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| Working draft of new UNR WLTP – excluding Annexes  The text has been based on text from the Working Document for GTR15 Amendment 5 (submitted to UNECE on 17th October 2018) and EU 2017/1151 both 1st Act and 2nd Act (for Level 1a and Level 2 where applicable).  Text has been updated to reflect amendments agreed at the 25th IWG and 78th GRPE as documented in Informal Document GRPE-78-25e.  There are some areas where alternative texts covering the same requirements have been added so that the most appropriate version, or combinations of text can be discussed and agreed.  Comments added to reflect content of document prepared by Japan for the 26th WLTP IWG (“*Additional discussion points for UNR WLTP Apr2019 JPN*”). These comments are shown by user name ‘JPN additional discussion points Apr19’ (Abbreviated as ‘JPN0419’) and are also identified by the symbol **¥.**  **Rob Gardner 14th April 2019**  Updates made during Task Force meeting on 8th May 2019 shown by User Name “Trans Task Force 090519”  Updates made prior to Task Force Meeting on 20th June shown by User Name “Rob Gardner June 2019” – abbreviated as “RG0619”  Version for Task Force meting 05-Sep-19  **Updates for 28th IWG**  **Updated proposal for Scope added**  **Abbreviations added**  **Additional identifiers for denoting L1a, L1b and L2 and ‘All Levels’ added**  **New definition for** *'Configurable start mode'* **added**  **11-Oct-19**  **Text added for gas fuelled vehicles** |

**Regulation No. ‘WLTP’**

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.

**1. Scope**

This Regulation provides requirements for two 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. The second level requires testing using a 3-phase WLTC cycle (low, medium and high as defined in Annex B1) – this is called Level 1b.

Where the requirements in this Regulation apply to either Level 1a or Level 1b only the Regulatory text uses “Level 1a only” or “Level 1b only” to denote the start of the level specific requirements. The use of the text “All levels” denotes where requirements apply to both Level 1a and Level 1b.

The level applies until the point where the next level identifier occurs.

Scope for Level 1A;

This Regulation applies to the type approval of vehicles of categories M1, M2, N1 and N2 with a reference mass not exceeding 2,610 kg with regard to the WLTP Type 1 test for 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 and On-Board Diagnostic (OBD) systems.

At the manufacturer's request, type approval granted under this Regulation may be extended from vehicles mentioned above to M1, M2, N1 and N2 vehicles with a reference mass not exceeding 2,840 kg and which meet the conditions laid down in this Regulation.

Scope for Level 1B;

This Regulation applies to the type approval of vehicles of categories M2, N1 and N2 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 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, to the Type 4 test.

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

Scope for Level 2;

This Regulation applies to the type approval of vehicles of categories M1 with a reference mass not exceeding 2,610 kg and vehicles of categories M2 and N1 with a reference mass not exceeding 2,610 kg and a technical permissible maximum laden mass not exceeding 3,500 kg 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, 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.

At the manufacturer's request, type approval granted under this Regulation may be extended from vehicles mentioned above to vehicles of categories M1 with a reference mass not exceeding 2,840 kg and vehicles of categories M2 and N1 with a reference mass not exceeding 2,840 kg and a technical permissible maximum laden mass not exceeding 3,500 kg and which meet the conditions laid down in this Regulation.

**2. Abbreviations**

2.1. General abbreviations

|  |  |
| --- | --- |
| AC | Alternating current |
| CFD | Computational fluid dynamics |
| CFV | Critical flow venturi |
| CFO | Critical flow orifice |
| CLD | Chemiluminescent detector |
| CLA | Chemiluminescent analyser |
| CVS | Constant volume sampler |
| DC | Direct current |
| 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 |
| 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 |
| 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 |
| LC | Liquid chromatography |
|  |  |
| LPG | Liquefied petroleum gas |
| 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 |
| OBFCM | On-board fuel and/or energy consumption monitoring |
| 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 |
| Per cent FS | Per cent of full scale |
| 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 |
|  | Charge-depleting actual range |
| RCB | REESS charge balance |
| REESS | Rechargeable electric energy storage system |
| RRC | Rolling resistance coefficient |
| SSV | Subsonic venturi |
| USFM | Ultrasonic flow meter |
| 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:

3.0.1 For Level 1A

"Vehicle type with regard to emissions" means a group of vehicles which:

(a) do not differ with respect to the criteria constituting an "interpolation family" as defined in paragraph 6.3.2.;

(b) fall in a single "CO2 interpolation range" within the meaning of paragraph 2.3.2 of Annex B6;

(c) do not differ with respect to any characteristics that have a non-negligible influence on tailpipe emissions, such as, but not limited to, the following:

— types and sequence of pollution control devices (e.g. three-way catalyst, oxidation catalyst, lean NOx trap, SCR, lean NOx catalyst, particulate trap or combinations thereof in a single unit);

— exhaust gas recirculation (with or without, internal/external, cooled/non-cooled, low/high pressure).

Level 1B = JPN definition TBD

Level 2 = TBD

3.03. "*Engine capacity*" means:

For reciprocating piston engines, the nominal engine swept volume.

For rotary piston engines (Wankel), twice the nominal swept volume of a combustion chamber per piston.

3.0.4.

3.0.4. "*Approval of a vehicle*" means the approval of a vehicle type with regard to the scope of this Regulation.

Purple = from GTR15 17.10.2018

3.1. Test equipment

3.1.1. "*Accuracy*" means the difference between a measured value and a reference value, traceable to a national standard and describes the correctness of a result. See Figure 1.

3.1.2. "*Calibration*" means the process of setting a measurement system's response so that its output agrees with a range of reference signals.

3.1.3. "*Calibration gas*" means a gas mixture used to calibrate gas analysers.

3.1.4. "*Double dilution method*" means the process of separating a part of the diluted exhaust flow and mixing it with an appropriate amount of dilution air prior to the particulate sampling filter.

3.1.5. "*Full flow exhaust dilution system*" means the continuous dilution of the total vehicle exhaust with ambient air in a controlled manner using a Constant Volume Sampler (CVS).

3.1.6. "*Linearization*" means the application of a range of concentrations or materials to establish a mathematical relationship between concentration and system response.

3.1.7. "*Major maintenance*" means the adjustment, repair or replacement of a component or module that could affect the accuracy of a measurement.

3.1.8. "*Non-Methane Hydrocarbons*" (NMHC) are the Total Hydrocarbons (THC) minus the methane (CH4) contribution.

3.1.9. "*Precision*" means the degree to which repeated measurements under unchanged conditions show the same results (Figure 1) and, in this Regulation, always refers to one standard deviation.

3.1.10. "*Reference value*" means a value traceable to a national standard. See Figure 1.

3.1.11. "*Set point*" means the target value a control system aims to reach.

3.1.12. "*Span*" means to adjust an instrument so that it gives a proper response to a calibration standard that represents between 75 per cent and 100 per cent of the maximum value in the instrument range or expected range of use.

3.1.13. "*Total hydrocarbons*" (THC) means all volatile compounds measurable by a flame ionization detector (FID).

3.1.14. "*Verification*" means to evaluate whether or not a measurement system's outputs agrees with applied reference signals within one or more predetermined thresholds for acceptance.

3.1.15. "*Zero gas*" means a gas containing no analyte which is used to set a zero response on an analyser.

3.1.16. "*Response time*" means the difference in time between the change of the component to be measured at the reference point and a system response of 90 per cent of the final reading (t90) with the sampling probe being defined as the reference point, whereby the change of the measured component is at least 60 per cent full scale (FS) and takes place in less than 0.1 second. The system response time consists of the delay time to the system and of the rise time of the system.

3.1.17. "*Delay time*" means the difference in time between the change of the component to be measured at the reference point and a system response of 10 per cent of the final reading (t10) with the sampling probe being defined as the reference point. For gaseous components, this is the transport time of the measured component from the sampling probe to the detector.

3.1.18. "*Rise time*" means the difference in time between the 10 per cent and 90 per cent response of the final reading (t90 – t10).

Figure 1

**Definition of accuracy, precision and reference value**



3.2. Road load and dynamometer setting

3.2.1. "*Aerodynamic drag*" means the force opposing a vehicle’s forward motion through air.

3.2.2. "*Aerodynamic stagnation point*" means the point on the surface of a vehicle where wind velocity is equal to zero.

3.2.3. "*Anemometer blockage*" means the effect on the anemometer measurement due to the presence of the vehicle where the apparent air speed is different than the vehicle speed combined with wind speed relative to the ground.

3.2.4. "*Constrained analysis*" means the vehicle’s frontal area and aerodynamic drag coefficient have been independently determined and those values shall be used in the equation of motion.

3.2.5. "*Mass in running order*" means the mass of the vehicle, with its fuel tank(s) filled to at least 90 per cent of its or their capacity/capacities, including the mass of the driver, fuel and liquids, fitted with the standard equipment in accordance with the manufacturer’s specifications and, when they are fitted, the mass of the bodywork, the cabin, the coupling and the spare wheel(s) as well as the tools.

3.2.6. "*Mass of the driver*" means a mass rated at 75 kg located at the driver’s seating reference point.

3.2.7. "*Maximum vehicle load*" means the technically permissible maximum laden mass minus the mass in running order, 25 kg and the mass of the optional equipment as defined in paragraph 3.2.8. of this Regulation.

3.2.8. "*Mass of the optional equipment*" means maximum mass of the combinations of optional equipment which may be fitted to the vehicle in addition to the standard equipment in accordance with the manufacturer's specifications.

3.2.9. "*Optional equipment*" means all the features not included in the standard equipment which are fitted to a vehicle under the responsibility of the manufacturer, and that can be ordered by the customer.

3.2.10. "*Reference atmospheric conditions (regarding road load measurements)*" means the atmospheric conditions to which these measurement results are corrected:

(a) Atmospheric pressure: p0 = 100 kPa;

(b) Atmospheric temperature: T0 = 20 °C;

(c) Dry air density: ρ0 = 1.189 kg/m3;

(d) Wind speed: 0 m/s.

3.2.11. "*Reference speed*" means the vehicle speed at which road load is determined or chassis dynamometer load is verified.

3.2.12. "*Road load*" means the force resisting the forward motion of a vehicle as measured with the coastdown method or methods that are equivalent regarding the inclusion of frictional losses of the drivetrain.

3.2.13. "*Rolling resistance*" means the forces of the tyres opposing the motion of a vehicle.

3.2.14. "*Running resistance*" means the torque resisting the forward motion of a vehicle measured by torque meters installed at the driven wheels of a vehicle.

3.2.15. "*Simulated road load*" means the road load experienced by the vehicle on the chassis dynamometer which is intended to reproduce the road load measured on the road, and consists of the force applied by the chassis dynamometer and the forces resisting the vehicle while driving on the chassis dynamometer and is approximated by the three coefficients of a second order polynomial.

3.2.16. "*Simulated running resistance*" means the running resistance experienced by the vehicle on the chassis dynamometer which is intended to reproduce the running resistance measured on the road, and consists of the torque applied by the chassis dynamometer and the torque resisting the vehicle while driving on the chassis dynamometer and is approximated by the three coefficients of a second order polynomial.

3.2.17. "*Stationary anemometry*" means measurement of wind speed and direction with an anemometer at a location and height above road level alongside the test road where the most representative wind conditions will be experienced.

3.2.18. "*Standard equipment*" means the basic configuration of a vehicle which is equipped with all the features that are required under the regulatory acts of the Contracting Party including all features that are fitted without giving rise to any further specifications on configuration or equipment level.

3.2.19. "*Target road load*" means the road load to be reproduced on the chassis dynamometer.

3.2.20. "*Target running resistance*" means the running resistance to be reproduced.

3.2.21. "*Vehicle coastdown mode*" means a system of operation enabling an accurate and repeatable determination of road load and an accurate dynamometer setting.

