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1958 Agreement:

Consideration of draft amendments to existing

UN Regulations submitted by GRPE

Proposal for a new 08 series of amendments to UN Regulation No. 83 (Emissions of light-duty vehicles)

Submitted by the Working Party on Pollution and Energy *

The text reproduced below was adopted by the Working Party on Pollution and Energy (GRPE) at its eighty-seventh session (ECE/TRANS/WP.29/GRPE/87, para. 35). It is based on ECE/TRANS/WP.29/GRPE/2023/2 and GRPE-87-26-Rev.1 as amended by Addendum 1 of the report. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their June 2023 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2023 as outlined in proposed programme budget for 2023 (A/77/6 (Sect.20), para 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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1. Scope

This Regulation establishes technical requirements for the type approval of motor vehicles with regard to idling emissions (Type 2 test), crankcase emissions (Type 3 test) and exhaust emissions at low ambient temperature (Type 6 test) for emissions of gaseous compounds.

In addition, this Regulation lays down rules for in-service conformity.

- 1.1. This Regulation shall apply to vehicles of categories M₁, M₂, N₁ and N₂ with a reference mass not exceeding 2,610 kg.¹

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.

At the manufacturer's request, type approval granted under this Regulation may be extended from vehicles mentioned above to special purpose vehicles of categories M₁, M₂, N₁ and N₂ regardless of their reference mass. The manufacturer shall demonstrate to the type approval authority which granted the type approval that the vehicle in question is a special purpose vehicle.¹

2. Definitions

For the purposes of this Regulation the definitions in UN Regulation No. 154 shall apply, unless specified otherwise below, in which case the following definitions shall apply:

- 2.1. "*Vehicle type*" means a group of vehicles that do not differ in the following respects:
- 2.1.1. The equivalent inertia determined in relation to the reference mass as prescribed in Table A4a/3 of Annex 4a of the 07 series of amendments to this Regulation; and
- 2.1.2. The engine and vehicle characteristics as defined in Annex 1 to this Regulation.
- 2.2. Reserved
- 2.3. "*Maximum mass*" means the technically permissible maximum mass declared by the vehicle manufacturer (this mass may be greater than the maximum mass authorised by the national administration).
- 2.4. - 2.7. Reserved
- 2.8. "*Crankcase*" means the spaces in or external to an engine which are connected to the oil sump by internal or external ducts through which gases and vapour can escape.
- 2.9. - 2.11. Reserved
- 2.12. "*Pollution control devices*" means those components of a vehicle that control and/or limit exhaust and evaporative emissions.
- 2.13. Reserved
- 2.14. "*In-service Conformity test*" means the test and evaluation of conformity conducted in accordance with paragraph 9 and Annex 4 of this Regulation.

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2. - www.unece.org/transport/vehicle-regulations/wp29/resolutions

- 2.15. "*Properly maintained and used*" means, for the purpose of a test vehicle, that such a vehicle satisfies the criteria for acceptance of a selected vehicle laid down in Appendix 1 to Annex 4.
- 2.16. – 2.18. Reserved
- 2.19. "*Approval of a vehicle*" means the approval of a vehicle type with regard to the scope of this Regulation.
- 2.20. - 2.25. Reserved
- 2.26. "*Cold start*" means, in the context of the in use performance ratio of OBD monitors, an engine coolant temperature or equivalent temperature at engine start less than or equal to 35 °C and less than or equal to 7 °C higher than ambient temperature, if available.
- 2.27. – 2.34. Reserved
- 2.35. "*Reagent*" means any product other than fuel that is stored on-board the vehicle and is provided to the exhaust after-treatment system upon request of the emission control system.
- 2.36. "*Real driving emissions (RDE)*" means the emissions of a vehicle under its normal conditions of use.
- 2.37. "*Portable emissions measurement system (PEMS)*" means a portable emissions measurement system meeting the requirements specified in Appendix 1 to Annex IIIA.
- 2.38. "*Base Emission Strategy (BES)*" means an emission strategy that is active throughout the speed and load operating range of the vehicle unless an Auxiliary Emission Strategy is activated.
- 2.39. "*Auxiliary Emission Strategy (AES)*" means an emission strategy that becomes active and replaces or modifies a BES for a specific purpose and in response to a specific set of ambient or operating conditions and only remains operational as long as those conditions exist.
- 2.40. "*Third party*" means a party with legitimate interest and the resources to testing facilities with accreditation in accordance with EN ISO/IEC 17020 and EN ISO/IEC 17025.

3. Application for approval

- 3.1. The application for approval of a vehicle type with regard to idling emissions, crankcase emissions and exhaust emissions at low ambient temperature shall be submitted by the vehicle manufacturer or by their authorized representative to the type approval authority.
- 3.1.1. In addition, the manufacturer shall submit the following information:
- (a) A declaration by the manufacturer that the OBD system complies with the provisions of paragraph 7 of Appendix 1 to Annex C5 of UN Regulation No. 154 and paragraph 1 of Annex 11 to this Regulation relating to in-use performance under all reasonably foreseeable driving conditions;
 - (b) A description of the provisions taken to prevent tampering with and modification of the emission control systems, including the emission control computer and odometer including the recording of mileage values;
 - (c) Where appropriate, copies of other type approvals with the relevant data to enable extension of approvals;
 - (d) Demonstration of compliance with Part III of UN Regulation No. 24 (if applicable), UN Regulation No. 85, Level 1a or Level 2 of UN Regulation No. 154 and UN Regulation No. [xxx] on RDE (if applicable).

- 3.2. A model of the information document relating to exhaust emissions is given in Annex 1 to this Regulation.
- 3.3. For the tests described in paragraph 5. 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.
- 3.3.1. The application referred to in paragraph 3.1. of this Regulation shall be drawn up in accordance with the model of the information document set out in Annex 1 to this Regulation.
- 3.3.2. For the purposes of paragraph 3.1.1.(a), the manufacturer shall use the model of a manufacturer's certificate of compliance with the OBD in-use performance requirements set out in Appendix 2 to Annex 2 to this Regulation.
- 3.3.3. – 3.3.4. Reserved
- 3.3.5. For the purposes of paragraph 3.1.1.(b) of this Regulation, 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.
- 3.3.6. For the tests specified in Table A, the manufacturer shall submit to the Technical service responsible for the type approval tests a vehicle representative of the type to be approved.
- 3.3.7. The application for type approval of flex-fuel vehicles shall comply with the additional requirements laid down in paragraph 5.8. of UN Regulation No. 154.
- 3.3.8. 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.
- 3.4. Extended documentation package
- 3.4.1. In order for the approval authorities to be able to assess the proper use of AES, taking into account the prohibition of defeat devices contained in paragraph 5.1.7., the manufacturer shall also provide an extended documentation package, as described in Appendix 3a to Annex 1 to this Regulation.
- 3.4.2. For vehicles approved under the character EB and EC as defined in Table A3/1, Annex 3, the manufacturer shall introduce an indicator (AES Flag or Timer) to indicate when a vehicle runs in AES mode instead of BES mode. The indicator shall be available via the serial port of a standard diagnostic connector upon request of a generic scan-tool. The AES that is running shall be identifiable via the formal documentation package, as in Appendix 3a to Annex 1.
- 3.4.3. The extended documentation package shall be identified and dated by the type approval authority and kept by that authority for at least 10 years after the approval is granted.
- 3.4.4. At the request of the manufacturer, the type approval authority shall conduct a preliminary assessment of the AES for new vehicle types. In that case, the relevant documentation shall be provided to the type approval authority between 2 and 12 months before the start of the type approval process.
- 3.4.5. The type approval authority shall make a preliminary assessment on the basis of the extended documentation package, as described in point (b) of Appendix 3a to Annex 1, provided by the manufacturer. The type approval authority shall make the assessment in accordance with the methodology described in Appendix 3b to Annex 1. The type approval authority may deviate from that methodology in exceptional and duly justified cases.
- 3.4.6. The preliminary assessment of the AES for new vehicle types shall remain valid for the purposes of type approval for a period of 18 months. That period may be extended by a further 12 months if the manufacturer provides to the

type approval authority proof that no new technologies have become accessible in the market that would change the preliminary assessment of the AES.

- 3.4.7. The type approval authority may test the functioning of AES.
- 3.4.8. A list of AES which were deemed non-acceptable by type approval authorities shall be compiled yearly by a Contracting Party on request of a regional authority.
- 3.4.9. The manufacturer shall also provide to the type approval authorities a formal documentation package, as in Appendix 3a to Annex 1, containing information on AES/BES that would allow an independent tester to identify if the emissions measured can be attributed to an AES or BES strategy or are potentially due to a defeat device. The formal documentation package shall be made available upon request.
- 3.4.10. Vehicles of category M₁ or N₁ shall be approved with emission characters EA, EB or EC as specified in Table A3/1, Annex 3, taking into account the utility factors determined in accordance with the values specified in Table A8.App5/1 of paragraph 3.2. of Annex B8 to UN Regulation No. 154.
- 3.5. The manufacturer shall also provide the type approval authority which granted the emission type approval under this Regulation ('granting type approval authority') with a package on testing transparency containing the necessary information in order to allow the performance of testing in accordance with paragraph 5.9. of Annex 4.

4. Approval

- 4.1. If the vehicle type submitted for approval following this amendment meets the requirements of paragraph 5. of this Regulation, approval of that vehicle type shall be granted.
- 4.2. An approval number shall be assigned to each type approved.
- 4.2.1. 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 approval².
- Section 2: The number 83, 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 two characters indicating the emission standard (e.g. EA, EB or EC) as defined in Table A3/1, Annex 3.
- Section 3: A four-digit sequential number (with leading zeros as applicable). The sequence shall start from 0001.

² The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.6 – Annex 3, www.unece.org/transport/vehicle-regulations/wp29/resolutions

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 numerals.

