an SOCE and/or SOCR value that is higher than that of the corresponding MPR. The DPRi shall then replace the MPRi for the purposes of determining compliance by that manufacturer.

The manufacturer shall ensure that batteries installed in vehicles comply with the rules specified in paragraph 4.3. of Annex 5 of UN Regulation No. 83 for the MPRi (or DPRi if applicable).

At the request of the manufacturer and for vehicles designed with V2X or for Category N vehicles used for non-traction purposes, the equivalent virtual distance calculated following the equation below will be reported by each vehicle.

Where:

“worst case certified energy consumption Part B family” means the worst case certified energy consumption of a Part B family, as defined in paragraph 6.3.12.2. of this Regulation, which needs to be provided according to Appendix 2 of this annex.

At the option of the manufacturer, instead of using the worst case certified energy consumption value of the Part B family, , as defined in paragraph 6.3.12.2. of this Regulation, the manufacturer may be allowed to use any higher energy consumption value.

The virtual distance value shall comply with the accuracy specified in paragraph 5.2. of Annex 5 of UN Regulation No. 83 for the virtual distance verification.

The total distance used for confirming the compliance with the minimum performance requirements will consist of the sum of the distance driven and the virtual distance. The total virtual distance shall be recorded and monitored.

1.3. The vehicle manufacture shall demonstrate compliance defined in paragraph 1.1. and 1.2. by using the following procedure during type approval..

1.3.1. Monitor Requirement ~~and its accuracy~~

Technical Service shall check the accessibility of monitor parameter define in paragraph xxxx to this Regulation and shall confirm the technical explanation and/or technical evidence provided by the vehicle manufacture to comply the SOCE accuracy defined in paragraph zzz of the UNR83 09 series

1.3.2. Battery Performance Requirements

Technical Service shall confirm the technical explanation and/or technical evidence provided by the vehicle manufacture to comply the MPRs defined in paragraph zzz of the UNR83 09 series.

1.4. This paragraph is applicable to Level 1A only

Without prejudice to paragraph 1.3., the vehicle manufacture may declare the compliance defined in paragraphs 1.1. and 1.2. during Type Approval.

~~Annex C1 - Appendix 1~~

~~Vehicle Survey~~

~~The vehicle survey shall be used for all vehicles selected for testing in Part A of the verification of SOCE/SOCR monitors defined in paragraph 3. of Annex 5 of UN Regulation No. 83. Vehicles that fall under one of the exclusion criteria below shall be eliminated from testing, or otherwise updated according to the procedures described below.~~

|  |  |  |  |
| --- | --- | --- | --- |
|  | **~~x = Exclusion Criteria~~** | **~~x = Checked and reported~~** | **~~Confidential~~** |
| **~~Date:~~** |  |  | **~~x~~** |
| **~~Name of investigator:~~** |  |  | **~~x~~** |
| **~~Location of test:~~** |  |  | **~~x~~** |
| **~~Country of registration:~~** |  | **~~x~~** |  |
|  |  |  |  |