3.2.22. "*Wind correction*" means correction of the effect of wind on road load based on input of the stationary or on-board anemometry.

3.2.23. "*Technically permissible maximum laden mass*" means the maximum mass allocated to a vehicle on the basis of its construction features and its design performances.

3.2.24. "*Actual mass of the vehicle*" means the mass in running order plus the mass of the fitted optional equipment to an individual vehicle.

3.2.25. "*Test mass of the vehicle*" means the sum of the actual mass of the vehicle, 25 kg and the mass representative of the vehicle load.

3.2.26. "*Mass representative of the vehicle load*" means x per cent of the maximum vehicle load where x is 15 per cent for category M vehicles and 28 per cent for category N vehicles.

3.2.27. "*Technically permissible maximum laden mass of the combination*" (MC) means the maximum mass allocated to the combination of a motor vehicle and one or more trailers on the basis of its construction features and its design performances or the maximum mass allocated to the combination of a tractor unit and a semi-trailer.

3.2.28. "*n/v ratio*" means the engine rotational speed divided by vehicle speed in a specific gear.

3.2.29. "*Single roller dynamometer*" means a dynamometer where each wheel on a vehicle's axle is in contact with one roller.

3.2.30. "*Twin-roller dynamometer*" means a dynamometer where each wheel on a vehicle's axle is in contact with two rollers.

3.2.31. "*Powered axle*" means an axle of a vehicle which is able to deliver propulsion energy and/or recuperate energy, independent of whether that is only temporarily or permanently possible and/or selectable by the driver.

3.2.32. "*2WD dynamometer*" means a dynamometer where only the wheels on one vehicle axle are in contact with the roller(s).

3.2.33. "*4WD dynamometer*" means a dynamometer where all wheels on both vehicle axles are in contact with the rollers.

3.2.34. "*Dynamometer in 2WD operation*" means a 2WD dynamometer, or a 4WD dynamometer which only simulates inertia and road load on the powered axle of the test vehicle and where the rotating wheels on the non-powered axle shall have no influence on the measurement results compared to a situation where the wheels on the non-powered axle are not rotating.

3.2.35. "*Dynamometer in 4WD operation*" means a 4WD dynamometer which simulates inertia and road load on both axles of the test vehicle.

3.3. Pure electric, pure ICE, hybrid electric, fuel cell and alternatively-fuelled vehicles

3.3.1. "*All-Electric Range*" (AER) means the total distance travelled by an OVC-HEV from the beginning of the charge-depleting test to the point in time during the test when the combustion engine starts to consume fuel.

3.3.2. "*Pure Electric Range*" (PER) means the total distance travelled by a PEV from the beginning of the charge-depleting test until the break-off criterion is reached.

3.3.3. "*Charge-Depleting Actual Range*" (RCDA) means the distance travelled in a series of WLTCs in charge-depleting operating condition until the Rechargeable Electric Energy Storage System (REESS) is depleted.

3.3.4. "*Charge-Depleting Cycle Range*" (RCDC) means the distance from the beginning of the charge-depleting test to the end of the last cycle prior to the cycle or cycles satisfying the break-off criterion, including the transition cycle where the vehicle may have operated in both depleting and sustaining conditions.

3.3.5. "*Charge-depleting operating condition*" means an operating condition in which the energy stored in the REESS may fluctuate but decreases on average while the vehicle is driven until transition to charge-sustaining operation.

3.3.6. "*Charge-sustaining operating condition*" means an operating condition in which the energy stored in the REESS may fluctuate but, on average, is maintained at a neutral charging balance level while the vehicle is driven.

3.3.7. "*Utility Factors*" are ratios based on driving statistics depending on the range achieved in charge-depleting condition and are used to weigh the charge-depleting and charge-sustaining exhaust emission compounds, CO2 emissions and fuel consumption for OVC-HEVs.

3.3.8. "*Electric machine*" (EM) means an energy converter transforming between electrical and mechanical energy.

3.3.9. "*Energy converter*" means a system where the form of energy output is different from the form of energy input.

3.3.9.1. "*Propulsion energy converter*" means an energy converter of the powertrain which is not a peripheral device whose output energy is used directly or indirectly for the purpose of vehicle propulsion.

3.3.9.2. "*Category of propulsion energy converter*" means (i) an internal combustion engine, or (ii) an electric machine, or (iii) a fuel cell.

3.3.10. "*Energy storage system*" means a system which stores energy and releases it in the same form as was input.

3.3.10.1. "*Propulsion energy storage system*" means an energy storage system of the powertrain which is not a peripheral device and whose output energy is used directly or indirectly for the purpose of vehicle propulsion.

3.3.10.2. "*Category of propulsion energy storage system*" means (i) a fuel storage system, or (ii) a rechargeable electric energy storage system, or (iii) a rechargeable mechanical energy storage system.

3.3.10.3 "*Form of energy*" means (i) electrical energy, or (ii) mechanical energy, or (iii) chemical energy (including fuels).

3.3.10.4. "*Fuel storage system*" means a propulsion energy storage system that stores chemical energy as liquid or gaseous fuel.

3.3.11. "*Equivalent all-electric range*" (EAER) means that portion of the total charge-depleting actual range (RCDA) attributable to the use of electricity from the REESS over the charge-depleting range test.

3.3.12. "*Hybrid electric vehicle*" (HEV) means a hybrid vehicle where one of the propulsion energy converters is an electric machine.

3.3.13. "*Hybrid vehicle*" (HV) means a vehicle equipped with a powertrain containing at least two different categories of propulsion energy converters and at least two different categories of propulsion energy storage systems.

3.3.14. "*Net energy change*" means the ratio of the REESS energy change divided by the cycle energy demand of the test vehicle.

3.3.15. "*Not off-vehicle charging hybrid electric vehicle*" (NOVC-HEV) means a hybrid electric vehicle that cannot be charged from an external source.

3.3.16. "*Off-vehicle charging hybrid electric vehicle*" (OVC-HEV) means a hybrid electric vehicle that can be charged from an external source.

3.3.17. "*Pure electric vehicle*" (PEV) means a vehicle equipped with a powertrain containing exclusively electric machines as propulsion energy converters and exclusively rechargeable electric energy storage systems as propulsion energy storage systems.

3.3.18. "*Fuel cell*" means an energy converter transforming chemical energy (input) into electrical energy (output) or vice versa.

3.3.19. "*Fuel cell vehicle*" (FCV) means a vehicle equipped with a powertrain containing exclusively fuel cell(s) and electric machine(s) as propulsion energy converter(s).

3.3.20. "*Fuel cell hybrid vehicle*" (FCHV) means a fuel cell vehicle equipped with a powertrain containing at least one fuel storage system and at least one rechargeable electric energy storage system as propulsion energy storage systems.

3.3.20.1. "*Not off-vehicle charging fuel cell hybrid electric vehicle*" (NOVC-FCHV) means a …

3.3.20.2. "*Off-vehicle charging fuel cell hybrid electric vehicle*" (OVC-FCHV) means a …

3.3.21. "*Bi-fuel vehicle*" means a vehicle with two separate fuel storage systems that is designed to run primarily on only one fuel at a time; however, the simultaneous use of both fuels is permitted in limited amount and duration.

3.3.22. "*Bi-fuel gas vehicle*" means a bi-fuel vehicle where the two fuels are petrol (petrol mode) and either LPG, NG/biomethane, or hydrogen.

3.3.23. "*Pure ICE vehicle*" means a vehicle where all of the propulsion energy converters are internal combustion engines.

3.3.24. "*On-board charger*" means the electric power converter between the traction REESS and the vehicle's recharging socket.

3.3.25. "*Flex fuel vehicle*" means a vehicle with one fuel storage system that can run on different mixtures of two or more fuels.

3.3.26. "*Flex fuel ethanol vehicle*" means a flex fuel vehicle that can run on petrol or a mixture of petrol and ethanol up to an 85 per cent ethanol blend (E85).

3.3. 27. "Mono-fuel vehicle" means a vehicle that is designed to run primarily on one type of fuel.

3.3.28. "Mono-fuel gas vehicle" means a vehicle that is designed primarily for permanent running on LPG or NG/biomethane or hydrogen, but may also have a petrol system for emergency purposes or starting only, where the nominal capacity of the petrol tank does not exceed 15 litres.

3.4. Powertrain

3.4.1. "*Powertrain*" means the total combination in a vehicle of propulsion energy storage system(s), propulsion energy converter(s) and the drivetrain(s) providing the mechanical energy at the wheels for the purpose of vehicle propulsion, plus peripheral devices.

3.4.2. "*Auxiliary devices*" means energy consuming, converting, storing or supplying non-peripheral devices or systems which are installed in the vehicle for purposes other than the propulsion of the vehicle and are therefore not considered to be part of the powertrain.

3.4.3. "Peripheral devices" means any energy consuming, converting, storing or supplying devices, where the energy is not directly or indirectly used for the purpose of vehicle propulsion but which are essential to the operation of the powertrain and are therefore considered to be part of the powertrain.

3.4.4. "*Drivetrain*" means the connected elements of the powertrain for transmission of the mechanical energy between the propulsion energy converter(s) and the wheels.

3.4.5. "*Manual transmission*" means a transmission where gears can only be shifted by action of the driver.

3.5. General

3.5.1. "*Criteria emissions*" means those emission compounds for which limits are set in regional legislation.

3.5.2. Reserved

3.5.3. Reserved

3.5.4. Reserved

3.5.5. Reserved

3.5.6. "*Cycle energy demand*" means the calculated positive energy required by the vehicle to drive the prescribed cycle.

3.5.7. "*Defeat device*" means any element of design which senses temperature, vehicle speed, engine speed (RPM), transmission gear, manifold vacuum or any other parameter for the purpose of activating, modulating, delaying or deactivating the operation of any part of the emission control system, that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use.

3.5.8. "*Driver-selectable mode*" means a distinct driver-selectable condition which could affect emissions, or fuel and/or energy consumption.

3.5.9. "Predominant mode" for the purpose of this Regulation means a single driver-selectable mode that is always selected when the vehicle is switched on, regardless of the driver-selectable mode in operation when the vehicle was previously shut down, and which cannot be redefined to another mode. After the vehicle is switched on, the predominant mode can only be switched to another driver-selectable mode by an intentional action of the driver.

3.5.10. "*Reference conditions (with regards to calculating mass emissions)*" means the conditions upon which gas densities are based, namely 101.325 kPa and 273.15 K (0 °C).

3.5.11. "*Exhaust emissions*" means the emission of gaseous, solid and liquid compounds from the tailpipe.

3.5.12. *'Configurable start mode'* for the purpose of this Regulation means a driver-selectable mode that can be set by the driver as a mode which is automatically selected when the vehicle is switched on. After the vehicle is switched on, the configurable start mode can only be switched to another mode by an intentional action of the driver.

3.6. PM/PN

The term "particle" is conventionally used for the matter being characterised (measured) in the airborne phase (suspended matter), and the term "particulate" for the deposited matter.

3.6.1. "*Particle number emissions*" (PN) means the total number of solid particles emitted from the vehicle exhaust quantified according to the dilution, sampling and measurement methods as specified in this Regulation.

3.6.2. "*Particulate matter emissions*" (PM) means the mass of any particulate material from the vehicle exhaust quantified according to the dilution, sampling and measurement methods as specified in this Regulation.

3.7. WLTC

3.7.1. "*Rated engine power*" () means maximum net power of the engine or motor in kW as per the requirements of UN Regulation No. 85..

3.7.2. "*Maximum speed*" () means the maximum speed of a vehicle as defined by the Contracting Party. In the absence of a definition, the maximum speed shall be declared by the manufacturer according to UN Regulation No. 68.