4.2.2. Example of an Approval Number to this Regulation:

E11*83R08/01/EA*0123*01

The first extension of the Approval numbered 0123, issued by the United Kingdom to Series of Amendments 08, Supplement 01, which is an Approval according to emission standard 'Euro 6e'.

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

4.3. 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 Agreement which apply this Regulation by means of a form conforming to the model in Annex 2 to this Regulation.

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

4.4. 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:

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

4.4.2. 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 4.4.1.

4.4.3. The approval mark shall contain an additional character after the type approval number, the purpose of which is to distinguish the emission standard for which the approval has been granted. This letter should be chosen according to the Table A3/1 of Annex 3 to this Regulation.

4.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1. need not be repeated; in such a case, the Regulation, approval numbers and the additional symbols of all the UN 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 4.4.1. of this Regulation.

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

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

4.7.1. Annex 3 to this Regulation gives examples of arrangements of the approval mark.

5. Specifications and tests

5.1. General

5.1.1. Manufacturers shall demonstrate that all new vehicles are type approved in accordance with this Regulation. These obligations include meeting the emission limits set out in this Regulation.

Manufacturers shall ensure that type approval procedures for verifying conformity of production and in-service conformity are met.

In addition, the technical measures taken by the manufacturer must be such as to ensure that the tailpipe and evaporative emissions are effectively limited, pursuant to this Regulation, throughout the normal life of the vehicles under normal conditions of use. Therefore, in-service conformity measures shall be checked for a period of up to five years or 100 000 km, whichever is the sooner.

In-service conformity shall be checked, in particular, for tailpipe emissions as tested against emission limits set out in UN Regulation No. 154.

- 5.1.2. The manufacturer shall equip vehicles so that the components likely to affect emissions are designed, constructed and assembled so as to enable the vehicle, in normal use, to comply with this Regulation.
- 5.1.3. Reserved
- 5.1.4. Reserved
- 5.1.5. Provisions for electronic system security
 - 5.1.5.1. The requirements for electronic system security of paragraph 6.1.7. of UN Regulation No. 154 shall be complied with. The effective application of these strategies in protecting the emission control systems may be tested during type approval and/or regional market surveillance.
 - 5.1.5.2. Manufacturers shall effectively deter reprogramming of the odometer readings, in the board network, in any powertrain controller as well as in the transmitting unit for remote data exchange if applicable. Manufacturers shall include systematic tamper-protection strategies and write-protect features to protect the integrity of the odometer reading. Methods giving an adequate level of tamper protection shall be approved by the type approval authority. The effective application of these strategies in protecting the odometer may be tested during type approval and/or regional market surveillance.
- 5.1.6. It shall be possible to inspect the vehicle for roadworthiness test in order to determine its performance in relation to the data collected in accordance with paragraph 5.3.7. If this inspection requires a special procedure, this shall be detailed in the service manual (or equivalent media). This special procedure shall not require the use of special equipment other than that provided with the vehicle.
- 5.1.7. 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.
- 5.2. Application of tests

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

Table A - Requirements
Application of test requirements for type approval and extensions

<i>Application of test requirements for type approval and extensions</i>										
<i>Vehicle category</i>	<i>Vehicles with positive ignition engines including hybrids¹</i>								<i>Vehicles with compression ignition engines including hybrids</i>	
	<i>Mono fuel</i>				<i>Bi-fuel²</i>			<i>Flex-fuel</i>	<i>Mono fuel</i>	
Reference fuel	Petrol	LPG	NG/Bio methane	Hydrogen (ICE)	Petrol	Petrol	Petrol	Petrol	Diesel	Petrol
					LPG	NG/Bio methane	Hydrogen (ICE)	Ethanol (E85)		
Idle emissions (Type 2 test)	Yes	Yes	Yes	—	Yes (both fuels)	Yes (both fuels)	Yes (petrol only)	Yes (both fuels)	—	—
Crankcase emissions (Type 3 test)	Yes	Yes	Yes	—	Yes (petrol only)	Yes (petrol only)	Yes (petrol only)	Yes (petrol only)	—	—
Low temperature emissions (Type 6 test)	Yes	—	—	—	Yes (petrol only)	Yes (petrol only)	Yes (petrol only)	Yes (both fuels)	—	—
In-service conformity	Yes	Yes	Yes	Yes	Yes (both fuels)	Yes (both fuels)	Yes (both fuels)	Yes (both fuels)	Yes	Yes

¹ Specific test procedures for hydrogen vehicles and flex fuel biodiesel vehicles will be defined at a later stage.

² When a bi-fuel vehicle is combined with a flex fuel vehicle, both test requirements are applicable.

5.3. Description of tests

5.3.1. Reserved

5.3.2. Type 2 test (Carbon monoxide emission test at idling speed)

5.3.2.1. This test is carried out on all vehicles powered by positive ignition engines, as follows:

5.3.2.1.1. Vehicles that can be fuelled either with petrol or with LPG or NG/biomethane shall be tested in the Type 2 test on both fuels.

5.3.2.1.2. Notwithstanding the requirement of paragraph 5.3.2.1.1., mono-fuel gas vehicles will be regarded for the Type 2 test as vehicles that can only run on a gaseous fuel.

5.3.2.2. For the Type 2 test set out in Annex 5 to this Regulation, at normal engine idling speed, the maximum permissible carbon monoxide content in the exhaust gases shall be that stated by the vehicle manufacturer. However, the maximum carbon monoxide content shall not exceed 0.3 per cent vol.

At high idle speed, the carbon monoxide content by volume of the exhaust gases shall not exceed 0.2 per cent, with the engine speed being at least 2,000 min⁻¹ and Lambda being 1 ± 0.03 or in accordance with the specifications of the manufacturer.

5.3.3. Type 3 test (Verifying emissions of crankcase gases)

5.3.3.1. This test shall be carried out on all vehicles referred to in paragraph 1. except those having compression-ignition engines.

- 5.3.3.1.1. Vehicles that can be fuelled either with petrol or with LPG or NG should be tested in the Type 3 test on petrol only.
- 5.3.3.1.2. Notwithstanding the requirement of paragraph 5.3.3.1.1., mono-fuel gas vehicles will be regarded for the Type 3 test as vehicles that can only run on a gaseous fuel.
- 5.3.3.2. When tested in accordance with Annex 6 to this Regulation, the engine's crankcase ventilation system shall not permit the emission of any of the crankcase gases into the atmosphere.
- 5.3.4. Reserved
- 5.3.5. Type 6 test (Verifying the average exhaust emissions of carbon monoxide and hydrocarbons after a cold start at low ambient temperature).
- 5.3.5.1. This test shall be carried out on all vehicles referred to in paragraph 1. except those having compression-ignition engines.
- 5.3.5.1.1. The vehicle is placed on a chassis dynamometer equipped with a means of load an inertia simulation.
- 5.3.5.1.2. The test consists of the four elementary urban driving cycles of Part One of the NEDC based Type I test. The Part One test is described in paragraph 6.1.1. of Annex 4a to the 07 series of amendments to this Regulation, and illustrated in Figure A4a/1 of the same annex. The low ambient temperature test lasting a total of 780 seconds shall be carried out without interruption and start at engine cranking.
- 5.3.5.1.3. The low ambient temperature test shall be carried out at an ambient test temperature of 266 K (-7 °C). Before the test is carried out, the test vehicles shall be conditioned in a uniform manner to ensure that the test results may be reproducible. The conditioning and other test procedures are carried out as described in Annex 8 to this Regulation.
- 5.3.5.1.4. During the test, the exhaust gases are diluted and a proportional sample collected. The exhaust gases of the vehicle tested are diluted, sampled and analysed, following the procedure described in Annex 8 to this Regulation, and the total volume of the diluted exhaust is measured. The diluted exhaust gases are analysed for carbon monoxide and total hydrocarbons.
- 5.3.5.2. Subject to the requirements in paragraphs 5.3.5.2.2. and 5.3.5.3. the test shall be performed three times. The resulting mass of carbon monoxide and hydrocarbon emission shall be less than the limits shown in Table 2.

Table 2

Emission limit for the carbon monoxide and hydrocarbon tailpipe emissions after a cold start test

<i>Test temperature 266 K (-7 °C)</i>			
<i>Vehicle category</i>	<i>Class</i>	<i>Mass of carbon monoxide (CO) L₁ (g/km)</i>	<i>Mass of hydrocarbons (HC) L₂ (g/km)</i>
M	-	15	1.8
N ₁	I	15	1.8
	II	24	2.7
	III	30	3.2
N ₂	-	30	3.2

- 5.3.5.2.1. Notwithstanding the requirements of paragraph 5.3.5.2., for each pollutant, at least two of the three test results must be below the limit. One of the test results can exceed the limit but by no more than 10 per cent. The arithmetical mean value of the three test results for a pollutant must be below the prescribed limit. Where the prescribed limits are exceeded for more than one pollutant, it is immaterial whether this occurs in the same test or in different tests.
- 5.3.5.2.2. The number of tests prescribed in paragraph 5.3.5.2. may, at the request of the manufacturer, be increased to 10 if the arithmetical mean of the first three results is lower than 110 per cent of the limit. In this case, the requirement after testing is only that the arithmetical mean of all 10 results shall be less than the limit value.
- 5.3.5.3. The number of tests prescribed in paragraph 5.3.5.2. may be reduced according to paragraphs 5.3.5.3.1. and 5.3.5.3.2.
- 5.3.5.3.1. Only one test is performed if the result obtained for each pollutant of the first test is less than or equal to 0.70 L.
- 5.3.5.3.2. If the requirement of paragraph 5.3.5.3.1. is not satisfied, only two tests are performed if for each pollutant the result of the first test is less than or equal to 0.85 L and the sum of the first two results is less than or equal to 1.70 L and the result of the second test is less than or equal to L.
($V_1 \leq 0.85 \text{ L}$ and $V_1 + V_2 \leq 1.70 \text{ L}$ and $V_2 \leq L$).
- 5.3.6. Reserved
- 5.3.7. Emission data required for roadworthiness testing
- 5.3.7.1. This requirement applies to all vehicles powered by a positive ignition engine for which type approval is sought in accordance with this Regulation.
- 5.3.7.2. When tested in accordance with Annex 5 to this Regulation (Type 2 test) at normal idling speed:
- (a) The carbon monoxide content by volume of the exhaust gases emitted shall be recorded; and
 - (b) The engine speed during the test shall be recorded, including any tolerances.
- 5.3.7.3. When tested at "high idle" speed (i. e. $> 2,000 \text{ min}^{-1}$)
- (a) The carbon monoxide content by volume of the exhaust gases emitted shall be recorded;
 - (b) The Lambda value shall be recorded; and
 - (c) The engine speed during the test shall be recorded, including any tolerances.