~~Vehicle Characteristics~~

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **~~x = Exclusion Criteria~~** | **~~x = Checked and reported~~** | **~~Confidential~~** | |
| **~~Registration plate number:~~** |  | **~~x~~** | **~~x~~** | |
| *~~The vehicle must have both~~* ***~~‘age’ and ‘distance~~******~~travelled’~~*** *~~(defined as the time elapsed after manufacture) below the ones required in paragraph 1.2. of this annex for the MPR verification~~* | **~~x~~** |  |  | |
| ~~Is the vehicle either PEV or OVC-HEV?~~  ~~If no: the vehicle cannot be selected~~ | **~~x~~** |  |  | |
| **~~Date of manufacture:~~** |  | **~~x~~** |  | |
|  |  |  |  | |
| **~~[VIN:~~** |  | **~~x]~~** |  | |
| **~~Emission class and character or Model Year~~** |  | **~~x~~** |  | |
| **~~Country of registration:~~**  *~~The vehicle must be registered in a Contracting Party~~* | **~~x~~** | **~~x~~** |  | |
| **~~Model:~~** |  | **~~x~~** |  | |
| **~~Engine code (where applicable):~~** |  | **~~x~~** |  | |
| **~~Engine capacity (l) (where applicable):~~** |  | **~~x~~** |  | |
| **~~Engine power (kW) (where applicable):~~** |  | **~~x~~** |  | |
| **~~Electric motor code:~~** |  | **~~x~~** |  | |
| **~~Electric motor power (kW):~~** |  | **~~x~~** |  | |
| **~~Electric powertrain type~~** |  | **~~x~~** |  | |
| **~~Energy capacity and type of battery~~** |  | **~~x~~** |  | |
| **~~Gearbox type (auto/manual):~~** |  | **~~x~~** |  | |
| **~~Drive axle (FWD/AWD/RWD):~~** |  | **~~x~~** |  | |
| **~~Tyre size (front and rear if different):~~** |  | **~~x~~** |  | |
| **~~Average fuel consumption for OVC-HEVs~~** |  | **~~x~~** |  | |
| **~~Has the vehicle been involved in a recall or service campaign? If yes: Which one? Have the campaign repairs already been done?~~**  *~~The repairs must have been done before selecting the vehicle.~~* | **~~x~~** | **~~x~~** |  | |
| **~~Vehicle Owner Interview~~**  *~~(the owner will only be asked the main questions and shall have no knowledge of the implications of the replies)~~* |  |  |  | |
|  |  |  |  | |
| **~~Name of the owner (only available to the accredited inspection body or laboratory/technical service)~~** |  |  | ~~x~~ | |
| **~~Contact (address / telephone) (only available to the accredited inspection body or laboratory/technical service)~~** |  |  | ~~x~~ | |
|  |  |  |  | |
| **~~How many owners did the vehicle have?~~** |  | **~~x~~** |  | |
| **~~Did the odometer always work?~~** *~~If no, the vehicle cannot be selected.~~* | **~~x~~** |  |  | |
| **~~Was the vehicle used for one of the following?~~** |  |  |  | |
| ~~As car used in show-rooms?~~ |  | **~~x~~** |  | |
| ~~As a taxi?~~ |  | **~~x~~** |  | |
| ~~As a delivery vehicle?~~ |  | **~~x~~** |  | |
| ~~For racing / motor sports?~~ | **~~x~~** |  |  | |
| ~~As a rental car?~~ |  | **~~x~~** |  | |
| **~~Has the vehicle carried heavy loads over the specifications of the manufacturer?~~** *~~If yes, the vehicle cannot be selected.~~* | **~~x~~** |  |  | |
| **~~Have there been major engine, electric motor or vehicle repairs?~~** |  | **~~x~~** |  | |
| **~~Have there been unauthorised major engine or vehicle repairs?~~**  *~~If yes, the vehicle cannot be selected.~~* | **~~x~~** |  |  | |
| **~~Was the propulsion battery changed or repaired?~~**  *~~If yes, the vehicle cannot be selected for testing, but information should be collected~~* | **~~x~~** | **~~x~~** |  | |
| **~~Has there been an unauthorised power increase/tuning?~~** *~~If yes, the vehicle cannot be selected.~~* | **~~x~~** |  |  | |
| **~~Was any part of the emissions after-treatment system modified (where applicable)?~~**  *~~If yes, the vehicle cannot be selected~~* | **~~x~~** |  |  | |
| **~~Where has your vehicle been used more often?~~** |  |  |  | |
| ~~% motorway~~ |  | **~~x~~** |  | |
| ~~% rural~~ |  | **~~x~~** |  | |
| ~~% urban~~ |  | **~~x~~** |  | |
| **~~Has the vehicle been maintained and used in accordance with the manufacturer's instructions?~~** *~~If not, the vehicle cannot be selected.~~* | **~~x~~** |  |  | |
| **~~Is a full service and repair history including any re-works available?~~** *~~If the full documentation cannot be provided, the vehicle cannot be selected.~~* | **~~x~~** |  |  | |
| **~~Battery related checks:~~** |  |  |  | |
| **~~How often did you charge the vehicle when:~~**  **~~%with battery almost at 0 charge~~**  **~~%with battery half charged~~**  **~~%with battery almost fully charged~~** | **~~-~~**  **~~-~~**  **~~-~~** | **~~x~~**  **~~x~~**  **~~x~~** |  | |
| **~~On average how often were fast or superfast chargers used per month?~~** |  | **~~x~~** |  | |