3.8. Procedure

3.8.1. "*Periodically regenerating system*" means an exhaust emissions control device (e.g. catalytic converter, particulate trap) that requires a periodical regeneration.

From GTR19 – proposal for 24th IWG (“WLTP-24-05e\_Appendix01\_GTR19\_Amd2text”)

[Numbering for Evaporative emissions definitions TBD]

3.3. Evaporative emission

3.3.1. "*Fuel tank system*" means the devices which allow storing the fuel, comprising the fuel tank, the fuel filler, the filler cap and the fuel pump when it is fitted in or on the fuel tank.

3.3.2. "*Fuel system*" means the components which store or transport fuel on board the vehicle and comprise the fuel tank system, all fuel and vapour lines, any non-tank mounted fuel pumps and the activated carbon canister.

3.3.3. "*Butane working capacity*" (BWC) means the mass of butane which a carbon canister can adsorb.

3.3.4. "*BWC300*" means the butane working capacity after 300 cycles of fuel ageing cycles experienced.

3.3.5. "*Permeability Factor*" (PF) means the factor determined from hydrocarbon losses over a period of time and used to determine the final evaporative emissions.

3.3.6. "*Monolayer non-metal tank*" means a fuel tank constructed with a single layer of non-metal material including fluorinated/sulfonated materials.

3.3.7. "*Multilayer tank*" means a fuel tank constructed with at least two different layered materials, one of which is a hydrocarbon barrier material.

3.3.8. "*Sealed fuel tank system*" means a fuel tank system where the fuel vapours do not vent during parking over the 24-hour diurnal cycle defined in paragraph 6.5.9. of Annex C3 when performed with the applicable reference fuel defined in Annex 2 of this Regulation.

3.3.9. "*Evaporative emissions*" means in the context of this Regulation the hydrocarbon vapours lost from the fuel system of a motor vehicle during parking and immediately before refuelling of a sealed fuel tank.

Reserved

3.3.11. "*Depressurisation puff loss*" means hydrocarbons venting from a sealed fuel tank system pressure relief exclusively through the carbon canister allowed by the system.

3.3.12. "*Depressurisation puff loss overflow*" are the depressurisation puff loss hydrocarbons that pass through the carbon canister during depressurisation.

3.3.13. "*Fuel tank relief pressure*" is the minimum pressure value at which the sealed fuel tank system starts venting in response only to pressure inside the tank.

3.3.14. "*2 gram breakthrough*" shall be considered accomplished when the cumulative quantity of hydrocarbons emitted from the activated carbon canister equals 2 grams.

OBD Definitions

NUMBERING TBD

2.1. "On-Board Diagnostic (OBD) system" means in context of this regulation, an system on-board the vehicle diagnostic system for emission control which has the capability of detecting malfunction by means of fault codes stored in computer memory, and illumination of the Malfunction Indicator (MI) to notify the operator of the vehicle.

2.3. "*OBD family*" means a manufacturer's grouping of vehicles which, through their design, are expected to have similar exhaust emission and OBD system characteristics. Each vehicle of this family shall have complied with the requirements of this Regulation as defined in paragraph 6.8.1.

2.4. "*Emission control system*" means in the context of OBD the electronic engine management controller and any emission-related component in the exhaust or evaporative system which supplies an input to or receives an output from this controller.

2.5. "*Malfunction indicator (MI)*" means a visible or audible indicator that clearly informs the driver of the vehicle in the event of a malfunction of any emission-related component connected to the OBD system, or the OBD system itself.

2.6. "*Malfunction*" means the failure of an emission-related component or system that would result in emissions exceeding the OBD threshold limits in paragraph 6.8.2. of this Regulation or if the OBD system is unable to fulfil the basic monitoring requirements of this annex.

2.7. "*Secondary air*" refers to air introduced into the exhaust system by means of a pump or aspirator valve or other means that is intended to aid in the oxidation of HC and CO contained in the exhaust gas stream.

2.8. "*Engine misfire*" means lack of combustion in the cylinder of a positive ignition engine due to absence of spark, poor fuel metering, poor compression or any other cause. In terms of OBD monitoring it is that percentage of misfires out of a total number of firing events (as declared by the manufacturer) that would result in emissions exceeding the OBD threshold limits given in paragraph 6.8.2. of this Regulation or that percentage that could lead to an exhaust catalyst, or catalysts, overheating causing irreversible damage.

2.9. "*Type 1 test*" means the means the applicable driving cycle used for emission approvals, as detailed in this Regulation.

2.10. A "*driving cycle*" consists of key-on, a driving mode where a malfunction would be detected if present, and key-off.

2.11. A "*warm-up cycle*" means sufficient vehicle operation such that the coolant temperature has risen by a least 22 K from engine starting and reaches a minimum temperature of 343 K (70 °C).

2.12. A "*Fuel trim*" refers to feedback adjustments to the base fuel schedule. Short-term fuel trim refers to dynamic or instantaneous adjustments. Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments. These long-term adjustments compensate for vehicle differences and gradual changes that occur over time.

2.13. A "*Calculated load value*" refers to an indication of the current airflow divided by peak airflow, where peak airflow is corrected for altitude, if available. This definition provides a dimensionless number that is not engine specific and provides the service technician with an indication of the proportion of engine capacity that is being used (with wide open throttle as 100 per cent);



2.14. "Permanent emission default mode" refers to a case where the engine management controller permanently switches to a setting that does not require an input from a failed component or system where such a failed component or system would result in an increase in emissions from the vehicle to a level above the OBD threshold limits given in paragraph 6.8.2. of this Regulation.

2.15. "Power take-off unit" means an engine-driven output provision for the purposes of powering auxiliary, vehicle mounted, equipment.

2.16. "Access" means the availability of all emission-related OBD data including all fault codes required for the inspection, diagnosis, servicing or repair of emissions-related parts of the vehicle, via the serial interface for the standard diagnostic connection (pursuant to paragraph 6.5.3.5. of Appendix 1 to Annex C5).

2.17. "Unrestricted" means:

2.17.1. Access not dependent on an access code obtainable only from the manufacturer, or a similar device; or

2.17.2. Access allowing evaluation of the data produced without the need for any unique decoding information, unless that information itself is standardised.

2.18. "Standardised" means that all data stream information, including all fault codes used, shall be produced only in accordance with industry standards which, by virtue of the fact that their format and their permitted options are clearly defined, provide for a maximum level of harmonisation in the motor vehicle industry, and whose use is expressly permitted in this Regulation.

2.19. "Repair information" means all information required for diagnosis, servicing, inspection, periodic monitoring or repair of the vehicle and which the manufacturers provide for their authorised dealers/repair shops. Where necessary, such information shall include service handbooks, technical manuals, diagnosis information (e.g. minimum and maximum theoretical values for measurements), wiring diagrams, the applicable software calibration identification number, instructions for individual and special cases, information provided concerning tools and equipment, data record information and two-directional monitoring and test data. The manufacturer shall not be obliged to make available that information which is covered by intellectual property rights or constitutes specific know-how of manufacturers and/or OEM suppliers; in this case the necessary technical information shall not be improperly withheld.

2.20. "*Deficiency*" means, in respect of vehicle OBD systems, that up to two separate components or systems that are monitored contain temporary or permanent operating characteristics that impair the otherwise efficient OBD monitoring of those components or systems or do not meet all of the other detailed requirements for OBD. Vehicles may be type-approved, registered and sold with such deficiencies according to the requirements of paragraph 4. of Annex C5.

[ADD OBFCM DEFINITIONS?]

**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:

(a) In the case of vehicles equipped with positive ignition engines, a declaration by the manufacturer of the minimum percentage of misfires out of a total number of firing events that would either result in emissions exceeding the OBD threshold limits given in paragraph 6.8., if that percentage of misfire had been present from the start of a Type 1 test as described in Annexes Part B to this Regulation, or that could lead to an exhaust catalyst, or catalysts, overheating prior to causing irreversible damage;

(b) Detailed written information fully describing the functional operation characteristics of the OBD system, including a listing of all relevant parts of the emission control system of the vehicle that are monitored by the OBD system;

(c) A description of the malfunction indicator used by the OBD system to signal the presence of a fault to a driver of the vehicle;

(d) A declaration by the manufacturer that the OBD system complies with the provisions of paragraph 7. of Appendix 1 to Annex C5 to this Regulation relating to in-use performance under all reasonably foreseeable driving conditions;

(e) A plan describing the detailed technical criteria and justification for incrementing the numerator and denominator of each monitor that shall fulfil the requirements of paragraphs 7.2. and 7.3. of Appendix 1 to Annex C5 to this Regulation, as well as for disabling numerators, denominators and the general denominator under the conditions outlined in paragraph 7.7. of Appendix 1 to Annex C5 to this Regulation;

(f) A description of the provisions taken to prevent tampering with and modification of the emission control computer;

(g) If applicable, the particulars of the OBD family as referred to in paragraph 6.8.1.;

(h) Where appropriate, copies of other type approvals with the relevant data to enable extension of approvals and establishment of deterioration factors.

4.1.3. For the tests described in paragraph 3. of Annex C5 to this Regulation, a vehicle representative of the vehicle type or vehicle family fitted with the OBD system to be approved shall be submitted to the Technical Service responsible for the type approval test. If the Technical Service determines that the submitted vehicle does not fully represent the OBD family described in paragraph 6.8.1., an alternative and, if necessary, an additional vehicle shall be submitted for test in accordance with paragraph 3. of Annex C5 to this Regulation.

4.2. A model of the information document relating to exhaust emissions, emissions of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric range, evaporative emissions, durability and OBD, is given in Annex A1 to this Regulation. The information mentioned under item 3.2.12.2.7.6. of Annex A1 to this Regulation is to be included in Appendix 1 "OBD - Related information" to the type approval communication given in Annex A2 to this Regulation.

4.2.1. Where appropriate, copies of other type approvals with the relevant data to enable extensions of approvals and establishment of deterioration factors shall be submitted.

4.3. For the tests specified in Table A in paragraph 6. of this Regulation a vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service responsible for the approval tests.

4.3.1. For the purposes of paragraph 4.1.2.(e), the Type Approval Authority that grants the approval shall make the information referred to in that point available to the Type Approval Authorities upon request.

4.3.2. For the purposes of subparagraphs 4.1.2. (d) and (e), Type Approval Authorities shall not approve a vehicle if the information submitted by the manufacturer is inappropriate for fulfilling the requirements of paragraph 7. of Appendix 1 to Annex C5 to this Regulation. Paragraphs 7.2., 7.3. and 7.7. of Appendix 1 to Annex C5 to this Regulation shall apply under all reasonably foreseeable driving conditions.

4.3.3. For the assessment of the implementation of the requirements set out in the first and second subparagraphs, the Type Approval Authority shall take into account the state of technology.

4.3.4. For the purposes of paragraph 4.1.2. (f), the provisions taken to prevent tampering with and modification of the emission control computer shall include the facility for updating using a manufacturer-approved programme or calibration.

4.3.5. The application for type approval of flex-fuel, mono fuel, bi-fuel and vehicles shall comply with the additional requirements laid down in paragraphs 5.8. and 5.9. of this Regulation.

4.3.6. Changes to the make of a system, component or separate technical unit that occur after a type approval shall not automatically invalidate a type approval, unless its original characteristics or technical parameters are changed in such a way that the functionality of the engine or pollution control system is affected.

4.4. The Type Approval Authority shall verify the existence of satisfactory provisions to ensure an effective check of conformity of production before approval of the vehicle type is granted.

**5. Approval**

5.1. If the vehicle type submitted for approval meets all the relevant requirements of paragraph 6. of this Regulation, approval of that vehicle type shall be granted.

5.2. An approval number shall be assigned to each type approved.

5.2.1. The type approval number shall consist of four sections. Each section shall be separated by the '\*' character.

Section 1: The capital letter 'E' followed by the distinguishing number of the Contracting Party which has granted the type approval.