The Lambda value shall be calculated using the simplified Brettschneider equation as follows:

$$\frac{[\text{CO}_2] + \frac{[\text{CO}]}{2} + [\text{O}_2] + \left(\frac{\text{Hcv}}{4} \cdot \frac{3.5}{3.5 + \frac{[\text{CO}]}{[\text{CO}_2]}} - \frac{\text{Ocv}}{2} \right) \cdot ([\text{CO}_2] + [\text{CO}])}{\left(1 + \frac{\text{Hcv}}{4} - \frac{\text{Ocv}}{2} \right) \cdot ([\text{CO}_2] + [\text{CO}] + \text{K1}[\text{HC}]}$$

Where:

[] = concentration in per cent volume,

K1 = conversion factor for Non-Dispersive Infrared (NDIR) measurement to Flame Ionisation Detector (FID) measurement (provided by manufacturer of measuring equipment),

H_{cv} = Atomic ratio of hydrogen to carbon:

- (a) for petrol (E10) 1.93;
- (b) for LPG 2.53;
- (c) for NG/biomethane 4.0;
- (d) for ethanol (E85) 2.74;
- (e) for ethanol (E75) 2.61.

O_{cv} = Atomic ratio of oxygen to carbon:

- (a) for petrol (E10) 0.033;
- (b) for LPG 0.0;
- (c) for NG/biomethane 0.0;
- (d) for ethanol (E85) 0.39;
- (e) for ethanol (E75) 0.329.

- 5.3.7.4. The engine oil temperature at the time of the test shall be measured and recorded.
- 5.3.7.5. The table of item 2.2. of the Addendum to Annex 2 to this Regulation shall be completed.
- 5.3.7.6. The manufacturer shall confirm the accuracy of the Lambda value recorded at the time of type approval in paragraph 5.3.7.3. as being representative of typical production vehicles within 24 months of the date of the granting of type approval by the type approval authority. An assessment shall be made based on surveys and studies of production vehicles.

6. Reserved

7. Extensions to type approvals

- 7.1. Extensions for tailpipe emissions (Type 2 test)
 - 7.1.1. The type approval shall be extended without the need for further testing to vehicles if they conform to the criteria of paragraph 3.0.1. (c) of UN Regulation No. 154.
- 7.2. Extensions for low temperature test (Type 6 test)
 - 7.2.1. Vehicles with different reference masses
 - 7.2.1.1. The type approval shall be extended only to vehicles with a reference mass requiring the use of the next two higher equivalent inertia or any lower equivalent inertia.
 - 7.2.1.2. For category N vehicles, the approval shall be extended only to vehicles with a lower reference mass, if the emissions of the vehicle already approved are within the limits prescribed for the vehicle for which extension of the approval is requested.
 - 7.2.2. Vehicles with different overall transmission ratios
 - 7.2.2.1. The type approval shall be extended to vehicles with different transmission ratios only under certain conditions.
 - 7.2.2.2. To determine whether type approval can be extended, for each of the transmission ratios used in the Type 6 test, the proportion,

$$(E) = (V_2 - V_1)/V_1$$

shall be determined where, at an engine speed of $1,000 \text{ min}^{-1}$, V_1 is the speed of the vehicle-type approved and V_2 is the speed of the vehicle type for which extension of the approval is requested.

7.2.2.3. If, for each transmission ratio, $E \leq 8$ per cent, the extension shall be granted without repeating the Type 6 test.

7.2.2.4. If, for at least one transmission ratio, $E > 8$ per cent, and if, for each gear ratio, $E \leq 13$ per cent, the Type 6 test shall be repeated. The tests may be performed in a laboratory chosen by the manufacturer subject to the approval of the Technical service. The report of the tests shall be sent to the Technical service responsible for the type approval tests.

7.2.3. Vehicles with different reference masses and transmission ratios

The type approval shall be extended to vehicles with different reference masses and transmission ratios, provided that all the conditions prescribed in paragraphs 7.2.1. and 7.2.2. are fulfilled.

8. Conformity of production (COP)

8.1. Every vehicle bearing an approval mark as prescribed under this Regulation shall conform, with regard to components affecting the emission of pollutants by the engine and emissions from the crankcase, to the vehicle type approved. The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3), with the following requirements:

8.1.1. Where applicable the Type 2 and 3 test, as described in Table A of this Regulation, shall be performed. The specific procedures for conformity of production are set out in the paragraph 8.2.

8.2. Checking the conformity of the vehicle for a Type 3 test.

8.2.1. If a verification of the Type 3 test is to be carried out, it shall be conducted in accordance with the following requirements:

8.2.1.1. When the type approval authority determines that the quality of production seems unsatisfactory, a vehicle shall be randomly taken from the family and subjected to the tests described in Annex 6.

8.2.1.2. The production shall be deemed to conform if this vehicle meets the requirements of the tests described in Annex 6.

8.2.1.3. If the vehicle tested does not satisfy the requirements of paragraph 8.2.1.1. a further random sample of four vehicles shall be taken from the same family and subjected to the tests described in Annex 6. The tests may be carried out on vehicles which have completed a maximum of 15,000 km with no modifications.

8.2.1.4. The production shall be deemed to conform if at least three vehicles meet the requirements of the tests described in Annex 6.

9. In-service conformity

9.1. Measures to ensure in-service conformity of vehicles type-approved under this Regulation shall be taken in accordance with Annex 4 to this Regulation.

9.2. The in-service conformity checks shall be appropriate for confirming that tailpipe and evaporative emissions are effectively limited during the normal life of vehicles under normal conditions of use.

9.3. In-service conformity shall be checked on properly maintained and used vehicles, in accordance with Appendix 1 of Annex 4, between 15,000 km or 6 months whichever occurs later and 100,000 km or 5 years whichever occurs sooner. In service conformity for evaporative emissions shall be checked on

properly maintained and used vehicles, in accordance with Appendix 1 of Annex 4, between 30,000 km or 12 months whichever occurs later and 100,000 km or 5 years whichever occurs sooner.

The requirements for in-service conformity checks are applicable until 5 years after the last vehicles of that in-service conformity family are registered.

- 9.4. In-service conformity checks shall not be mandatory if the annual production volume of an in-service conformity family intended for sales in the Contracting Parties that apply this regulation was less than 5,000 vehicles for the previous year. For the European Union, this shall apply for the whole Union. For such families, the manufacturer shall provide the type approval authority with a report of any emissions related warranty and relevant repair as set out in paragraph 4. of Annex 4. Such in-service conformity families may still be selected to be tested in accordance with Annex 4.
- 9.5. The manufacturer and the granting type approval authority shall perform in-service conformity checks in accordance with Annex 4. Other type approval authorities, technical services and other actors may perform parts of the in-service conformity checks in accordance with Annex 4.
- 9.6. The granting type approval authority shall take the decision on whether a family failed the provisions of in-service conformity, following a compliance assessment and approve the plan of remedial measures presented by the manufacturer in accordance with Annex 4.
- 9.7. If a type approval authority, technical service or other actors have established that an in-service conformity family fails the in-service conformity check, it shall notify without delay the granting type approval authority.
- Following that notification the granting type approval authority shall inform the manufacturer that an in-service conformity family fails the in-service conformity checks and that the procedures laid out in paragraphs 6. and 7. of Annex 4 shall be followed.
- 9.8. The manufacturer shall ensure that, throughout the normal life of a vehicle which is type approved in accordance with UN Regulation No. 154, its final RDE emission results as determined in accordance with UN Regulation No. [xxx] on RDE and emitted at any RDE test performed in accordance with that Regulation, do not exceed the emission limits for NO_x and PN.

10. Penalties for non-conformity of production

- 10.1. The approval granted in respect of a vehicle type pursuant to this Regulation, may be withdrawn if the requirements laid down in paragraph 8.1. are not complied with or if the vehicle or vehicles taken fail to pass the tests prescribed in paragraph 8.1.1.
- 10.2. If a Contracting Party 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 2 to this Regulation.

11. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he 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 2 to this Regulation.

12. Transitional provisions

12.1. General provisions

12.1.1. As from the official date of entry into force of the 08 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the 08 series of amendments.

12.2. Type approvals

12.2.1. As from 1 September 2023, Contracting Parties applying this Regulation shall grant an approval to new types of vehicle only if they comply with:

- (a) The requirements for vehicles approved under the character EA as defined in Table A3/1, Annex 3 of this Regulation, as amended by the 08 series of amendments.
- (b) The requirements stated in Part III of UN Regulation No. 24 (if applicable).
- (c) The requirements of UN Regulation No. 85.
- (d) The Level 1A requirements of the 02 series of amendment to UN Regulation No. 154 or the requirements of the 03 series of amendment to UN Regulation No. 154.
- (e) The requirements of UN Regulation No. [xxx] on RDE.

12.2.2. As from 1 January 2025, Contracting Parties applying this Regulation shall grant an approval to new types of vehicle only if they comply with:

- (a) The requirements for vehicles approved under the character EB as defined in Table A3/1, Annex 3 of this Regulation, as amended by the 08 series of amendments.
- (b) The requirements stated in Part III of UN Regulation No. 24 (if applicable).
- (c) The requirements of UN Regulation No. 85.
- (d) The Level 1A requirements of Supplement 1, or later version, to the 02 series of amendment to UN Regulation No. 154 or the requirements of Supplement 1, or later version, to the 03 series of amendment to UN Regulation No. 154.
- (e) The requirements of UN Regulation No. [xxx] on RDE.