| **~~What is your estimation of the percentage of time that the vehicle was used in the following ambient temperature ranges:~~**  **~~Below -7°C:~~**  **~~Between -7°C and 35°C:~~**  **~~More than 35°C:~~** |  | **~~x~~**  **~~x~~**  **~~x~~** |  | |
|  |  |  |  | |
| **~~Vehicle Examination and Maintenance by the Testing Centre (please use the relevant entries according to the type of vehicle)~~** | **~~x= Exclusion Criteria~~** | **~~x=checked and reported~~** | | **~~[Relevant for EV]~~** |
|  |  |  | |  |
| **~~When was the vehicle last adequately\* charged?~~**  *~~If the vehicle has not been charged adequately during the last month (as evidenced by values read from the vehicle under point 5, Appendix 2 of this annex), then it has to be conditioned before testing by driving the vehicle no less than 50 km and in a manner that results in discharge of at least 50 per cent of the usable capacity of the battery, followed by a full recharge.~~*  ~~Note: \* Adequately in this sense means that the vehicle was not charged in a manner stated by the manufacturer that would lead to an accurate SOCE/SOCR~~ | **~~x~~** |  | | **~~x~~** |
| **~~Fuel tank level (full / empty) (where applicable)~~** ~~Is the fuel reserve light ON?~~ *~~If yes, refuel before test.~~* |  | **~~x~~** | |  |
| **~~Are there any warning lights on the instrument panel activated indicating a vehicle or exhaust after-treatment system malfunctioning (where applicable) that cannot be resolved by normal maintenance? (Malfunction Indication Light, Engine Service Light, etc?)~~**  *~~If yes, the vehicle cannot be selected~~* | **~~x~~** |  | |  |
| **~~Is the SCR light (where applicable) on after engine-on?~~**  *~~If yes, the reagent should be filled, or the repair executed before the vehicle is used for testing.~~* | **~~x~~** |  | |  |
| **~~Visual inspection exhaust system (where applicable)~~** ~~Check leaks between exhaust manifold and end of tailpipe. Check and document (with photos)~~ *~~If there is damage or leaks, the vehicle cannot be tested~~* | **~~x~~** |  | |  |
| **~~Exhaust gas relevant components (where applicable)~~** ~~Check and document (with photos) all emissions relevant components for damage.~~ *~~If there is damage, the vehicle cannot be tested~~* | **~~x~~** |  | |  |
| **~~Air filter and oil filter (where applicable)~~** ~~Check for contamination and damage. Change if damaged or heavily contaminated or less than 800 km before the next recommended change.~~ |  | **~~x~~** | |  |
| **~~Wheels (front & rear)~~** ~~Check whether the wheels are freely moveable or blocked or impeded by the brake.~~  *~~If not freely moveable, the vehicle cannot be selected.~~* | **~~x~~** |  | | **~~Y~~** |
| **~~Drive belts & cooler cover~~***~~In case of damage, the vehicle cannot be tested.~~* | **~~x~~** |  | |  |
| **~~Check fluid levels (where applicable)~~** ~~Check the max. and min. levels (engine oil, cooling liquid) / top up if below minimum~~ |  | **~~x~~** | |  |
| **~~Vacuum hoses and electrical wiring~~** ~~Check all for integrity.~~ *~~In case of damage, the vehicle cannot be tested.~~* | **~~x~~** |  | | **~~Y~~** |
| **~~Injection valves / cabling (where applicable)~~** ~~Check all cables and fuel lines.~~ *~~In case of damage, the vehicle cannot be tested.~~* | **~~x~~** |  | | **~~Y~~** |
| **~~Ignition cable (gasoline) (where applicable)~~** ~~Check spark plugs, cables, etc. In case of damage, replace them.~~ |  | **~~x~~** | |  |
| **~~EGR & Catalyst, Particle Filter (where applicable)~~** ~~Check all cables, wires and sensors.~~  *~~In case of tampering or damage, the vehicle cannot be selected.~~* | **~~x~~** |  | |  |
| **~~Safety condition~~** ~~Check tyres, vehicle’s body, electrical and braking system status are in safe conditions for the test and respect road traffic rules.~~  *~~If not, the vehicle cannot be selected.~~* | **~~x~~** |  | | **~~Y~~** |
| **~~Semi-trailer~~** ~~Are there electric cables for semi-trailer connection, where required?~~ |  | **~~x~~** | | **~~Y~~** |
| **~~Check if less than 800 km away from next scheduled service, if yes, then perform the service.~~** |  | **~~x~~** | | **~~Y~~** |
| **~~Powertrain Control Module calibration part number and checksum~~** |  | **~~x~~** | | **~~Y~~** |
| **~~OBD diagnosis (before or after the range test)~~** ~~Read Diagnostic Trouble Codes & Print error log~~ |  | **~~x~~** | |  |
| **~~OBD Service Mode 09 Query (before or after the range test)~~** ~~Read Service Mode 09. Record the information.~~ |  | **~~x~~** | |  |
| **~~OBD mode 7 (before or after the range test)~~**  ~~Read Service Mode 07. Record the information~~ |  | **~~x~~** | |  |
|  |  |  | |  |
|  |  |  | |  |