Section 2: The number [of this UN Regulation,] followed by the letter 'R', successively followed by:

(a) Two digits (with leading zeros as applicable) indicating the series of amendments incorporating the technical provisions of the UN Regulation applied to the approval (00 for the UN Regulation in its original form);

(b) A slash (/) and two digits (with leading zeros as applicable) indicating the number of supplement to the series of amendments applied to the approval (00 for the series of amendments in its original form);

(c) A slash (/) and one or two character(s) indicating the implementing stage (e.g. 1A, 1B, 02).

Section 3: A four-digit sequential number (with leading zeros as applicable). The sequence shall start from 0001.

Section 4: A two-digit sequential number (with leading zeros if applicable) to denote the extension. The sequence shall start from 00.

All digits shall be Arabic digits.

5.2.2. Example of an Approval Number to this Regulation:

E11\*[XXX]R01/00/02\*0123\*01

The first extension of the Approval numbered 0123, issued by the United Kingdom to Series of Amendments 01 which is a Level 2 Approval

5.2.3. The same Contracting Party shall not assign the same number to another vehicle type.

5.3. Notice of approval or of extension or refusal of approval of a vehicle type pursuant to this Regulation shall be communicated to the Contracting Parties to the 1958 Agreement which apply this Regulation by means of a form conforming to the model in Annex A2 to this Regulation.

5.3.1. In the event of amendment to the present text, for example, if new limit values are prescribed, the Contracting Parties to the 1958 Agreement shall be informed which vehicle types already approved comply with the new provisions.

5.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation, an international approval mark consisting of:

5.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country that has granted approval.

5.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle described in paragraph 5.4.1.

5.4.3. The approval mark shall contain an additional character after the type approval number, the purpose of which is to distinguish the level (1A, 1B or 2) for which the approval has been granted. [This letter should be chosen according to the Table A3/1 of Annex A3 to this Regulation.]

5.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the 1958 Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 5.4.1. need not be repeated; in such a case, the Regulation, approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 5.4.1.

5.6. The approval mark shall be clearly legible and be indelible.

5.7. The approval mark shall be placed close to or on the vehicle data plate.

5.7.1. Annex A3 to this Regulation gives examples of arrangements of the approval mark.

5.8. Additional requirements for approval of flex fuel vehicles

This paragraph is only applicable for Level 1A

5.8.1. For the type approval of a flex fuel ethanol vehicle, the vehicle manufacturer shall describe the capability of the vehicle to adapt to any mixture of petrol and ethanol fuel (up to an 85 per cent ethanol blend).

5.9. Additional requirements for mono fuel gas vehicles, and bi-fuel gas vehicles.

~~5.9.1. The additional requirements for granting of type-approval for mono fuel gas vehicles, and bi-fuel gas vehicles shall be those set out in sections 1, 2 and 3 and Appendices 1 and 2 to Annex 12 to UN/ECE Regulation No 83, with the exceptions set out below.~~

5.9.1. For LPG or NG, the fuel to be used shall be ~~the one selected by the manufacturer for the measurement of the net power in accordance with UN Regulation No. 85. The selected fuel shall be~~ specified in the information document set out in Annex A1 to this Regulation.

5.10. Requirements for approval regarding the OBD system

5.10.1. The manufacturer shall ensure that all vehicles are equipped with an OBD system.

5.10.2. The OBD system shall be designed, constructed and installed on a vehicle so as to enable it to identify types of deterioration or malfunction over the entire life of the vehicle.

5.10.3. The OBD system shall comply with the requirements of this Regulation during conditions of normal use.

5.10.4. When tested with a defective component in accordance with Appendix 1 to Annex C5 to this Regulation, the OBD system malfunction indicator shall be activated. The OBD system malfunction indicator may also activate during this test at levels of emissions below the OBD threshold limits specified in paragraph 6.8. to this Regulation.

5.10.5. The manufacturer shall ensure that the OBD system complies with the requirements for in-use performance set out in paragraph 7. of Appendix 1 to Annex C5 to this Regulation under all reasonably foreseeable driving conditions.

5.10.6. In-use performance related data to be stored and reported by a vehicle's OBD system according to the provisions of paragraph 7.6. of Appendix 1 to Annex C5 to this Regulation shall be made readily available by the manufacturer to national authorities and independent operators without any encryption.

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 of categories M1 and N1 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).

5.11.2. The device for monitoring the consumption of fuel and/or electric energy shall comply with the requirements laid down in Appendix 4.

**6. Specifications and tests**

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6.1. General

6.1.1. The vehicle and its components liable to affect CO2 and fuel consumption or electric energy consumption and the emissions of gaseous compounds, including evaporative emissions, particulate matter, particle number (if PN measurement is required) shall be so designed, constructed and assembled as to enable the vehicle in normal use and under normal conditions of use such as humidity, rain, snow, heat, cold, sand, dirt, vibrations, wear, etc. to comply with the provisions of this Regulation during its useful life.

This shall include the security of all hoses, joints and connections used within the emission control systems and the evaporative emission control systems [which shall be so constructed as to conform with the original design intent.].

For exhaust emissions, CO2 and fuel consumption or electric energy consumption these provisions are deemed to be met if the provisions of paragraph 6.3. of this Regulation and paragraph 8.x. of this Regulation are complied with.

For evaporative emissions, these conditions are deemed to be met if the provisions of paragraph 6.6. of this Regulation and paragraph 8.x. of this Regulation are complied with.

6.1.2. The test vehicle shall be representative in terms of its emissions-related components and functionality of the intended production series to be covered by the approval. The manufacturer and the responsible authority shall agree which vehicle test model is representative.

6.1.3. With respect to evaporative emissions, for vehicles with a sealed fuel tank system, this shall also include having a system which, just before refuelling, releases the tank pressure exclusively through a carbon canister which has the sole function of storing fuel vapour. This ventilation route shall also be the only one used when the tank pressure exceeds its safe working pressure.

6.1.4. Vehicle testing condition

6.1.4.1. The types and amounts of lubricants and coolant for emissions testing shall be as specified for normal vehicle operation by the manufacturer.

6.1.4.2. The type of fuel for emissions testing shall be as specified in Annex B3 to this Regulation.

6.1.4.3. All emissions controlling systems, including evaporative emissions controlling systems shall be in working order.

6.1.4.4. The use of any defeat device is prohibited.

6.1.4.5. The engine shall be designed to avoid crankcase emissions.

6.1.4.6. The tyres used for emissions testing shall be as defined in paragraph 2.4.5. of Annex B6 to this Regulation.

6.1.5. Fuel tank inlet orifices

6.1.5.1. For Level 1A and Level 2 only;

Subject to paragraph 6.1.5.2. of this Regulation, the inlet orifice of the petrol or ethanol tank shall be so designed as to prevent the tank from being filled from a fuel pump delivery nozzle which has an external diameter of 23.6 mm or greater.

For Level 1B

No requirement for fuel tank inlet orifices.

6.1.5.2. Paragraph 6.1.5.1. of this Regulation shall not apply to a vehicle in respect of which both of the following conditions are satisfied:

6.1.5.2.1. The vehicle is so designed and constructed that no device designed to control the emissions shall be adversely affected by leaded petrol; and

6.1.5.2.2. The vehicle is conspicuously, legibly and indelibly marked with the symbol for unleaded petrol, specified in ISO 2575:2010 "Road vehicles -- Symbols for controls, indicators and tell-tales", in a position immediately visible to a person filling the petrol tank. Additional markings are permitted.

6.1.6. Provision shall be made to prevent excess evaporative emissions and fuel spillage caused by a missing fuel filler cap. This may be achieved by using one of the following:

6.1.6.1. An automatically opening and closing, non-removable fuel filler cap;

6.1.6.2. Design features which avoid excess evaporative emissions in the case of a missing fuel filler cap; or

6.1.6.3. Any other provision which has the same effect. Examples may include, but are not limited to, a tethered filler cap, a chained filler cap or one utilising the same locking key for the filler cap as for the vehicle's ignition. In this case, the key shall be removable from the filler cap only in the locked condition.

6.1.7. Provisions for electronic system security

6.1.7.1. Any vehicle with an emission control computer, including an evaporative emission control computer, including when integrated in an exhaust emissions control computer, shall include features to deter modification, except as authorised by the manufacturer. The manufacturer shall authorise modifications if those modifications are necessary for the diagnosis, servicing, inspection, retrofitting or repair of the vehicle. Any reprogrammable computer codes or operating parameters shall be resistant to tampering and afford a level of protection at least as good as the provisions in ISO 15031-7: 2013. Any removable calibration memory chips shall be potted, encased in a sealed container or protected by electronic algorithms and shall not be changeable without the use of specialized tools and procedures.

6.1.7.1.1. Only features directly associated with emissions calibration or prevention of vehicle theft may be protected in accordance with paragraph 6.1.7.1.

6.1.7.2. Computer-coded engine operating parameters shall not be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) enclosures).

6.1.7.3. Manufacturers may seek approval from the responsible authority for an exemption to one of these requirements for those vehicles that are unlikely to require protection. The criteria that the responsible authority shall evaluate in considering an exemption shall include, but are not limited to, the current availability of performance chips, the high-performance capability of the vehicle and the projected sales volume of the vehicle.

6.1.7.4. Manufacturers using programmable computer code systems shall deter unauthorised reprogramming. Manufacturers shall include enhanced tamper protection strategies and write-protect features requiring electronic access to an off-site computer maintained by the manufacturer. Methods giving an adequate level of tamper protection shall be approved by the responsible authority.

6.1.8. Rounding

[Add some introductory text]

6.1.8.1. When the digit immediately to the right of the last place to be retained is less than 5, that last digit retained shall remain unchanged.

Example:

If a result is 1.234 grams but only two places of decimal are to be retained, the final result shall be 1.23 grams.

6.1.8.2. When the digit immediately to the right of the last place to be retained is greater than or equal to 5, that last digit retained shall be increased by 1.

Example:

If a result is 1.236 grams but only two places of decimal are to be retained, and because 6 is greater than 5, the final result shall be 1.24 grams.

6.1.9. The use of defeat devices that reduce the effectiveness of emission control systems shall be prohibited. The prohibition shall not apply where:

(a) the need for the device is justified in terms of protecting the engine against damage or accident and for safe operation of the vehicle;

(b) the device does not function beyond the requirements of engine starting;

or

(c) the conditions are substantially included in the test procedures for verifying evaporative emissions and average tailpipe emissions.

6.2. Test procedure

Table A illustrates the various possibilities for type approval of a vehicle.

6.2.1. Positive ignition engine-powered vehicles and hybrid electric vehicles equipped with a positive ignition engine shall be subject to the following tests:

Type 1 (WLTP);

Type 4 (evaporation emissions);

Type 5 (durability of anti-pollution devices)

OBD-test.

6.2.2. Positive ignition engine-powered vehicle and hybrid electric vehicles equipped with positive ignition engine fuelled with LPG or NG/biomethane (mono or bi-fuel) shall be subjected to the following tests (according to Table A):

Type 1 (verifying the average exhaust emissions after a cold start);

Type 4 (evaporative emissions), where applicable;

Type 5 (durability of anti-pollution devices)

OBD-test.

6.2.3. Compression ignition engine-powered vehicles and hybrid electric vehicles equipped with a compression ignition engine shall be subject to the following tests:

Type 1 (verifying the average exhaust emissions after a cold start);

Type 5 (durability of anti-pollution control devices)

OBD-test.