12.2.3. As from 1 January 2027, Contracting Parties applying this Regulation shall grant an approval to new types of vehicle only if they comply with:

- (a) The requirements for vehicles approved under the character EC as defined in Table A3/1, Annex 3 of this Regulation, as amended by the 08 series of amendments.
- (b) The requirements stated in Part III of UN Regulation No. 24 (if applicable).
- (c) The requirements of UN Regulation No. 85.
- (d) The Level 1A requirements of Supplement 1, or later version, to the 02 series of amendment to UN Regulation No. 154 or the requirements of Supplement 1, or later version, to the 03 series of amendment to UN Regulation No. 154.
- (e) The requirements of UN Regulation No. [xxx] on RDE.

13. 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 sent³.

³ This communication shall be done via the “343-app” that is available at: https://apps.unece.org/WP29_application

Annex 1

Engine and vehicle characteristics and information concerning the conduct of tests

The following information, when applicable, shall be supplied in triplicate and include a list of contents.

If there are drawings, they shall be to an appropriate scale and show sufficient detail; they shall be presented in A4 format or folded to that format. Photographs, if any, shall show sufficient detail.

If the systems, components or separate technical units have electronic controls, information concerning their performance shall be supplied.

0. General
- 0.1. Make (name of undertaking):.....
- 0.2. Type:
- 0.2.1. Commercial name(s), if available:
- 0.2.3.1. Interpolation family (according to UN Regulation No. 154): ...
- 0.2.3.3. PEMS family identifier (according to UN Regulation No. [XXX] on RDE (if applicable)
- 0.2.3.4. Roadload family
- 0.3. Means of identification of type, if marked on the vehicle:⁴
- 0.3.1. Location of that mark:.....
- 0.4. Category of vehicle:⁵.....
- 0.5. Name and address of manufacturer:.....
- 0.8. Name(s) and address(es) of assembly plant(s):.....
- 0.9. Name and address of manufacturer's authorized representative where appropriate:.....
.....
2. Masses and dimensions⁶ (in kg and mm) (refer to drawing where applicable).....

⁴ If the means of identification of type contains characters not relevant to describe the vehicle, component or separate technical unit types covered by this information document, such characters shall be represented in the documentation by the symbol '?' (e.g. ABC??123??).

⁵ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2. - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>.

⁶ Where there is one version with a normal cab and another with a sleeper cab, both sets of masses and dimensions are to be stated.

- 2.6. Mass of the vehicle with bodywork and, in the case of a towing vehicle of category other than M₁, with coupling device, if fitted by the manufacturer, in running order, or mass of the chassis or chassis with cab, without bodywork and/or coupling device if the manufacturer does not fit the bodywork and/or coupling device (including liquids, tools, spare wheel, if fitted, and driver and, for buses and coaches, a crew member if there is a crew seat in the vehicle)⁷ (maximum and minimum for each variant):.....
- 2.8. Technically permissible maximum laden mass as stated by the manufacturer:^{8,9}
3. Description of energy converters and power plant.¹⁰ (In the case of a vehicle that can run either on petrol, diesel, etc., or also in combination with another fuel, items shall be repeated.¹¹)
- 3.1. Engine Manufacturer:
- 3.1.1. Manufacturer's engine code (as marked on the engine, or other means of identification):.....
- 3.2. Internal combustion engine:
- 3.2.1. Specific engine information:
- 3.2.1.1. Working principle: positive ignition/compression-ignition, four-stroke/two-stroke/rotary cycle¹²
- 3.2.1.6. Normal engine idling speed:¹²
- 3.2.1.6.1. High idle engine speed:¹²
- 3.2.1.7. Carbon monoxide content by volume in the exhaust gas with the engine idling (according to the manufacturer's specifications, positive ignition engines only)¹²..... per cent
- 3.2.13. Location of the absorption coefficient symbol (compression ignition engines only):.....
- 3.2.15. LPG fuelling system: yes/no⁹.....
- 3.2.16. NG fuelling system: yes/no⁹
- 3.2.18. Hydrogen fuelling system: yes/no⁹
- 3.4. Engines or motor combinations
- 3.4.1. Hybrid Electric Vehicle: yes/no⁹
- 3.4.2. Category of Hybrid Electric vehicle Off Vehicle Charging/Not Off Vehicle Charging⁹
- 3.4.3. Operating mode switch: with/without⁹
- 3.4.3.1. Selectable modes.....
- 3.4.3.1.1. Pure electric: yes/no⁹

⁷ The mass of the driver and, if applicable, of the crew member is assessed at 75 kg (subdivided into 68 kg occupant mass and 7 kg luggage mass according to ISO Standard 2416 – 1992), the fuel tank is filled to 90 per cent and the other liquid containing systems (except those for used water) to 100 per cent of the capacity s specified by the manufacturer.

⁸ For trailers or semi-trailers, and for vehicles coupled with a trailer or a semi-trailer, which exert a significant vertical load on the coupling device or the fifth wheel, this load, divided by standard acceleration of gravity, is included in the maximum technical permissible mass.

⁹ Please fill in here the upper and lower values for each variant.

¹⁰ In the case of non-conventional engines and systems, particulars equivalent to those referred to here shall be supplied by the manufacturer.

¹¹ Mono-fuel gas vehicles will be regarded for the test as vehicles which can only run a gaseous fuel.

¹² Strike out what does not apply.

- 3.4.3.1.2. Pure fuel consuming: yes/no⁹
- 3.4.3.1.3. Hybrid modes: yes/no (if yes, short description)
- 3.4.5. Electric machines (describe each type of electric machine separately)
- 3.4.5.1. Make:
- 3.4.5.2. Type:
- 3.4.5.3. Primary use: traction motor/generator
- 4. Transmission¹³
- 4.5. Gearbox:.....
- 4.5.1. Type (manual/automatic/CVT (continuously variable transmission)⁹
- 4.6. Gear ratios.....

<i>Index</i>	<i>Internal gearbox ratios (ratios of engine to gearbox output shaft revolutions)</i>	<i>Final drive ratios (ratio of gearbox output shaft to driven wheel revolutions)</i>	<i>Total gear ratios</i>
Maximum for Continuously Variable Transmission (CVT)			
1			
2			
3			
4, 5, others			
Minimum for CVT			
Reverse			

- 6. Suspension
- 6.6. Tyres and wheels.....
- 6.6.1. Tyre / wheel combination(s)
 - (a).....
 - For all tyre options indicate size designation, load-capacity index, speed category symbol;
 - (b).....
 - For tyres of category Z intended to be fitted on vehicles whose maximum speed exceeds 300 km/h equivalent information shall be provided; for wheels indicate rim size(s) and off-set(s).
- 6.6.1.1. Axles
 - 6.6.1.1.1. Axle 1:.....
 - 6.6.1.1.2. Axle 2:.....
 - 6.6.1.1.3. Axle 3:.....
 - 6.6.1.1.4. Axle 4:..... etc.
- 6.6.2. Upper and lower limit of rolling radii/circumference:¹⁴

¹³ The specified particulars are to be given for any proposed variants.

¹⁴ Specify one or another.

- 6.6.2.1. Axles
- 6.6.2.1.1. Axle 1:.....
- 6.6.2.1.2. Axle 2:.....
- 6.6.2.1.3. Axle 3:.....
- 6.6.2.1.4. Axle 4:..... etc.
- 6.6.3. Tyre pressure(s) recommended by the manufacturer:kPa

Annex 1 - Appendix 1

Test report

Test Reports

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

The following information, if applicable, is the minimum data required

Report number

APPLICANT			
Manufacturer			
SUBJECT	...		
Object submitted to tests			
	Make	:	
	Type	:	
CONCLUSION	The object submitted to tests complies with the requirements mentioned in the subject.		

PLACE,	DD/MM/YYYY
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General notes:

If there are several options (references), the one tested should be described in the test report

If there are not, a single reference to the information document at the start of the test report may be sufficient.

Every Technical Service is free to include some additional information.

Characters are included in the sections of the test report relating to specific vehicle types, as follows:

"(a)" Specific to positive ignition engine vehicles

"(b)" Specific to compression ignition engine vehicles

1. Description of tested vehicle(s)

1.1. General

Vehicle numbers	:	Prototype number and VIN
Category	:	
Drive wheels	:	

1.1.1. Powertrain Architecture

Powertrain architecture	:	pure ICE, hybrid
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1.1.2. Internal combustion engine

For more than one ICE, please repeat the point

Make	:	
Type	:	
Working principle	:	two/four stroke
Cylinders number and arrangement	:	
Engine capacity (cm ³)	:	
Engine idling speed (min ⁻¹)	:	+ -
High engine idling speed (min ⁻¹) (a)	:	+ -
Rated engine power	:	kW at rpm
Maximum net torque	:	Nm at rpm
Spark plug (if applicable)	:	make and type
Ignition coil (if applicable)	:	make and type
Engine lubricant	:	make and type
Cooling system	:	Type: air/water/oil

1.1.3. Test fuel

For more than one test fuel, please repeat the point

Make	:	
Type	:	Petrol - Diesel - LPG - NG - ...
Density at 15°C	:	
Sulphur content	:	Only for Diesel and Petrol
Batch number	:	

1.1.4. Fuel feed system (if applicable)

For more than one fuel feed system, please repeat the point

Direct injection	:	yes/no or description
Vehicle fuel type	:	Monofuel / bifuel / flex fuel
Control unit		
Part reference	:	same as information document
Software tested	:	read via scantool, for example
Air flowmeter	:	
Throttle body	:	
Pressure sensor	:	
Injection pump	:	
Injector(s)	:	

1.1.5. Intake system (if applicable)

For more than one intake system, please repeat the point

Pressure charger	:	Yes/no make & type (1)
Intercooler	:	yes/no type (air/air – air/water) (1)
Air filter (element) (1)	:	make & type
Intake silencer (1)	:	make & type

1.1.6. Exhaust system and anti-evaporative system (if applicable)

For more than one, please repeat the point

First catalytic converter	:	make & reference (1) principle: three way / oxidising / NO _x trap / NO _x storage system / Selective Catalyst Reduction...
Second catalytic converter	:	make & reference (1) principle: three way / oxidising / NO _x trap / NO _x storage system / Selective Catalyst Reduction...
Particulate trap	:	with/without/not applicable catalysed: yes/no make & reference (1)
Reference and position of oxygen and/or lambda sensor(s)	:	before catalyst / after catalyst
Air injection	:	with/without/not applicable
Water injection	:	with/without/not applicable
EGR	:	with/without/not applicable cooled/non-cooled HP/LP
Reference and position of NO _x sensor(s)	:	Before/ after
General description (1)	:	

1.1.8. Transmission (if applicable)

For more than one Transmission, please repeat the point

Gearbox	:	manual / automatic / continuous variation
Control unit	:	

Gearbox lubricant	:	make and type
Tyres		
Make	:	
Type	:	
Dimensions front/rear	:	
Dynamic circumference (m)	:	
Tyre pressure (kPa)	:	

* for OVC-HEV, specify for charge sustaining and for charge depleting operating conditions.