**~~Remarks for: Repair / replacement of components / part numbers~~**

~~Annex C1 - Appendix 2~~

~~Values to be read from vehicles~~

~~The manufacturer shall make available the following values to be read visually or via the on-board network:~~

**~~Mandatory values:~~**

~~1. On board SOCE value [%]~~

~~2. On board SOCR value [%]~~

~~3. Odometer (i.e. distance driven by the vehicle) [km]~~

~~4. Date of manufacture of the vehicle~~

~~5. Elapsed time since last charged by more than 50 per cent SOC swing [days]~~

~~6. Average battery temperature while propulsion system is active, during charging and (if equipped) during non-usage of the vehicles (i.e. non-propulsion system active, non-charging)~~

**~~Values required if manufacturer applies virtual distance option:~~**

~~7. Total distance (sum of the distance driven as reported by the odometer and the virtual distance) [km]~~

~~8. Virtual distance [km]~~

~~9. Worst case certified energy consumption of PART B family [Wh/km]~~

~~10. Total discharge energy in V2X [kWh]~~

~~11. Total discharge energy for non-traction purposes [kWh], only applicable for category 2 vehicles and if requested by the manufacturer~~

**~~Values that may be required by regional regulations:~~**

~~12. Energy throughput [kWh]~~

Annex C1 - Appendix 3

Determination of Performance Parameter during Part A verification of SOCE/SOCR monitors Test Procedure

1. General

For the calculation of SOCEmeasured and SOCRmeasured according to paragraph 3.1.2. of Annex 5 of UN Regulation No. 83, the measured and certified values of usable battery energy (UBE) and electric range (PER for PEVs and EAER for OVC-HEVs) are required:

 UBEmeasured and UBEcertified

 Rangemeasured and Rangecertified

[This annex describes the determination of these parameters in case of WLTP, in paragraph 2. for PEVs and in paragraph 3. for OVC-HEVs and sets out the requirements for which measurements need to be performed and which certified values need to be applied for a vehicle selected in the Part A verification procedure defined in paragraph 3. of Annex 5 of UN Regulation No. 83.]

For the purposes of this annex, for PEVs the term ’battery‘ includes not only REESS used mainly for traction purposes, but also all other REESSs.