6.2.4. Pure electric vehicles

Electric energy consumption and electric range

6.2.5. Hydrogen fuel cell vehicles

Fuel consumption

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| *Table A* | | | | | | | | | | | |
| *Application of test requirements for type-approval and extensions* | | | | | | | | | | | |
| Vehicle category | Vehicles with positive ignition engines including hybrids1,2 | | | | | | | | Vehicles with compression ignition engines including hybrids | Pure electric vehicles | Hydrogen fuel cell vehicles |
|  | Mono fuel | | | | Bi-fuel3 | | | Flex-fuel3 |  |  |  |
| Reference fuel | Petrol | LPG | NG/ Biomethane | Hydrogen (ICE) | Petrol | Petrol | Petrol | Petrol | Diesel | — | 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 XX) (limits) | Yes | Yes6 | Yes6 | Yes4 | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes | — | — |
| ATCT  (14°C test) | Yes | Yes | Yes | Yes4 | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes  (both fuels) | Yes | — | — |
| Evaporative emissions  (Type 4 test) | Yes | Yes 5 | Yes 5 | — | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | — | — | — |
| Durability  (Type 5 test) | Yes | Yes | Yes | Yes | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | Yes  (petrol only) | Yes | — | — |
| OBD | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| OBFCM | Yes | — | — | — | — | — | — | Yes | Yes | — | — |

1 Specific test procedures for hydrogen vehicles will be defined at a later stage.

2 Particulate mass and particle number limits and respective measurement procedures shall apply only to vehicles with direct injection engines

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 In the case that a mono-fuel gas vehicle has a petrol tank, otherwise and for Level 1A “—“

6 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

[6.2.6. 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:

* IP = Interpolation family as defined in paragraph 6.3.2. with or without using the interpolation method
* RL = Road load family as defined in paragraph 6.3.3.
* RM = Road load matrix family as defined in paragraph  6.3.4.
* PR = Periodically regenerating systems (Ki) family as defined in paragraph 6.3.5.
* AT = ATCT family as defined in paragraph 2. of Annex B6a.
* EV = Evaporative emissions family, as defined in paragraph 6.6.3.
* DF = Durability family, as defined in paragraph 6.7.x.
* OB = OBD family identifier, as defined paragraph 6.8.x.
* SC = SCR family identifier, as defined in paragraph 6.9.2.
* GV = GFV family identifier, as defined in paragraph 6.3.6.3.
* [OF = OBFCM family identifier, as defined in paragraph 6.3.7.]

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. Description of Type 1 test (WLTP)

xxx

6.3.1. The Type 1 test shall be performed according to:

(a) The WLTCs as described in Annex B1;

(b) The gear selection and shift point determination as described in Annex B2;

(c) The appropriate fuel as specified in Annex B3;

(d) The road load and dynamometer settings as described in Annex B4;

(e) The test equipment as described in Annex B5;

(f) The test procedures as described in Annexes B6 and B8;

(g) The methods of calculation as described in Annexes B7 and B8.

6.3.2. Interpolation family

6.3.2.1. Interpolation family for pure ICE vehicles

6.3.2.1.1.Vehicles may be part of the same interpolation family in any of the following cases including combinations of these cases:

(a) They belong to different vehicle classes as described in paragraph 2. of Annex B1;

(b) They have different levels of downscaling as described in paragraph 8. of Annex B1;

(c) They have different capped speeds as described in paragraph 9. of Annex B1.

6.3.2.1.2. Only vehicles that are identical with respect to the following vehicle/power-train/transmission characteristics may be part of the same interpolation family:

(a) Type of internal combustion engine: fuel type (or types in the case of flex-fuel or bi-fuel vehicles), combustion process, engine displacement, full-load characteristics, engine technology, and charging system, and also other engine subsystems or characteristics that have a non-negligible influence on CO2 mass emission under WLTP conditions;

(b) Operation strategy of all CO2 mass emission influencing components within the powertrain;

(c) Transmission type (e.g. manual, automatic, CVT) and transmission model (e.g. torque rating, number of gears, number of clutches, etc.);

(d) n/v ratios (engine rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to n/v ratios of the most commonly installed transmission type is within 8 per cent;

(e) Number of powered axles.

[(f) This point is only applicable for L1A and L2

ATCT family, per reference fuel in the case of flex-fuel or bi-fuel vehicles;]

6.3.2.1.3. If an alternative parameter such as a higher nmin\_drive, as specified in paragraph 2.(k) of Annex B2, or ASM, as defined in paragraph 3.4. of Annex B2 is used, this parameter shall be the same within an interpolation family.

6.3.2.2. Interpolation family for NOVC-HEVs and OVC-HEVs

In addition to the requirements of paragraph 6.3.2.1. of this Regulation, only OVC-HEVs and NOVC-HEVs that are identical with respect to the following characteristics may be part of the same interpolation family:

(a) Type and number of electric machines: construction type (asynchronous/ synchronous, etc.), type of coolant (air, liquid) and any other characteristics having a non-negligible influence on CO2 mass emission and electric energy consumption under WLTP conditions;

(b) Type of traction REESS (model, capacity, nominal voltage, nominal power, type of coolant (air, liquid));

(c) Type of electric energy converter between the electric machine and traction REESS, between the traction REESS and low voltage power supply and between the recharge-plug-in and traction REESS, and any other characteristics having a non-negligible influence on CO2 mass emission and electric energy consumption under WLTP conditions;

(d) The difference between the number of charge-depleting cycles from the beginning of the test up to and including the transition cycle shall not be more than one.

6.3.2.3. Interpolation family for PEVs

Only PEVs that are identical with respect to the following electric powertrain/transmission characteristics may be part of the same interpolation family:

(a) Type and number of electric machines: construction type (asynchronous/ synchronous, etc.), type of coolant (air, liquid) and any other characteristics having a non-negligible influence on electric energy consumption and range under WLTP conditions;

(b) Type of traction REESS (model, capacity, nominal voltage, nominal power, type of coolant (air, liquid));

(c) Transmission type (e.g. manual, automatic, CVT) and transmission model (e.g. torque rating, number of gears, numbers of clutches, etc.);

(d) Number of powered axles;

(e) Type of electric energy converter between the electric machine and traction REESS, between the traction REESS and low voltage power supply and between the recharge-plug-in and traction REESS, and any other characteristics having a non-negligible influence on electric energy consumption and range under WLTP conditions;

(f) Operation strategy of all components influencing the electric energy consumption within the powertrain;

(g) n/v ratios (engine rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to the n/v ratios of the most commonly installed transmission type and model is within 8 per cent.

6.3.3. Road load family

Only vehicles that are identical with respect to the following characteristics may be part of the same road load family:

(a) Transmission type (e.g. manual, automatic, CVT) and transmission model (e.g. torque rating, number of gears, number of clutches, etc.). At the request of the manufacturer and with approval of the responsible authority, a transmission with lower power losses may be included in the family;

(b) n/v ratios (engine rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to the transmission ratios of the most commonly installed transmission type is within 25 per cent;

(c) Number of powered axles;

If at least one electric machine is coupled in the gearbox position neutral and the vehicle is not equipped with a coastdown mode (paragraph 4.2.1.8.5. of Annex B4) such that the electric machine has no influence on the road load, the criteria in paragraph 6.3.2.2. (a) of this Regulation and paragraph 6.3.2.3. (a) of this Regulation shall apply.

If there is a difference, apart from vehicle mass, rolling resistance and aerodynamics, that has a non-negligible influence on road load, that vehicle shall not be considered to be part of the family unless approved by the responsible authority.

6.3.4.Road load matrix family

The road load matrix family may be applied for vehicles with a technically permissible maximum laden mass ≥ 3,000 kg.

Vehicles with a technically permissible maximum laden mass ≥ 2500 kg may be part of the road load matrix family provided the driver seat R-point height is above 850 mm from the ground.

“R-point” means “R” point or “seating reference point” as defined in paragraph 2.4. of Annex 1 to the Consolidated Resolution on the Construction of Vehicles (R.E.3.).

Only vehicles which are identical with respect to the following characteristics may be part of the same road load matrix family:

(a) Transmission type (e.g. manual, automatic, CVT);

(b) Number of powered axles.

6.3.5. Periodically regenerating systems (Ki) family

Only vehicles that are identical with respect to the following characteristics may be part of the same periodically regenerating systems family:

(a) Type of internal combustion engine: fuel type, combustion process,

(b) Periodically regenerating system (i.e. catalyst, particulate trap);

(i) Construction (i.e. type of enclosure, type of precious metal, type of substrate, cell density);

(ii) Type and working principle;

(iii) Volume ±10 per cent;

(iv) Location (temperature ±100 °C at second highest reference speed).

(c) The test mass of each vehicle in the family shall be less than or equal to the test mass of the vehicle used for the Ki demonstration test plus 250 kg.

[6.3.6. Gas Fuelled Vehicles (GFV) Family

6.3.6.1. GFVs may be grouped into a family of vehicle types fuelled by LPG or NG/biomethane which are then identified by a parent vehicle.

6.3.6.2. A GFV parent vehicle is a vehicle that is selected to act as the vehicle on which the self-adaptability of a fuelling system is going to be demonstrated, and to which the members of a GFV family refer. It is possible to have more than one parent vehicle in a GFV family.

6.3.6.3. Member of the GFV family

6.3.6.3.1. Only vehicles which share the following essential characteristics with its GFV parent(s) may be grouped in a GFV family:

(a)It is produced by the same manufacturer;

(b)It is subject to the same emission limits;

(c)If the gas fuelling system has a central metering for the whole engine:

It has a certified power output between 0.7 and 1.15 times that of the GFV parent vehicle;

(d)If the gas fuelling system has an individual metering per cylinder:

It has a certified power output per cylinder between 0.7 and 1.15 times that of the GFV parent vehicle;

(e) If fitted with a catalyst, it has the same type of catalyst i.e. three way, oxidation, de-NOx;

(f)It has a gas fuelling system (including the pressure regulator) from the same system manufacturer and of the same type: induction, vapour injection (single point, multipoint), liquid injection (single point, multipoint);

(g)This gas fuelling system is controlled by an ECU of the same type and technical specification, containing the same software principles and control strategy. The vehicle may have a second ECU compared to the GFV parent vehicle, provided that the ECU is only used to control the injectors, additional shut-off valves and the data acquisition from additional sensors.

6.3.6.3.2. With regard to requirements of paragraph 6.3.6.3.1. (c) and (d):

In the case where a demonstration shows that two gas-fuelled vehicles could be members of the same family with the exception of their certified power output, respectively P1 and P2 (P1 < P2), and both are tested as if were parent vehicles the family relation will be considered valid for any vehicle with a certified power output between 0.7 P1 and 1.15 P2.]

6.3.7. Additional requirements for vehicles fuelled by LPG or NG/biomethane

6.3.7.1. The additional requirements for vehicles fuelled by LPG or NG/biomethane are provided in Annex B6.

6.3.7.2. [Vehicles that are fuelled with LPG or NG/biomethane shall be tested in the Type 1 test for variation in the composition of LPG or NG/biomethane, as set out in Annex B6 for pollutant emissions, with the fuel used for the measurement of the net power in accordance with UN Regulation No. 85.]

{Alternative text proposed below}

[For the Type 1 test set out in Annexes Part B, mono-fuel gas vehicles shall be tested in the Type 1 test for variation in the composition of either LPG or NG/biomethane, as set out in Annex B6 for pollutant emissions, [and] with the fuel used for the measurement of the net power in accordance with UN Regulation No. 85.]

6.3.7.3. [Vehicles that can be fuelled both with petrol or LPG or NG/biomethane shall be tested on both the fuels, tests on LPG or NG/biomethane being performed for variation in the composition of LPG or NG/biomethane, as set out in Annex B6, and with the fuel used for the measurement of the net power in accordance with UN Regulation No. 85.]

{Alternative text proposed below}

[Bi-fuel gas vehicles shall be tested with petrol and either LPG or NG/biomethane. The tests on LPG or NG/biomethane shall be performed for variation in the composition of LPG or NG/biomethane, as set out in Annex B6 for pollutant emissions, and with the fuel used for the measurement of the net power in accordance with UN Regulation No. 85.]