Transmission ratios (R.T.), primary ratios (R.P.) and (vehicle speed (km/h)) / (engine speed (1000 (min-1)) (V1000)) for each of the gearbox ratios (R.B.).

R.B.	R.P.	R.T.	V ₁₀₀₀
1 st	1/1		
2 nd	1/1		
3 rd	1/1		
4 th	1/1		
5 th	1/1		
...			

1.1.9. Electric machine (if applicable)

For more than one Electric Machine, please repeat the point

Make	:	
Type	:	
Peak Power (kW)	:	

1.1.10. Traction REESS (if applicable)

For more than one Traction REESS, please repeat the point

Make	:	
Type	:	
Capacity (Ah)	:	
Nominal Voltage (V)	:	

1.1.12. Power electronics (if applicable)

Can be more than one PE (propulsion converter, low voltage system or charger)

Make	:	
Type	:	
Power (kW)	:	

1.2. Vehicle description

1.2.1. Mass

Inertia mass (kg)	:	
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1.2.2. Road load parameters

f_0 (N)	:	
f_1 (N/(km/h))	:	
f_2 (N/(km/h) ²)	:	
Road load family's identifier	:	

2. Test results

2.2. Type 2 test (a)

Included the emissions data required for roadworthiness testing

Test	CO (% vol)	Lambda ¹⁵	Engine speed (min ⁻¹)	Oil temperature (°C)
Idle		—		
High idle				

2.3. Type 3 test (a)

Emission of crankcase gases into the atmosphere: none

2.7. Type 6 test (a)

Date of tests	:	(day/month/year)
Place of tests	:	
Method of setting of the chassis dyno	:	coast down (road load reference)
Effective power absorbed at 50 km/h including running losses of the vehicle on the dynamometer (kW)	:	

Pollutants		CO (g/km)	HC (g/km)
Test	1		
	2		
	3		
Average			
Limit			

¹⁵Delete where not applicable (there are cases where nothing needs to be deleted when more than one entry is applicable)

2.9. Smoke opacity test (b)

2.9.1. Steady speeds test

See family report(s)	:	
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2.9.2. Free acceleration test

Measured absorption value (m^{-1})	:	
Corrected absorption value (m^{-1})	:	

Annex 1 – Appendix 2

Reserved

Annex 1 – Appendix 3a

Documentation Packages

FORMAL DOCUMENTATION PACKAGE:

The manufacturer may use one formal documentation package for multiple emission type approvals. The formal documentation package shall include the following information:

Point	Explanation
Emission Type Approval Number(s)	List of emission type approval number(s) covered by this BES-AES declaration: including TA reference, software reference, calibration number, checksums of each version and of each relevant Control Unit (CU) such as engine and aftertreatment ones
Method of reading of software and calibration version	E.g. scan-tool explanation
Base Emission Strategies	
BES x	Description of strategy x
BES y	Description of strategy y
Auxiliary Emission Strategies	
Presentation of the AESs	Hierarchical relations among AES: which AES takes precedence if more than one are present
AES x	<ul style="list-style-type: none"> • AES description and justification • Measured and/or modelled parameters for AES activation • Other parameters used to activate the AES • Increase of pollutants and CO₂ during the use of AES compared to BES
AES y	As above

Extended Documentation Package

The extended documentation package shall include the following information on all AES:

- (a) a declaration of the manufacturer that the vehicle does not contain any defeat device not covered by one of the exceptions in paragraph 5.1.3. of this Regulation;
- (b) a description of the engine and the emission control strategies and devices employed, whether software or hardware, and any condition(s) under which the strategies and devices will not operate as they do during testing for TA;
- (c) a declaration of the software versions used to control these AES/BES, including the appropriate checksums or reference values of these software versions and instructions to the authority on how to read the checksums or reference values; the declaration shall be updated and sent to the type

approval authority that holds this extended documentation package each time there is a new software version that has an impact to the AES/BES. Manufacturers may request to use an alternative to a checksum as long as it provides an equivalent level of traceability for software version changes;

- (d) detailed technical reasoning of any AES estimating the impact with the AES and without it, and information on the following:
 - (i) why any of the exception clauses from the defeat device prohibition in paragraph 5.1.3. of this Regulation apply;
 - (ii) hardware element(s) that need to be protected by the AES, where applicable;
 - (iii) proof of sudden and irreparable engine damage that cannot be prevented by regular maintenance and would occur in the absence of the AES, where applicable;
 - (iv) a reasoned explanation on why there is a need to use an AES upon engine start, where applicable;
- (e) a description of the fuel system control logic, timing strategies and switch points during all modes of operation;
- (f) a description of the hierarchical relations among the AES (i.e., when more than one AES can be active concurrently, an indication of which AES is primary in responding, the method by which strategies interact, including data flow diagrams and decision logic and how does the hierarchy assure emissions from all AES are controlled to the lowest practical level;
- (g) a list of parameters which are measured and/or calculated by the AES, along with the purpose of every parameter measured and/or calculated and how each of those parameters relates to engine damage; including the method of calculation and how well these calculated parameters correlate with the true state of the parameter being controlled and any resulting tolerance or factor of safety incorporated into the analysis;
- (h) a list of engine/emission control parameters which are modulated as a function of the measured or calculated parameter(s) and the range of modulation for each engine/emission control parameter; along with the relationship between engine/emission control parameters and measured or calculated parameters;
- (i) an evaluation of how the AES will control real-driving emissions to the lowest practical level, including a detailed analysis of the expected increase of total regulated pollutants and CO₂ emissions by using the AES, compared to the BES.

The extended documentation package shall be limited to 100 pages and shall include all the main elements to allow the type approval authority to assess the AES. The package may be complemented with annexes and other attached documents, containing additional and complementary elements, if necessary. The manufacturer shall send a new version of the extended documentation package to the type approval authority every time changes are introduced to the AES. The new version shall be limited to the changes and their effect. The new version of the AES shall be evaluated and approved by the type approval authority.

The extended documentation package shall be structured as follows:

Table A1/1
Extended Documentation Package for AES Application No. YYY/OEM

<i>Parts</i>	<i>Paragraph</i>	<i>Point</i>	<i>Explanation</i>
Introduction documents		Introduction letter to TAA	Reference of the document with the version, the date of issuing the document, signature by the relevant person in the manufacturer organisation
		Versioning table	Content of each version modifications: and with part is modified
		Description of the (emission) types concerned	
		Attached documents table	List of all attached documents
		Cross references	Link to paragraph (a) to (i) of Appendix 3a (where to find each requirement of the regulation)
		Absence of defeat device declaration	+ signature
Core document	0	Acronyms/abbreviations	
	1	GENERAL DESCRIPTION	
	1.1	Engine general presentation	Description of main characteristics: displacement, after treatment, ...
	1.2	General system architecture	System bloc diagram: list of sensors and actuators, explanation of engine general functions
	1.3	Reading of software and calibration version	E.g. scan-tool explanation
	2	Base Emission Strategies	
	2.x	BES x	Description of strategy x
	2.y	BES y	Description of strategy y
	3	Auxiliary Emission Strategies	
	3.0	Presentation of the AESs	Hierarchical relations among AES: description and justification (e.g. safety, reliability, etc.)
	3.x	AES x	3.x.1 AES justification 3.x.2 measured and/or modelled parameters for AES characterization 3.x.3 Action mode of AES - Parameters used 3.x.4 Effect of AES on pollutants and CO ₂
	3.y	AES y	3.y.1 3.y.2 etc.