2. Performance parameters for PEVs

2.1. UBE for PEVs

2.1.1. Measured UBE values for PEVs

|  |  |  |
| --- | --- | --- |
| *Parameters* | *Explanation* | |
| UBEmeasured | Shortened Test Procedure (STP) | Consecutive Cycle Procedure (CCP) |
| UBE value shall be determined according to UN-R154 Annex 8, Table A8/11 Step no. 1. | UBE value shall be determined according to  UN-R154 Annex 8, Table A8/10 Step no. 1. |
| No rounding shall be applied on UBEmeasured. | |

2.1.2. Certified UBE values for PEVs

| *Parameters* | *Explanation* | |
| --- | --- | --- |
| UBEcertfied | Shortened Test Procedure (STP) | Consecutive Cycle Procedure (CCP) |
| UBEcertified is the adjusted measured usable battery energy (UBE) of the vehicle at certification:  where:  is the measured usable battery energy according to UN-R154 Annex 8, Table A8/11 Step no.1 at certification. In the case of more than one test (number of tests), the determined UBE values shall be averaged.  is the adjustment factor determined according to UN-R154, Annex 8, Table A8/11 Step no. 6. | UBEcertified is the adjusted measured usable battery energy (UBE) of the vehicle at certification:  where:  is the measured usable battery energy according to UN-R154 Annex 8, Table A8/10 Step no.1 at certification. In the case of more than one test (number of tests), the determined UBE values shall be averaged.  is the adjustment factor determined according to UN-R154, Annex 8, Table A8/10 Step no. 7. |
| UBEcertfied shall be rounded according to paragraph 6.1.8. of this Regulation:  - To the nearest whole number if the unit is Wh  - To three significant numbers if the unit is kWh | |
| In the case the interpolation method is applied, UBEcertified shall be determined by selecting  - The maximum UBEmeasured xAF) amongst vehicle H and vehicle L; | |

2.2. Range for PEVs

2.2.1. Measured Range values for PEVs

|  |  |  |
| --- | --- | --- |
| *Parameters* | *Explanation* | |
| Rangemeasured | Shortened Test Procedure (STP) | Consecutive Cycle Procedure (CCP) |
| Range value (PERWLTC) shall be determined according to UN-R154 Annex 8, Table A8/11, Step no. 4. | Range value (PERWLTC) shall be determined according to UN-R154 Annex 8, Table A8/10, step no. 5. |
| No rounding shall be applied on Rangemeasured. | |

2.2.2. Certified Range values for PEVs

|  |  |  |
| --- | --- | --- |
| *Parameters* | *Explanation* | |
| Rangecertified | Shortened Test Procedure (STP) | Consecutive Cycle Procedure (CCP) |
| Range value (PERWLTC) according to UN-R154 Annex 8, Table A8/11 Step no.6. or 9†. | Range value (PERWLTC) according to UN-R154 Annex 8, Table A8/10 Step no.7. or 10†. |
| Rangecertified shall be rounded to the nearest whole number according to paragraph 6.1.8. of this Regulation. | |