6.3.7.4. This paragraph applies to Level 1A only.

Notwithstanding the requirement of paragraph 6.3.7.3., mono-fuel gas vehicles will be regarded for the Type 1 test as vehicles that can only run on a gaseous fuel.

6.3.8. Additional requirements for flex fuel vehicles

6.3.8.1. For flex fuel vehicles, the transition from one reference fuel to another between the tests shall take place without manual adjustment of the engine settings.

6.3.9. OBFCM

xxx

[6.3.9.1. OBFCM family definition

Only vehicles that are identical with respect to the following characteristics may be

part of an OBFCM family:

(i) Fuel type (Mono fuel, bi fuel, flex fuel)

(ii) Combustion type

(iii) Number of cylinders and Engine displacement

(iv) Type of Fuel Injection (direct, indirect)

(v) Charging system (e. g. turbocharger)

(vi) Presence of a fuel injection into exhaust after-treatment system]

6.3.10. The resulting masses of gaseous emissions and the mass of particulates and number of particles (if PN measurement is required) obtained shall be less than the limits shown in Table 1A (for Level 1A) or Table 1B (for Level 1B):

Table 1A

This table is only applicable for L1A

**Emissions limits**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *Reference mass*  *(RM) (kg)* | *Limit values* | | | | | | | | | | | | | |
| *Mass of carbon monoxide (CO)* | | *Mass of total hydrocarbons*  *(THC)* | | *Mass of non-methane hydrocarbons*  *(NMHC)* | | *Mass of oxides  of nitrogen*  *(NOx)* | | *Combined mass of hydrocarbons and oxides of nitrogen*  *(THC + NOx)* | | *Mass of  particulate matter*  *(PM)* | | *Particle Number*  *(PN)* | |
| *L1*  *(mg/km)* | | *L2*  *(mg/km)* | | *L3*  *(mg/km)* | | *L4*  *(mg/km)* | | *L2 + L4*  *(mg/km)* | | *L5*  *(mg/km)* | | *L6*  *(#/km)* | |
| *Category* | *Class* |  | *PI* | *CI* | *PI* | *CI* | *PI* | *CI* | *PI* | *CI* | *PI* | *CI* | *PI1* | *CI* | *PI1,* | *CI* |
| M | — | All | 1,000 | 500 | 100 | — | 68 | — | 60 | 80 | — | 170 | 4.5 | 4.5 | 6.0 × 1011 | 6.0 × 1011 |
| N1 | I | RM ≤ 1,305 | 1,000 | 500 | 100 | — | 68 | — | 60 | 80 | — | 170 | 4.5 | 4.5 | 6.0 × 1011 | 6.0 × 1011 |
| II | 1,305 < RM ≤ 1,760 | 1,810 | 630 | 130 | — | 90 | — | 75 | 105 | — | 195 | 4.5 | 4.5 | 6.0 × 1011 | 6.0 × 1011 |
| III | 1,760 < RM | 2,270 | 740 | 160 | — | 108 | — | 82 | 125 | — | 215 | 4.5 | 4.5 | 6.0 × 1011 | 6.0 × 1011 |
| N2 | — | All | 2,270 | 740 | 160 | — | 108 | — | 82 | 125 | — | 215 | 4.5 | 4.5 | 6.0 × 1011 | 6.0 × 1011 |
| PI Positive Ignition  CI Compression Ignition  1 Positive ignition particulate mass and number limits shall apply only to vehicles with direct injection engines. | | | | | | | | | | | | | | | | |

Table 1B

This table is only applicable for L1B

**Emissions limits**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *technically permissible maximum laden mass*  *(GVW) (kg)* | *Limit values* | | | | | | | | | | | | | |
| *Mass of carbon monoxide (CO)* | |  | | *Mass of non-methane hydrocarbons*  *(NMHC)* | | *Mass of oxides  of nitrogen*  *(NOx)* | |  | | *Mass of  particulate matter*  *(PM)* | |  | |
| *L1*  *(mg/km)* | |  | | *L3*  *(mg/km)* | | *L4*  *(mg/km)* | |  | | *L5*  *(mg/km)* | |  | |
| *Category* | *Class* |  | *G* | *D* |  |  | *G* | *D* | *G* | *D* |  |  | *G\*1* | *D* |  |  |
| M | — | All | 1,150 | 630 |  |  | 100 | 24 | 50 | 150 |  |  | 5 | 5 |  |  |
| N1, N2 | —\*2 | GVW≤ 1,700 | 1,150 | 630 |  |  | 100 | 24 | 50 | 150 |  |  | 5 | 5 |  |  |
| — | 1,700 < GVW ≤ 3,500 | 2,550 | 630 |  |  | 150 | 24 | 70 | 240 |  |  | 7 | 7 |  |  |
| — | Light automobile | 4,020 | — |  |  | 100 | — | 50 | — |  |  | 5 | — |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| G Petrol, LPG  D Diesel  1 For petrol or LPG, particulate mass limits shall apply only to vehicles with direct injection engines.  2 Except light automobile | | | | | | | | | | | | | | | | |

Level 2 – meeting European limits for 4-phase and Japan limits for 3 phase

6.4. [Reserved]

6.5. [Reserved]

6.6. Type 4 test (Determination of evaporative emissions)

The Type 4 test shall be carried out on all vehicles with a petrol tank in accordance with the requirements of paragraphs 6.6.2. to 6.6.4. and Annex C3.

For Level 1A;

Mono-fuel gas vehicles are exempted.

6.6.2. When tested in accordance with Annex C3 to this Regulation, evaporative emissions shall be less than that specified in Table 2.

Table 2

Emission limit for evaporative emissions test

|  |
| --- |
| Mass of Evaporative Emission (g/test) |
| 2.0 |

6.6.3. Evaporative emission family

6.6.3.1. Only vehicles that are identical with respect to the characteristics listed in (a), (d) and (e), technically equivalent with respect to the characteristics listed in (b) and (c) and similar or, where applicable, within the stated tolerance regarding the characteristics listed in (f) and (g) may be part of the same evaporative emission family:

(a) Fuel tank system material and construction;

(b) Vapour hose material;

(c) Fuel line material and connection technique;

(d) Sealed tank or non-sealed tank system;

(e) Fuel tank relief valve setting (air ingestion and relief);

(f) Carbon canister butane working capacity (BWC300) within a 10 per cent range of the highest value (for carbon canisters with the same type of charcoal, the volume of charcoal shall be within 10 per cent of that for which the BWC300 was determined);

(g) Purge control system (for example, type of valve, purge control strategy).

The manufacturer shall demonstrate the technical equivalence of points (b) and (c) to the responsible authority.

6.6.3.2. The vehicle shall be considered to produce worst-case evaporative emissions and shall be used for testing if it has the largest ratio of fuel tank capacity to BWC300 within the family. The vehicle selection shall be agreed in advance with the responsible authority.

6.6.3.3. The use of any innovative system calibration, configuration, or hardware related to the evaporative control system shall place the vehicle model in a different family.

6.6.4. The responsible authority shall not grant type approval if the information provided is insufficient to demonstrate that the evaporative emissions are effectively limited during the normal use of the vehicle.

6.7. Type 5 test (Description of the endurance test for verifying the durability of pollution control devices)

6.7.1. This test shall be carried out on all vehicles referred to in paragraph 1. to which the test specified in paragraph 6.x. applies. The test represents an ageing test up to the target useful life driven in accordance with the programme described in Annex C4 to this Regulation on a test track, on the road or on a chassis dynamometer.

The test represents an ageing test up to the target useful life driven in accordance with the programme described in Annex C4 to this Regulation on a test track, on the road or on a chassis dynamometer.

For Level 1A and Level 2;

The target useful life is 160,000 km.

For Level 1B;

The target useful life is 80,000 km. For light motor vehicles the target useful life is 60,000 km.

6.7.1.1. Vehicles that can be fuelled either with petrol or with LPG or NG should be tested in the Type 5 test on petrol only. In that case the deterioration factor found with unleaded petrol will also be taken for LPG or NG.

6.7.2 Notwithstanding the requirement of paragraph 6.7.1., a manufacturer may choose to have the deterioration factors from Tables 3a and 3b used as an alternative to testing to paragraph 6.7.1.

Table 3a

This table is only applicable for Level 1A

**Multiplicative Deterioration factors (for WLTP tests with 4 phases)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Engine Category* | *Assigned deterioration factors* | | | | | | |
| *CO* | *THC* | *NMHC* | *NOx* | *HC + NOx* | *Particulate*  *Matter (PM)* | *Particles (PN)* |
| Positive ignition | 1.5 | 1.3 | 1.3 | 1.6 | - | 1.0 | 1.0 |
| Compression-ignition | As there are no assigned deterioration factors for compression ignition vehicles, manufacturers shall use the whole vehicle or bench ageing durability test procedures to establish deterioration factors. | | | | | | |

Table 3b

This table is only applicable for Level 1A

**Additive Deterioration factors (for WLTP tests with 3 phases)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Engine Category* | *Assigned deterioration factors* | | | | | | |
| *CO* |  | *NMHC* | *NOx* |  | *PM* |  |
| Gasoline fuel and LPG | 0.11 |  | 0.12 | 0.21 | - | 0.00 |  |
| Compression-ignition | As there are no assigned deterioration factors for compression ignition vehicles, manufacturers shall use the whole vehicle ~~or bench~~ ageing durability test procedures to establish deterioration factors. | | | | | | |

For Level 2, both conditions shall be applied and emission compliance shall be demonstrated accordingly (using the additive Deterioration Factors for the 3 phase test and the multiplicative Deterioration Factors for the 4 phase test).

6.7.3. At the request of the manufacturer, the Technical Service may carry out the Type 1 test before the Type 5 test has been completed using the deterioration factors in the table above. On completion of the Type 5 test, the Technical Service may then amend the type approval results recorded in Annex A2 to this Regulation by replacing the deterioration factors in the above table with those measured in the Type 5 test.

6.7.4.

6.7.5. Deterioration factors are determined using either procedure in paragraph 6.7.1. or using the values in Table 3 of paragraph 6.7.2. The factors are used to establish compliance with the requirements of paragraphs 6.3. and 8.2.

6.7.2. Durability family

Only vehicles whose engine or pollution control system parameters are identical or remain within the prescribed tolerances with reference to the vehicle used for the determination of the Deterioration Factor may be part of the same Durability family:

(a) Engine

(i) ratio between engine cylinder capacity and the volume of each catalytic component and/or filter (-10 to +5 per cent);

(ii) difference in engine capacity [ ±15 per cent and < 820 cm3] whichever occurs first;

[(iii) cylinder configuration (number of cylinders, shape, distance between bores and other configurations);]

[(iv) number of valves, control of valves, and camshaft driven method;]

(v) fuel type [and fuel system],

(vi) combustion process,

(b) Pollution control system parameters:

(i) Catalytic converters and particulate filters:

number and layout of catalytic converters, filters and elements,

type of catalytic activity (oxidizing, three-way, lean NOx trap, SCR, lean NOx catalyst or other), and filtering characteristics;

precious metal load (identical or higher),

precious metal type and ratio (± 15 per cent),

substrate (structure and material),

cell density,

[(ii) Air injection:

with or without

type (pulsair, air pumps, other(s))]

(iii) EGR:

with or without

type (cooled or non-cooled, active or passive control, high pressure/low pressure/combined pressure).

(iv) other devices having an influence on durability.

6.8. On-board diagnostics OBD – Test

This test shall be carried out on vehicle types as indicated in Table A.. The test procedure described in paragraph 3. of Annex C5 to this Regulation shall be followed.