	100 page limit ends here		
	Annex		List of types covered by this BES-AES: including TA reference, software reference, calibration number, checksums of each version and of each CU (engine and/or after-treatment if any)
Attached documents		Technical note for AES justification n° xxx	Risk assessment or justification by testing or example of sudden damage, if any
		Technical note for AES justification n° yyy	
		Test report for specific AES impact quantification	Test report of all specific tests done for AES justification, test conditions details, description of the vehicle, date of the tests, emission and/or CO ₂ impact with or without AES activation

Annex 1 – Appendix 3b

Methodology for the assessment of AES

The assessment of the AES by the type approval authority shall include at least the following verifications:

1. The increase of emissions induced by the AES shall be kept at the lowest possible level:
 - (a) The increase of total emissions when using an AES shall be kept at the lowest possible level throughout the normal use and life of the vehicles;
 - (b) Whenever a technology or design that would allow for improved emission control is available on the market at the time of the AES preliminary assessment it shall be used with no unjustified modulation
2. When used to justify an AES, the risk of sudden and irreparable damage to the ‘propulsion energy converter and the drivetrain’, as defined in Mutual Resolution No. 2 (M.R.2) of the 1958 and 1998 Agreements of UNECE containing Vehicle Propulsion System Definitions¹⁶, shall be appropriately demonstrated and documented, including the following information:
 - (a) Proof of catastrophic (i.e. sudden and irreparable) engine damage shall be provided by the manufacturer, along with a risk assessment which includes an evaluation of the likelihood of the risk occurring and severity of the possible consequences, including results of tests carried out to this effect;
 - (b) When a technology or design is available on the market at the time of the AES application that eliminates or reduces that risk, it shall be used to the largest extent technically possible (i.e. with no unjustified modulation);
 - (c) Durability and the long-term protection of the engine or components of the emission control system from wear and malfunctioning shall not be considered an acceptable reason to grant an exemption from the defeat device prohibition.
3. An adequate technical description shall document why it is necessary to use an AES for the safe operation of the vehicle:
 - (a) Proof of an increased risk to the safe operation of the vehicle should be provided by the manufacturer along with a risk assessment which includes an evaluation of the likelihood of the risk occurring and severity of the possible consequences, including results of tests carried out to this effect;
 - (b) When a different technology or design is available on the market at the time of the AES application that would allow for lowering the safety risk, it shall be used to the largest extent technically possible (i.e. with no unjustified modulation).
4. An adequate technical description shall document why it is necessary to use an AES during engine start:
 - (a) Proof of the need to use an AES during engine start shall be provided by the manufacturer along with a risk assessment which includes an evaluation of the likelihood of the risk occurring and severity of the possible consequences, including results of tests carried out to this effect;
 - (b) Where a different technology or design is available on the market at the time of the AES application that would allow for improved emission control upon engine start, it shall be used to the largest extent technically possible.

¹⁶ Document ECE/TRANS/WP.19/1121
<https://unece.org/fileadmin/DAM/trans/main/wp29/wp29resolutions/ECE-TRANS-WP29-1121e.pdf>

Annex 2

Communication

(maximum format: A4 (210 x 297 mm))



issued by: Name of administration:

- Concerning:² Approval granted
- Approval extended
- Approval refused
- Approval withdrawn
- Production definitively discontinued

of a vehicle type with regard to the emission of gaseous pollutants by the engine pursuant to the 08 series of amendments to UN Regulation No. 83

Approval No.
 Reason for extension:.....

Section I

- 0.1. Make (trade name of manufacturer):
- 0.2. Type:
- 0.2.1. Commercial name(s) (if available):
- 0.3. Means of identification of type if marked on the vehicle³
- 0.3.1. Location of that marking:
- 0.4. Category of vehicle:⁴
- 0.5. Name and address of manufacturer:
- 0.8. Name(s) and address(es) of assembly plant(s):
- 0.9. If applicable, name and address of manufacturer's representative:
- 1.0. Remarks: ...

Section II

- 1. Additional information (where applicable): (see addendum)
- 2. Technical Service responsible for carrying out the tests:
- 3. Date of test report:
- 4. Number of test report:

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).
² Strike out what does not apply.
³ If the means of identification of type contains characters not relevant to describe the vehicle, component or separate technical unit types covered by this information document, such characters shall be represented in the documentation by the symbol '?' (e.g. ABC??123??).
⁴ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2. - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>.

- 5. Remarks (if any): (see Section 3 of addendum)
- 6. Place:
- 7. Date:
- 8. Signature:.....

- Attachments:
- 1. Information package.
 - 2. Test report.

Addendum to type approval communication No ... concerning the type approval of a vehicle with regard to exhaust emissions pursuant to UN Regulation No. 83, 08 series of amendments

1. Additional information
 - 1.1. Mass of the vehicle in running order:
 - 1.2. Reference mass of the vehicle:
 - 1.3. Maximum mass of the vehicle:
 - 1.7. Drive wheels: front, rear, 4 x 4¹
 - 1.9. Hybrid electric vehicle: yes/no¹
 - 1.9.1. Category of Hybrid Electric vehicle: Off Vehicle Charging (OVC)/Not Off Vehicle Charging (NOVC)¹
 - 1.9.2. Operating mode switch: with/without¹
 - 1.10. Engine identification:.....
 - 1.10.1. Engine displacement:.....
 - 1.10.2. Fuel supply system: direct injection/indirect injection¹
 - 1.10.3. Fuel recommended by the manufacturer:
 - 1.10.4. Maximum power: kW at min⁻¹
 - 1.10.5. Pressure charging device: yes/no¹
 - 1.10.6. Ignition system: compression ignition / positive ignition¹
 - 1.11. Power train (for pure electric vehicle or hybrid electric vehicle)¹
 - 1.11.1. Maximum net power:kW, at: to min⁻¹
 - 1.11.2. Maximum thirty minutes power: kW
 - 1.11.3. Maximum net torque:Nm, at..... min⁻¹
 - 1.12. Traction battery (for pure electric vehicle or hybrid electric vehicle)
 - 1.12.1. Nominal voltage: V
 - 1.12.2. Capacity (2 h rate): Ah
 - 1.13. Transmission
 - 1.13.1. Manual or automatic or continuously variable transmission:¹⁻¹⁷
 - 1.13.2. Number of gear ratios:
 - 1.13.3. Total gear ratios (including the rolling circumferences of the tyres under load): road speeds per 1,000 min⁻¹ (km/h)

First gear:	Sixth gear:
Second gear:	Seventh gear:
Third gear:	Eighth gear:
Fourth gear:	Overdrive:
Fifth gear:	
 - 1.13.4. Final drive ratio:
 - 1.14. Tyres:
 - 1.14.1. Type:

¹⁷ In the case of vehicles equipped with automatic-shift gearboxes, give all pertinent technical data.

- 1.14.2. Dimensions:
- 1.14.3. Rolling circumference under load:

2. Test results

Type 3:

Type 6:

<i>Type 6</i>	<i>CO (mg/km)</i>	<i>THC (mg/km)</i>
Measured value		

2.2. Emissions data required for roadworthiness testing

<i>Test</i>	<i>CO value (per cent vol.)</i>	<i>Lambda*</i>	<i>Engine speed (min⁻¹)</i>	<i>Engine oil temperature (°C)</i>
Low idle test		N/A		
High idle test				

* Lambda formula: see paragraph 5.3.7.3. of this Regulation.

- 2.4. Smoke opacity test results¹⁻¹⁸
 - 2.4.1. At steady speeds: See technical service test report number (if any):
 - 2.4.2. Free acceleration tests
 - 2.4.2.1. Measured value of the absorption coefficient (if any):m⁻¹
 - 2.4.2.2. Corrected value of the absorption coefficient:m⁻¹
 - 2.4.2.3. Location of the absorption coefficient symbol on the vehicle:
- 3. Remarks:

¹⁸ Smoke opacity values according to provisions laid out in Regulation No. 24.

Annex 2 – Appendix 1

Reserved

Annex 2 - Appendix 2

Manufacturer's certificate of compliance with the OBD in-use performance requirements

(Manufacturer):

(Address of the manufacturer):

Certifies that:

1. The vehicle types listed in attachment to this Certificate are in compliance with the provisions of paragraph 7. of Appendix 1 to Annex C5 to UN Regulation No. 154 and paragraph 1. of Annex 11 to this Regulation relating to the in-use performance of the OBD system under all reasonably foreseeable driving conditions;
2. The plan(s) describing the detailed technical criteria for incrementing the numerator and denominator of each monitor attached to this Certificate are correct and complete for all types of vehicles to which this Certificate applies.

Done at [.....Place]

On [.....Date]

[Signature of the Manufacturer's Representative]

Annexes:

- (a) List of vehicle types to which this Certificate applies;
- (b) Plan(s) describing the detailed technical criteria for incrementing the numerator and denominator of each monitor, as well as plan(s) for disabling numerators, denominators and general denominator.

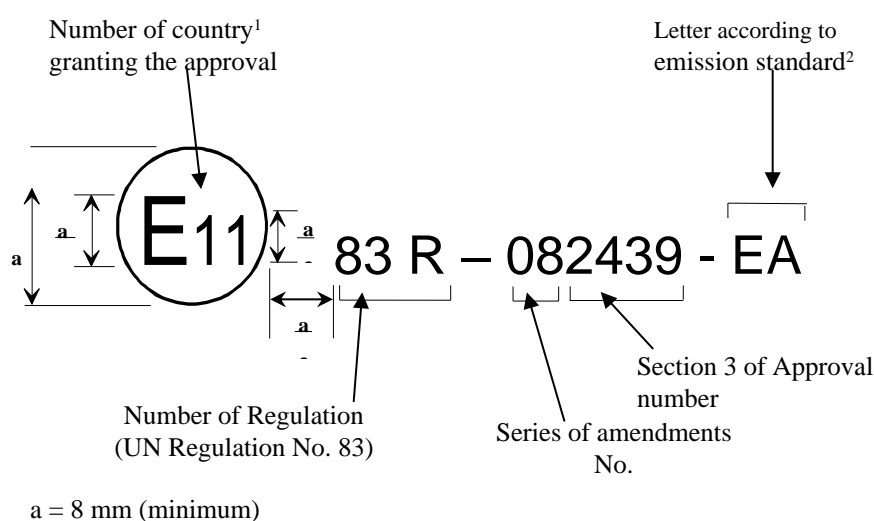
Annex 3

Arrangements of the approval mark

In the approval mark issued and affixed to a vehicle in conformity with paragraph 4. of this Regulation, the type approval number shall be accompanied by an alphabetical character assigned according to Table A3/1 of this annex, reflecting the emission standard that the approval is limited to.

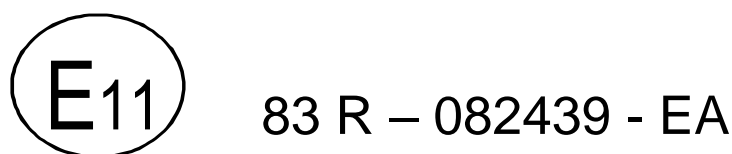
This annex outlines the appearance of this mark, and gives an example how it shall be composed.