Note: †depending on whether the interpolation method is applied or not

3. Performance parameters for OVC-HEVs

3.1. UBE for OVC-HEVs

3.1.1. Measured UBE values for OVC-HEVs

| *Parameters* | *Explanation* |
| --- | --- |
| UBEmeasured | UBEmeasured shall be the usable battery energy calculated as follows:  Where:  UBEmeasured,nc is the non-corrected usable battery energy of the charge-depleting test, (Wh);  is the electric energy change of the confirmation cycle, Wh;  is the average electric energy change of the confirmation cycle, (Wh);  CC means confirmation cycle as defined in UN-R154 Annex 8, paragraph 3.2.4.4.  The correction with the average electric energy change in the confirmation cycle is required as the break-off criterion, according to UN-R154 Annex B8, paragraph 3.2.4.5., allows a toggling around the absolute reference level. The correction shall compensate for this effect and is visualized in the following figure:  A graph with lines and numbers  AI-generated content may be incorrect. |
| The required input parameter UBEmeasured,nc is calculated as follows:  where:  is the measured electric energy change of battery i, (Wh);  i is the index number of the considered battery;  n is the total number of batteries;  and:  where:  is the voltage of battery i, V;  is the electric current of battery i, A;  t0 is the time at the beginning of the charge-depleting test, s;  tend is the time at the end of the confirmation cycle of the charge-depleting test, s;  is the conversion factor from Ws to Wh. |
| The required input parameter is calculated as follows:  Where:  is the average of the measured electric energy change of battery *i* during the confirmation cycle, (Wh);  is the index number of considered battery;  *n* is the total number of batteries;  and  where:  is the voltage of battery *i*, in V  is the current of battery *i*, in A  is the time at the beginning of the confirmation cycle of the charge-depleting test, s;  is the time at the end of the confirmation cycle of the charge-depleting test, s;  is the conversion factor from Ws to Wh.  CC means confirmation cycle as defined in UN-R154 Annex B8, paragraph 3.2.4.4. |
| No rounding shall be applied on UBEmeasured. | |

3.1.2. Certified UBE values for OVC-HEVs

|  |  |
| --- | --- |
| *Parameters* | *Explanation* |
| UBEcertified | UBEcertified is the adjusted measured usable battery energy (UBE) of the vehicle at certification:  Where:  is the measured usable battery energy at certification according to paragraph 3.1.1. of this appendix, Wh;  is the adjustment factor determined as described below.  At the option of the Contracting Party, one out of the following two adjustment factors shall be selected:  - Adjustment factor 1:  where:  is the electric energy consumption ECAC.CD according to UN-R154 Annex 8, Table A8/8, Step no. 14 at certification, Wh/km;  is the measured electric energy consumption ECAC,CD according to UN-R154 Annex 8, Table A8/8, Step no. 13 at certification. Wh/km.  - Adjustment factor 2:  where:  is EC according to UN-R154 Annex B8, Table A8/9, Step no. 8 at certification, Wh/km;  is measured EC according to UN-R154 Annex B8, Table A8/9, Step no. 7 at certification. Wh/km. |
| UBEcertfied shall be rounded according to paragraph 7 of this Regulation:  - To the nearest whole number if the unit is Wh  - To three significant numbers if the unit is kWh |
| In the case the interpolation method is applied, UBEcertified shall be determined by selecting:  - The maximum (UBEmeasured xAF) amongst vehicle H and vehicle L and (if applicable) vehicle M. |

3.2. Range for OVC-HEVs

3.2.1. Measured range values for OVC-HEVs

|  |  |
| --- | --- |
| *Parameters* | *Explanation* |
| Rangemeasured | Rangemeasured is the measured equivalent all-electric range as defined in the equation below:  where:   |  |  | | --- | --- | | *MCO2,CD,avg* | is the arithmetic average charge-depleting CO2 mass emission according to [UN-R154, Annex 8, Paragraph 4.4.4.1., g/km;] | | *MCO2,CS* | is the charge-sustaining CO2 mass emission according to UN-R154, Annex 8, Table A8/5 Step no. 5, g/km; | | *RCDC* | is the measured length of the charge-depleting test according to UN-R154, Annex B8, Table A8/8, Step no. 3, km; | |
| No rounding shall be applied on Rangemeasured. |

3.2.2. Certified range values for OVC-HEVs

|  |  |
| --- | --- |
| *Parameters* | *Explanation* |
| Rangecertified | Rangecertified (EAER) according to UN Regulation No. 154, Series of amendments 02 or later, Annex B8, Table A8/9 Step no. 8 or 9† at certification. |
| Rangecertified shall be rounded to the nearest whole number according to paragraph 6.1.8. of this Regulation. |

*Note:* †depending on whether the interpolation method is applied or not

]

Annex C2: (Reserved)

1. \* In accordance with the programme of work of the Inland Transport Committee for 2025 as outlined in proposed programme budget for 2025 (A/79/6 (Sect. 20), table 20.6), 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)
2. Page number will be added at a later stage prior to WP.29 submission [↑](#footnote-ref-3)