6.8.1. OBD family

6.8.1.1. Parameters defining the OBD family

The OBD family means a manufacturer's grouping of vehicles which, through their design, are expected to have similar exhaust emission and OBD system characteristics. Each engine of this family shall comply with the requirements of this Regulation.

The OBD family may be defined by basic design parameters which shall be common to vehicles within the family. In some cases there may be interaction of parameters. These effects shall also be taken into consideration to ensure that only vehicles with similar exhaust emission characteristics are included within an OBD family.

6.8.1.2. To this end, those vehicles whose parameters described below are identical may be considered to belong to the same OBD family.

Engine:

(a) Combustion process (i.e. positive ignition, compression-ignition, two-stroke, four-stroke/rotary);

(b) Method of engine fuelling (i.e. single or multi-point fuel injection); and

(c) Fuel type (i.e. petrol, diesel, flex fuel petrol/ethanol, flex fuel diesel/ biodiesel, NG/biomethane, LPG, bi fuel petrol/NG/biomethane, bi- fuel petrol/LPG).

Emission control system:

(a) Type of catalytic converter (i.e. oxidation, three-way, heated catalyst, SCR, other);

(b) Type of particulate trap;

(c) Secondary air injection (i.e. with or without); and

(d) Exhaust gas recirculation (i.e. with or without);

OBD parts and functioning.

The methods of OBD functional monitoring malfunction detection and malfunction indication to the vehicle driver.

6.8.2. OBD threshold limits

The OBD threshold limits referred to in Annex C5 are specified in Table xxx.

**Table xxx: OBD threshold limits**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *Reference mass*  *(RM)*  *(kg)* | *Mass of carbon monoxide* | | *Mass of non-methane hydrocarbons* | | | *Mass of oxides of nitrogen* | | | *Mass of particulate matter1* | | |
| *(CO)*  *(mg/km)* | | *(NMHC)*  *(mg/km)* | | | *(NOx)*  *(mg/km)* | | | *(PM)*  *(mg/km)* | | |
| Category | Class |  | PI | CI | PI | CI | PI | | CI | CI | | PI |  |
| M | — | All | 1,900 | 1,750 | 170 | 290 | 90 | | 140 | 12 | | 12 |  |
| N1 | I | RM ≤ 1305 | 1,900 | 1,750 | 170 | 290 | 90 | | 140 | 12 | | 12 |  |
| II | 1305 < RM ≤ 1760 | 3,400 | 2,200 | 225 | 320 | 110 | | 180 | 12 | | 12 |  |
| III | 1760 < RM | 4,300 | 2,500 | 270 | 350 | 120 | | 220 | 12 | | 12 |  |
| N2 | — | All | 4,300 | 2,500 | 270 | 350 | 120 | | 220 | 12 | | 12 |  |

*Key* PI Positive Ignition

CI Compression Ignition.

1 Positive ignition particulate mass and number limits apply only to vehicles with direct injection engines

6.9. Vehicles that use a reagent for the exhaust after-treatment system

6.9.1. Vehicles that use a reagent for the exhaust after-treatment system shall meet the requirements specified in Appendix 5 to this Regulation.

6.9.2. Selective Catalytic Reduction (SCR) family definition

[Base on text to be provided by UK/UTAC.]

**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)

7.4.1. The type-approval shall be extended to vehicles if they conform to the criteria of Article 2 (1) or if they conform to Article 2 (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 of the tested vehicle resulting from step 9 of Table A7/1 of Annex B7 [and the equivalent table in Annex B8] shall be less than or equal to the CO2 emission obtained from the initial interpolation line (including extrapolation) corresponding to the cycle energy demand of the tested vehicle.

The pollutant emissions shall respect the limits set out in Table 1 in paragraph x.x.

7.4.1.1. The type-approval shall not be extended to create an interpolation family if it has been granted only in relation to Vehicle High.

7.4.2. Vehicles with periodically regenerating systems

For Ki tests undertaken under Appendix 1 to Annex B6, the type-approval shall be extended to vehicles if they conform to the criteria of paragraph 6.3.5. of this Regulation.

7.5. Extensions for evaporative emissions (Type 4 test)

7.5.1. For tests performed in accordance with Annex C3 the type-approval shall be extended to vehicles belonging to an approved evaporative emission family as defined in paragraph 6.6.3. of this Regulation.

7.6. Extensions for durability of pollution control devices (Type 5 test)

7.6.1. The type-approval shall be extended to different vehicles and vehicle types, provided that both of the following conditions apply:

(a) The vehicles belong to the same Durability family, as defined in the paragraph 6.7.2. of this Regulation;

(b) The worst case Deterioration Factor (DF) derived within the Durability Family is applied. The worst case DF is determined on the vehicle with the highest temperature at the inlet of the pollution control system, measured as prescribed in paragraph 7.6.2.

7.6.2.The temperature at the catalyst inlet shall be checked under stabilized conditions. The vehicle shall be brought to a speed of 120 km/h and kept at that constant speed for at least 15 minutes at the load setting of the Type 1 test. At any time after this period, the temperature at catalyst inlet shall be measured for at least 2 continued minutes while the vehicle is kept at 120 km/h and the average temperature value shall be taken as representative value.

7.7. Extension for OBD

xxx

7.8. Extensions for OBFCM

For OBFCM determination the type approval can be extended to vehicles belonging to an approved OBFCM family as defined in paragraph 6.6.3. of this Regulation.

**8. Conformity of production (COP)**

**[TO BE ADDED]**

**9. Penalties for non-conformity of production**

9.1. The approval granted in respect of a vehicle type pursuant to this Regulation, may be withdrawn if the requirements laid down in paragraph 8.x.x. are not complied with or if the vehicle or vehicles taken fail to pass the tests prescribed in paragraph 8.x.x.

9.2. If a Contracting Party to the 1958 Agreement which applies this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex A2 to this Regulation.

**10. Production definitively discontinued**

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, they shall so inform the Type Approval Authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Contracting Parties to the 1958 Agreement applying this Regulation by means of copies of the communication form conforming to the model in Annex A2 to this Regulation.

**11. Special provisions**

11.1.

As from the official date of entry into force of the 01 series of amendments to this Regulation, and by way of derogation to the obligations of Contracting Parties, the Contracting Parties applying this Regulation and also applying the 08 or a later series of amendments to Regulation No. 83 may refuse to accept type approvals granted on the basis of this Regulation, which are not accompanied by an approval to the 08 or a later series of amendments to Regulation No. 83.

11.2. Until the official date of entry into force of the 01 series of amendments to this Regulation, and by way of derogation to the obligations of Contracting Parties, the Contracting Parties applying this Regulation may refuse to accept type approvals granted on the basis of this Regulation.

{ADD TRANSITIONAL PROVISIONS?}

**12. Names and addresses of Technical Services responsible for conducting approval tests, and of Type Approval Authorities**

The Contracting Parties to the 1958 Agreement which apply this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

**Appendix 1**

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

**[TO BE ADDED]**

**Appendix 2**

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

**[TO BE ADDED]**

**Appendix 3**

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

**[TO BE ADDED]**

**Appendix 4**

Only applicable for Level 1A and Level 2;

**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, 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.

2.8 "*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.

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 the standards referred to in paragraph 6.5.3.2 (a) of Appendix 1 to Annex C5.

3.1. For all vehicles referred to in Article 4a, with the exception of OVC-HEVs:

(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).

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).

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:



Where:

Fuel\_ConsumedWLTP (litres) is the fuel consumption determined at the first test carried out [on a vehicle representative of the OBFCM family] 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.

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 OVC-HEVs the charge-sustaining Type 1 test shall be used.

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 [on the vehicle representative of the OBFCM family] in accordance with paragraph 1.2 of Annex B6, in accordance with the formulae in paragraph 4.2, using the fuel consumed 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 [an OBFCM family containing only vehicles] tested without using the interpolation method (vehicle H), and six tests for [all other OBFCM families] (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 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.

[4.2.3. At the request of the manufacturer and approval of the approval authority, for the values stored according to the definitions described in paragraphs 2.3., 2.4. and 2.5, the manufacturer may take account of effects which contribute to CO2 emissions other than those from combustion of fuel injected into the engine during a Type 1 test. Examples of these effects are injection of SCR reagent, purging of an active charcoal canister, combustion of lubrication oil etc. The manufacturer shall provide the approval authority with an explanation of these adjustments, where applicable.]

**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) 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 paragraphs 5.3. and 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. The obligation to preserve the values of the lifetime counters shall in this case apply for new type approvals at the latest from 1 January 2022 and for new vehicles from 1 January 2023.

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.

**Appendix 5 Requirements for vehicles that use a reagent for the exhaust after-treatment system**

1. Introduction

This appendix sets out the requirements for vehicles that rely on the use of a reagent for the after-treatment system in order to reduce emissions. Every reference in this appendix to 'reagent tank' shall be understood as also applying to other containers in which a reagent is stored.

1.1. The capacity of the reagent tank shall be such that a full reagent tank does not need to be replenished over an average driving range of 5 full fuel tanks providing the reagent tank can be easily replenished (e.g. without the use of tools and without removing vehicle interior trim. The opening of an interior flap, in order to gain access for the purpose of reagent replenishment, shall not be understood as the removal of interior trim). If the reagent tank is not considered to be easy to replenish as described above, the minimum reagent tank capacity shall be at least equivalent to an average driving distance of 15 full fuel tanks. However, in the case of the option in paragraph 3.5., where the manufacturer chooses to start the warning system at a distance which may not be less than 2,400 km before the reagent tank becomes empty, the above restrictions on a minimum reagent tank capacity shall not apply.

1.2. In the context of this appendix, the term "average driving distance" shall be taken to be derived from the fuel or reagent consumption during a Type 1 test for the driving distance of a fuel tank and the driving distance of a reagent tank respectively.

2. Reagent indication

2.1. The vehicle shall include a specific indicator on the dashboard that informs the driver when reagent levels are below the threshold values specified in paragraph 3.5.

3. Driver warning system

3.1. The vehicle shall include a warning system consisting of visual alarms that informs the driver when an abnormality is detected in the reagent dosing, e.g. when emissions are too high, the reagent level is low, reagent dosing is interrupted, or the reagent is not of a quality specified by the manufacturer. The warning system may also include an audible component to alert the driver.

3.2. The warning system shall escalate in intensity as the reagent approaches empty. It shall culminate in a driver notification that cannot be easily defeated or ignored. It shall not be possible to turn off the system until the reagent has been replenished.

3.3. The visual warning shall display a message indicating a low level of reagent. The warning shall not be the same as the warning used for the purposes of OBD or other engine maintenance. The warning shall be sufficiently clear for the driver to understand that the reagent level is low (e.g. "urea level low", "AdBlue level low", or "reagent low").

3.4. The warning system does not initially need to be continuously activated, however the warning shall escalate so that it becomes continuous as the level of the reagent approaches the point where the driver inducement system in paragraph 8. comes into effect. An explicit warning shall be displayed (e.g. "fill up urea"', "fill up AdBlue", or "fill up reagent"). The continuous warning system may be temporarily interrupted by other warning signals providing that they are important safety related messages.

3.5. The warning system shall activate at a distance equivalent to a driving range of at least 2,400 km in advance of the reagent tank becoming empty, or at the choice of the manufacturer at the latest when the level of reagent in the tank reaches one of the following levels:

(a) a level expected to be sufficient for driving 150 per cent of an average driving range with a complete tank of fuel; or

(b) 10 per cent of the capacity of the reagent tank,

whichever occurs earlier.

4. Identification of incorrect reagent

4.1. The vehicle shall include a means of determining that a reagent corresponding to the characteristics declared by the manufacturer and recorded in Annex A1 is present on the vehicle.