The following schematic graphic presents the general lay-out, proportions and contents of the marking. The meaning of numbers and alphabetical character are identified, and sources to determine the corresponding alternatives for each approval case are also referred.



The following graphics are practical examples of how the marking should be composed.

Example 1

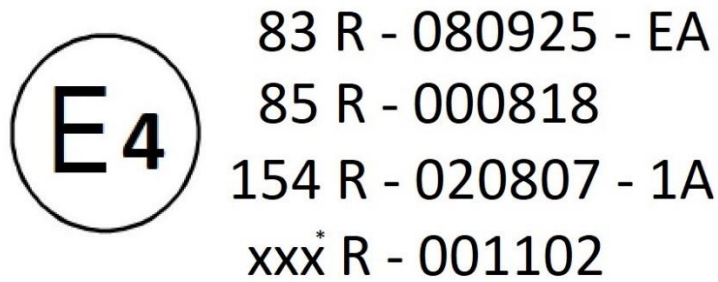


The preceding approval mark affixed to a vehicle in conformity with paragraph 4. of this Regulation shows that the vehicle type concerned has been approved in the United Kingdom (E 11), pursuant to UN Regulation No. 83 under approval number 2439, as defined in Section 3 of paragraph 4.2.1. of this Regulation. This mark indicates that the approval was given in accordance with the requirements of this Regulation with the 08 series of amendments incorporated. Furthermore, the accompanying letter (EA) denotes that the vehicle belongs to a vehicle that meets the Euro 6e emission standard.

¹ Number of country according to footnote in paragraph 4.4.1. of this Regulation.

² According to Table A3/1 of this annex.

Example 2



The preceding approval mark affixed to a vehicle in conformity with paragraph 4. of this Regulation shows that the vehicle type concerned has been approved in the Netherlands (E 4), pursuant to:

- (a) This UN Regulation No. 83 under approval number 0925, as defined in Section 3 of paragraph 4.2.1. of this Regulation. This mark indicates that the approval was given in accordance with the requirements of this Regulation with the 08 series of amendments incorporated. Furthermore, the accompanying letter (EA) denotes that the vehicle belongs to a vehicle that meets the Euro 6e emission standard.
- (b) UN Regulation No. 85 under approval number 0818. This mark indicates that the approval was given in accordance with the requirements of the Regulation in its original version.
- (c) UN Regulation No. 154 under approval number 0807. This mark indicates that the approval was given in accordance with the requirements of this Regulation with the 02 series of amendments incorporated. Furthermore, the accompanying code (1A) denotes that the vehicle is approved to Level 1A (Europe).
- (d) UN Regulation No. [xxx*] on RDE under approval number 1102. This mark indicates that the approval was given in accordance with the requirements of the Regulation in its original version.

*number to be assigned

Table A3/1

Letters with reference to emission standard, vehicle category and engine type

<i>Character</i>	<i>Emission standard</i>	<i>Vehicle category</i>	<i>Engine type</i>	<i>OBD</i>
EA	Euro 6e	M1, M2, N1, N2	PI, CI	OBD thresholds (see Table 4A in paragraph 6.8. of UN Regulation No. 154)
EB	Euro 6e-bis	M1, M2, N1, N2	PI, CI	
EC	Euro 6e-bis-FCM	M1, M2, N1, N2	PI, CI	

Annex 4

In-service conformity methodology

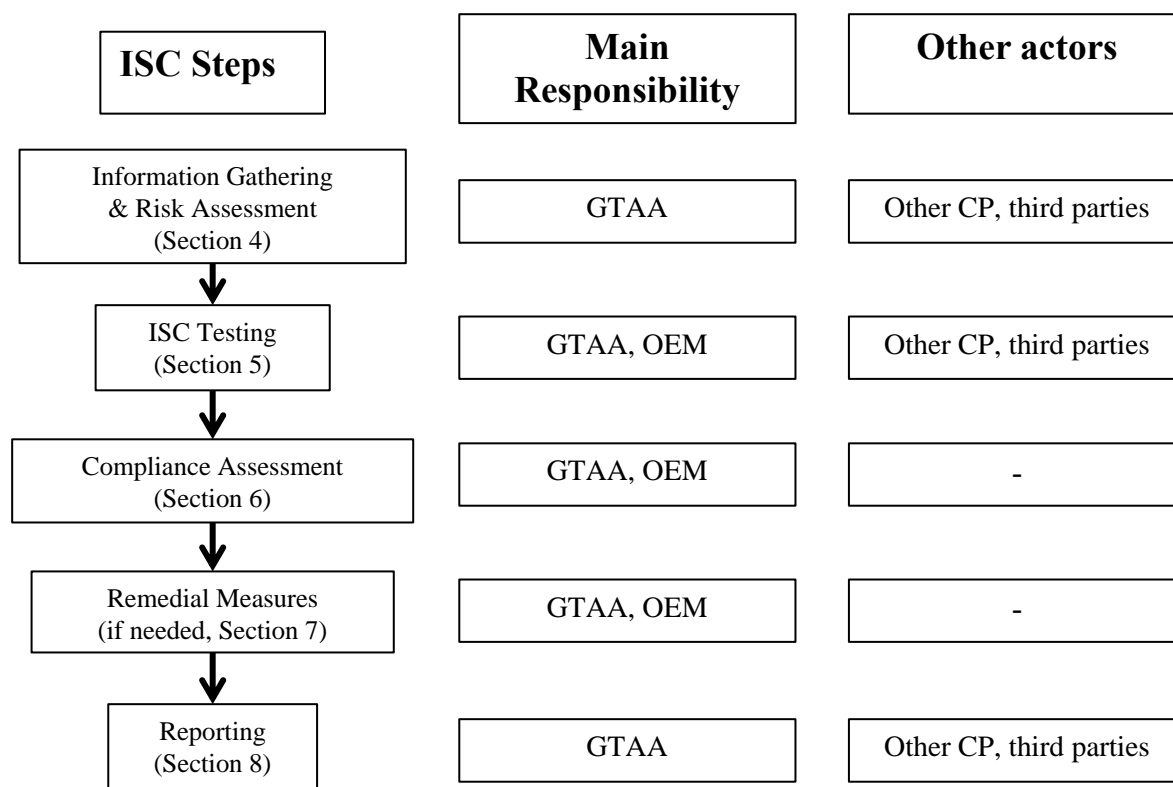
1. Introduction

This Annex sets out the in-service conformity (ISC) methodology for checking compliance against the emission limits for tailpipe (including low temperature) and evaporative emissions throughout the normal life of the vehicle.

2. Process description

Figure 4/1

Illustration of the in-service conformity process



Note: GTAA refers to the granting type- type approval authority, OEM refers to the manufacturer, and Other Actors are defined as: TAA refers to type approval authorities other than the one granting the relevant type approval, TS refer to Technical services, other CP to Contracting Parties not issuing the type approval, and third parties.

3. ISC family definition

An ISC family shall be composed of the following vehicles:

- (a) For tailpipe emissions (Type 1, RDE and Type 6 tests), the vehicles covered by the PEMS test family, as described in paragraph 6.3.1. of UN Regulation No. [xxx] on RDE,
- (b) For evaporative emissions (Type 4 test), the vehicles included in the evaporative emission family, as described in paragraph 6.6.3. of UN Regulation No. 154.

4. Information gathering and initial risk assessment

The granting type approval authority and other actors shall gather all relevant information on possible emission non-compliances relevant for deciding which ISC families to check in a particular year. They shall take into account in

particular, information indicating vehicle types with high emissions in real driving conditions. That information shall be obtained by appropriate methods, which may include remote sensing, simplified on-board emissions monitoring systems (SEMS) and testing with PEMS. The number and importance of exceedances observed during such testing may be used to prioritise ISC testing.

As part of the information provided for the ISC checks, each manufacturer shall report to the granting type approval authority on emission-related warranty claims, and any emission-related warranty repair works performed or recorded during servicing, in accordance with a format agreed between the granting type approval authority and the manufacturer at type approval. The information shall detail the frequency and nature of faults for emissions-related components and systems by ISC family. The ISC reports shall be filed at least once a year for each ISC family for the duration of the period during which in-service conformity checks are to be performed in accordance with paragraph 9.3. of this Regulation. The ISC reports shall be made available upon request.

On the basis of the information referred to in the first and second paragraphs, the granting type approval authority shall make an initial assessment of the risk of an ISC family to not comply with the in-service conformity rules and on that basis shall take a decision on which families to test and which types of tests to perform under the ISC provisions. Additionally, the granting type approval authority may randomly choose ISC families to test.

Other actors shall take into account the information collected according to the first paragraph in order to prioritise testing. Additionally, they may randomly choose ISC families to test.

5. ISC testing

The manufacturer shall perform ISC testing for tailpipe emissions comprising at least the Type 1 test for all ISC families. The manufacturer may also perform RDE, Type 4 and Type 6 tests for all or part of the ISC families. The manufacturer shall report to the granting type approval authority all results of the ISC testing for in-service conformity.

The granting type approval authority shall check an appropriate number of ISC families each year, as set out in paragraph 5.4.

Other actors may perform checks on any number of ISC families each year. They shall report to the granting type approval authority all results of the ISC testing.

5.1. Quality assurance of testing

The granting type approval authority shall annually audit the ISC checks performed by the manufacturer. The granting type approval authority may also audit the ISC checks performed by other actors. The audit shall be based on the information provided by the manufacturers, or other actors, which shall include at least the detailed ISC report in accordance with Appendix 3. The granting type approval authority may require the manufacturers, or other actors to provide additional information.

5.2. Disclosure of tests results

The granting type approval authority shall communicate the results of the compliance assessment and remedial measures for a particular ISC family to other actors which provided test results for that family as soon as they become available.