4.2. If the reagent in the storage tank does not correspond to the minimum requirements declared by the manufacturer the driver warning system in paragraph 3. shall be activated and shall display a message indicating an appropriate warning (e.g. "incorrect urea detected", "incorrect AdBlue detected", or "incorrect reagent detected"). If the reagent quality is not rectified within 50 km of the activation of the warning system then the driver inducement requirements of paragraph 8. shall apply.

5. Reagent consumption monitoring

5.1. The vehicle shall include a means of determining reagent consumption and providing off-board access to consumption information.

5.2. Average reagent consumption and average demanded reagent consumption by the engine system shall be available via the serial port of the standard diagnostic connector. Data shall be available over the previous complete 2,400 km period of vehicle operation.

5.3. In order to monitor reagent consumption, at least the following parameters within the vehicle shall be monitored:

(a) The level of reagent in the on-vehicle storage tank; and

(b) The flow of reagent or injection of reagent as close as technically possible to the point of injection into an exhaust after-treatment system.

5.4. A deviation of more than 50 per cent between the average reagent consumption and the average demanded reagent consumption by the engine system over a period of 30 minutes of vehicle operation, shall result in the activation of the driver warning system in paragraph 3., which shall display a message indicating an appropriate warning (e.g. "urea dosing malfunction", "AdBlue dosing malfunction", or "reagent dosing malfunction"). If the reagent consumption is not rectified within 50 km of the activation of the warning system then the driver inducement requirements of paragraph 8. shall apply.

5.5. In the case of interruption in reagent dosing activity the driver warning system as referred to in paragraph 3. shall be activated, which shall display a message indicating an appropriate warning. Where the reagent dosing interruption is initiated by the engine system because the vehicle operating conditions are such that the vehicle's emission performance does not require reagent dosing, the activation of the driver warning system as referred to in paragraph 3. may be omitted, provided that the manufacturer has clearly informed the approval authority when such operating conditions apply. If the reagent dosing is not rectified within 50 km of the activation of the warning system then the driver inducement requirements of paragraph 8. shall apply.

6. Monitoring NOx emissions

6.1. As an alternative to the monitoring requirements referred to in paragraphs 4. and 5., manufacturers may use exhaust gas sensors directly to sense excess NOx levels in the exhaust.

6.2. The manufacturer shall demonstrate that use of the sensors referred to in paragraph 6.1. and any other sensors on the vehicle, results in the activation of the driver warning system as referred to in paragraph 3., the display of a message indicating an appropriate warning (e.g. “emissions too high — check urea”, “emissions too high — check AdBlue”, “emissions too high — check reagent”), and the activation of the driver inducement system as referred to in paragraph 8.3., when the situations referred to in paragraphs 4.2., 5.4., or 5.5. occur.

For the purposes of this paragraph these situations are presumed to occur if the applicable NOx OBD threshold limit set out in Table xx of paragraph 6.x. is exceeded.

NOx emissions during the test to demonstrate compliance with these requirements shall be no more than 20 per cent higher than the OBD threshold limits.

7. Storage of failure information

7.1. Where reference is made to this paragraph, non-erasable Parameter Identifiers (PID) shall be stored identifying the reason for and the distance travelled by the vehicle during the inducement system activation. The vehicle shall retain a record of the PID for at least 800 days or 30,000 km of vehicle operation. The PID shall be made available via the serial port of a standard diagnostic connector upon request of a generic scan tool in accordance with the provisions of paragraph 6.5.3.1. of Appendix 1 to Annex C5. The information stored in the PID shall be linked to the period of cumulated vehicle operation, during which it has occurred, with an accuracy of not less than 300 days or 10,000 km.

7.2. Malfunctions in the reagent dosing system attributed to technical failures (e.g. mechanical or electrical faults) shall also be subject to the OBD requirements in paragraph 6.8. of this Regulation and Annex C5.

8. Driver inducement system

8.1. The vehicle shall include a driver inducement system to ensure that the vehicle operates with a functioning emission control system at all times. The inducement system shall be designed so as to ensure that the vehicle cannot operate with an empty reagent tank.

8.1.1. The requirement for a driver inducement system shall not apply to vehicles designed and constructed for use by the rescue services, armed services, civil defence, fire services and forces responsible for maintaining public order. Permanent deactivation of the driver inducement system for these vehicles shall only be done by the vehicle manufacturer.

8.2. The inducement system shall activate at the latest when the level of reagent in the tank reaches:

(a) In the case that the warning system was activated at least 2,400 km before the reagent tank was expected to become empty, a level expected to be sufficient for driving the average driving range of the vehicle with a complete tank of fuel.

(b) In the case that the warning system was activated at the level described in paragraph 3.5.(a), a level expected to be sufficient for driving 75 per cent of the average driving range of the vehicle with a complete tank of fuel; or

(c) In the case that the warning system was activated at the level described in paragraph 3.5.(b), 5 per cent of the capacity of the reagent tank.

(d) In the case that the warning system was activated ahead of the levels described in both paragraph 3.5.(a) and 3.5.(b) but less than 2,400 km in advance of the reagent tank becoming empty, whichever level described in (b) or (c) of this paragraph occurs earlier.

Where the alternative described in paragraph 6.1. is utilised, the system shall activate when the irregularities described in paragraphs 4. or 5. or the NOx levels described in paragraph 6.2. have occurred.

The detection of an empty reagent tank and the irregularities mentioned in paragraphs 4., 5., or 6. shall result in the failure information storage requirements of paragraph 7. taking effect.

8.3. The manufacturer shall select which type of inducement system to install. The options for a system are described in paragraphs 8.3.1., 8.3.2., 8.3.3. and 8.3.4.

8.3.1. A "no engine restart after countdown" approach allows a countdown of restarts or distance remaining once the inducement system activates. Engine starts initiated by the vehicle control system, such as start-stop systems, are not included in this countdown.

8.3.1.1. In the case that the warning system was activated at least 2,400 km before the reagent tank was expected to become empty, or the irregularities described in paragraphs 4. or 5. or the NOx levels described in paragraph 6.2. have occurred, engine restarts shall be prevented immediately after the vehicle has travelled a distance expected to be sufficient for driving the average driving range of the vehicle with a complete tank of fuel since the activation of the inducement system.

8.3.1.2. In the case that the inducement system was activated at the level described in paragraph 8.2.(b), engine restarts shall be prevented immediately after the vehicle has travelled a distance expected to be sufficient for driving 75 per cent of the average driving range of the vehicle with a complete tank of fuel since the activation of the inducement system.

8.3.1.3. In the case that the inducement system was activated at the level described in paragraph 8.2.(c), engine restarts shall be prevented immediately after the vehicle has travelled a distance expected to be sufficient for driving the average driving range of the vehicle with 5 per cent of the capacity of the reagent tank, since the activation of the inducement system.

8.3.1.4. In addition, engine restarts shall be prevented immediately after the reagent tank becomes empty, should this situation occur earlier than the situations specified in paragraphs 8.3.1.1, 8.3.1.2., or 8.3.1.3.

8.3.2. A "no start after refuelling" system results in a vehicle being unable to start after re-fuelling if the inducement system has activated.

8.3.3. A "fuel-lockout" approach prevents the vehicle from being refuelled by locking the fuel filler system after the inducement system activates. The lockout system shall be robust to prevent it being tampered with.

8.3.4. This paragraph and sub-paragraphs are only applicable for Level 1A

A "performance restriction" approach restricts the speed of the vehicle after the inducement system activates. The level of speed limitation shall be noticeable to the driver and significantly reduce the maximum speed of the vehicle. Such limitation shall enter into operation gradually or after an engine start. Shortly before engine restarts are prevented, the speed of the vehicle shall not exceed 50 km/h.

8.3.4.1. In the case that the warning system was activated at least 2,400 km before the reagent tank was expected to become empty, or the irregularities described in paragraphs 4. or 5. or the NOx levels described in paragraph 6.2. have occurred, engine restarts shall be prevented immediately after the vehicle has travelled a distance expected to be sufficient for driving the average driving range of the vehicle with a complete tank of fuel since the activation of the inducement system.

8.3.4.2. In the case that the inducement system was activated at the level described in paragraph 8.2.(b), engine restarts shall be prevented immediately after the vehicle has travelled a distance expected to be sufficient for driving 75 per cent of the average driving range of the vehicle with a complete tank of fuel since the activation of the inducement system.

8.3.4.3. In the case that the inducement system was activated at the level described in paragraph 8.2.(c), engine restarts shall be prevented immediately after the vehicle has travelled a distance expected to be sufficient for driving the average driving range of the vehicle with 5 per cent of the capacity of the reagent tank, since the activation of the inducement system.

8.3.4.4. In addition, engine restarts shall be prevented immediately after the reagent tank becomes empty, should this situation occur earlier than the situations specified in paragraphs 8.3.4.1, 8.3.4.2. or 8.3.4.3.

8.4. Once the inducement system has prevented engine restarts, the inducement system shall only be deactivated if the irregularities specified in paragraphs 4., 5., or 6. have been rectified or if the quantity of reagent added to the vehicle meets at least one of the following criteria:

(a) expected to be sufficient for driving 150 per cent of an average driving range with a complete tank of fuel; or

(b) at least 10 per cent of the capacity of the reagent tank.

After a repair has been carried out to correct a fault where the OBD system has been triggered under paragraph 7.2., the inducement system may be reinitialised via the OBD serial port (e.g. by a generic scan tool) to enable the vehicle to be restarted for self-diagnosis purposes. The vehicle shall operate for a maximum of 50 km to enable the success of the repair to be validated. The inducement system shall be fully reactivated if the fault persists after this validation.

8.5. The driver warning system referred to in paragraph 3. shall display a message indicating clearly:

(a) The number of remaining restarts and/or the remaining distance; and

(b) The conditions under which the vehicle can be restarted.

8.6. The driver inducement system shall be deactivated when the conditions for its activation have ceased to exist. The driver inducement system shall not be automatically deactivated without the reason for its activation having been remedied.

8.7. Detailed written information fully describing the functional operation characteristics of the driver inducement system shall be provided to the Type Approval Authority at the time of approval.

8.8. As part of the application for type approval under this Regulation, the manufacturer shall demonstrate the operation of the driver warning and inducement systems.

9. Information requirements

9.1. The manufacturer shall provide all owners of new vehicles with clear written information about any exhaust aftertreatment system which uses a reagent. This information shall state that if such an exhaust aftertreatment system is not functioning correctly, the driver shall be informed of a problem by the driver warning system and that the driver inducement system shall consequentially result in the vehicle being unable to start.

9.2. The instructions shall indicate requirements for the proper use and maintenance of vehicles, including the proper use of consumable reagents.

9.3. The instructions shall specify if consumable reagents have to be replenished by the vehicle driver between normal maintenance intervals. They shall indicate how the vehicle driver should replenish the reagent tank. The information shall also indicate a likely rate of reagent consumption for that type of vehicle and how often it should be replenished.

9.4. The instructions shall specify that use of, and replenishing of, a required reagent of the correct specifications is mandatory for the vehicle to comply with its certificate of conformity.

9.5. The instructions shall state that it may be a criminal offence to use a vehicle that does not consume any reagent if it is required for the reduction of emissions.

9.6. The instructions shall explain how the warning system and driver inducement systems work. In addition, the consequences of ignoring the warning system and not replenishing the reagent shall be explained.

10. Operating conditions of the after-treatment system

Manufacturers shall ensure that any exhaust aftertreatment system which uses a reagent retains its emission control function during all ambient conditions, especially at low ambient temperatures. This includes taking measures to prevent the complete freezing of the reagent during parking times of up to 7 days at 258 K (-15 °C) with the reagent tank 50 per cent full. If the reagent is frozen, the manufacturer shall ensure that the reagent shall be liquefied and ready for use within 20 minutes of the vehicle being started at 258 K (-15 °C) measured inside the reagent tank.

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