The results of the tests, including the detailed data for all vehicles tested, may only be disclosed to the public after the publication by the granting type approval authority of the annual report or the results of an individual ISC procedure or after the closure of the statistical procedure (see paragraph 5.10.)

without a result. If the results of the ISC tests undertaken by other actors are published, reference shall be made to the annual report by the granting type approval authority which included them.

5.3. Types of tests

ISC testing shall only be performed on vehicles selected in accordance with Appendix 1.

ISC testing with the Type 1 test shall be performed in accordance with UN Regulation No. 154.

ISC testing with the RDE test shall be performed in accordance with UN Regulation No. [xxx] on RDE, Type 4 tests shall be performed in accordance with Appendix 2 to this Annex and Type 6 tests shall be performed in accordance with Annex 8.

5.4. Frequency and scope of ISC testing

The time period between commencing two in-service conformity checks by the manufacturer for a given ISC family shall not exceed 24 months.

The frequency of ISC testing performed by the granting type approval authority shall be based on a risk assessment methodology consistent with the international standard ISO 31000:2018 — Risk Management — Principles and guidelines which shall include the results of the initial assessment made according to paragraph 4.

Each granting type approval authority shall perform both the Type 1 and RDE tests on a minimum of 5 per cent of the ISC families per manufacturer per year or at least two ISC families per manufacturer per year, where available. The requirement for testing a minimum of 5 per cent or at least two ISC families per manufacturer per year shall not apply to small volume manufacturers. The granting type approval authority shall ensure the widest possible coverage of ISC families and vehicle age in a particular in-service conformity family in order to ensure compliance with paragraph 9.3. of this Regulation. The granting type approval authority shall complete the statistical procedure for each ISC family it has started within 12 months.

Type 4 or Type 6 ISC tests shall have no minimum frequency requirements.

5.5. Funding for ISC testing by the granting type approval authorities

The granting type approval authority shall ensure that sufficient resources are available to cover the costs for in-service conformity testing. Without prejudice to national law, those costs shall be recovered by fees that can be levied on the manufacturer by the granting type approval authority. Such fees shall cover ISC testing of up to 5 per cent of the in-service conformity families per manufacturer per year or at least two ISC families per manufacturer per year.

5.6. Testing plan

When performing testing for ISC, the granting type approval authority shall draft a testing plan. In the case of RDE testing, that plan shall include testing to check ISC compliance under a wide range of conditions in accordance with UN Regulation No. [xxx] on RDE.

5.7. Selection of vehicles for ISC testing

The information gathered shall be sufficiently comprehensive to ensure that in-service performance can be assessed for vehicles that are properly maintained and used. The tables in Appendix 1 shall be used to decide whether the vehicle can be selected for the purposes of ISC testing. During the check against the tables in Appendix 1, some vehicles may be declared as faulty and not tested during ISC, when there is evidence that parts of the emission control system were damaged.

The same vehicle may be used to perform and establish reports from more than one type of tests (Type 1, RDE, Type 4, Type 6) but only the first valid test of each type shall be taken into account for the statistical procedure.

5.7.1. General requirements

The vehicle shall belong to an ISC family as described in paragraph 3 and shall comply with the checks set out in the table in Appendix 1. It shall be registered in the Contracting Party and have been driven in the Contracting Party for at least 90 per cent of its driving time. The emissions testing may be done in a different geographical region from that where the vehicles have been selected. In case of ISC testing conducted by the manufacturer, with the agreement of the granting type approval authority, vehicles registered in a non-Contracting Party may be tested, if they belong to the same ISC family and are accompanied by a certificate of conformity defined in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3).

The vehicles selected shall be accompanied by a maintenance record which shows that the vehicle has been properly maintained and has been serviced in accordance with the manufacturer's recommendations with only original parts used for the replacement of emissions related parts.

Vehicles exhibiting indications of abuse, improper use that could affect its emissions performance, tampering or conditions that may lead to unsafe operation shall be excluded from ISC.

The vehicles shall not have undergone aerodynamic modifications that cannot be removed prior to testing.

A vehicle shall be excluded from ISC testing if the information stored in the on-board computer shows that the vehicle was operated after a fault code was displayed and a repair was not carried out in accordance with manufacturer specifications.

A vehicle shall be excluded from ISC testing if the fuel from the vehicle tank does not meet the applicable standards or if there is evidence or record of fuelling with the wrong type of fuel.

5.7.1.1. Additional RDE related ISC requirements

For ISC or regional market surveillance testing purposes, the reference CO₂ mass shall be obtained from the Certificate of Conformity for the individual vehicle. The value for OVC-HEV vehicles shall be obtained from the WLTP test conducted using the Charge Sustaining mode.

5.7.1.2. Lubricating oil, fuel and reagent

For tests performed during ISC, or regional market surveillance the fuel used for RDE testing may be any fuel legally available in the market and within the specifications issued by the manufacturer for vehicle operation by the customer.

5.7.2. Vehicle Examination and Maintenance

Diagnosis of faults and any normal maintenance necessary in accordance with Appendix 1 shall be performed on vehicles accepted for testing, prior to or after proceeding with ISC testing.

The following checks shall be carried out: OBD checks (performed before or after the test), visual checks for lit malfunction indicator lamps, checks on air filter, all drive belts, all fluid levels, radiator and fuel filler cap, all vacuum and fuel system hoses and electrical wiring related to the after-treatment system for integrity; checks on ignition, fuel metering and pollution control device components for maladjustments and/or tampering.

If the vehicle is within 800 km of a scheduled maintenance service, that service shall be performed.

The window washer fluid shall be removed before the Type 4 test and replaced with hot water.

A fuel sample shall be collected and kept in accordance with the requirements of UN Regulation No. [xxx] on RDE for further analysis in case of fail.

All faults shall be recorded. When the fault is on the pollution control devices then the vehicle shall be reported as faulty and not be used further for testing, but the fault shall be taken into account for the purposes of the compliance assessment performed in accordance with paragraph 6.1.

5.8. Sample size

When manufacturers apply the statistical procedure set out in paragraph 5.10. for the Type 1 test, the number of sample lots shall be set on the basis of the annual production volume of an in-service family intended for sale in the Contracting Parties that apply this regulation, as described in Table 4/1.

Table 4/1
Number of sample lots for ISC testing with Type 1 tests

<i>Contracting Party Production Volume per calendar year of vehicles in the sampling period</i>	<i>Number of sample lots (for Type 1 tests)</i>
up to 100,000	1
100,001 to 200,000	2
above 200,000	3

Each sample lot shall include enough vehicle types, in order to ensure that at least 20 % of the total registrations of this PEMS family in the Contracting Party for the previous year are covered. In case the same PEMS family is shared between more brands, then all brands shall be tested. When a family requires more than one sample lot to be tested, the vehicles in the second and third sample lots shall select vehicles used in different ambient and/or typical use conditions from those selected for the first sample.

5.9. Access to data required for testing

The manufacturer shall complete the package on Testing Transparency in the format specified in Tables 1 and 2 of Appendix 5 and in Table A4/2 and transmit it to the granting type approval authority. Table 2 of Appendix 5 shall be used in order to allow the selection of vehicles from the same family for testing and along with Table 1 of Appendix 5 provide sufficient information for vehicles to be tested.

All information in Tables 1 and 2 of Appendix 5 shall be accessible to the public in an electronic form free of charge within 5 working days of the request.

The following information shall also be part of the package on Testing Transparency and shall be provided by the manufacturer free-of-charge within 5 working days of the request by other actors.

Table A4/2
Sensitive information

<i>ID</i>	<i>Input</i>	<i>Description</i>
1.	Special Procedure for conversion of vehicles (4WD to 2WD) for dyno testing if available	As defined in paragraph 2.4.2.4. of Annex B6 to UN Regulation No. 154

<i>ID</i>	<i>Input</i>	<i>Description</i>
2.	Dyno mode instructions, if available	How to enable the dyno mode as done also during TA tests
3.	Coastdown mode used during the TA tests	If the vehicle has coastdown mode instructions how to enable this mode
4.	Battery discharge procedure (OVC-HEV, PEV)	OEM procedure to deplete battery for preparing OVC-HEV for charge sustaining tests, and PEV to charge the battery
5.	Procedure to deactivate all auxiliaries	If used during TA
6.	Procedure to measure current and voltage of all REESS with the use of external equipment	As defined in Appendix 3 of Annex B8 to UN Regulation No. 154 To measure current and voltage independently of on-board data, OEM provides procedure, description of current and voltage access points and list of devices used for current and voltage measurement during type approval.

5.10. Statistical Procedure

5.10.1. General

The verification of in-service conformity shall rely on a statistical method following the general principles of sequential sampling for inspection by attributes. The minimum sample size for a pass result is three vehicles, and the maximum cumulative sample size is ten vehicles for the Type 1 and RDE tests.

For the Type 4 and Type 6 tests a simplified method may be used, where the sample shall consist of three vehicles and shall be considered a fail if all three vehicles fail to pass the test, and a pass if all three vehicles pass the test. In cases where two out of three passed or failed, the type approval authority may decide to conduct further tests or proceed with assessing the compliance in accordance with paragraph 6.1.

Test results shall not be multiplied by deterioration factors.

Prior to the performance of the first ISC test, the manufacturer, or other actors shall notify the intent of performing in-service conformity testing of a given vehicle family to the granting type approval authority. Upon this notification, the granting type approval authority shall open a new statistical folder to process the results for each relevant combination of the following parameters for that particular party/or that pool of parties: vehicle family, emissions test type and pollutant. Separate statistical procedures shall be opened for each relevant combination of those parameters.

The granting type approval authority shall incorporate in each statistical folder only the results provided by the relevant party. The granting type approval authority shall keep a record of the number of tests performed, the number of failed and passed tests and other necessary data to support the statistical procedure.

Whereas more than one statistical procedure can be open at the same time for a given combination of test type and vehicle family, a party shall only be allowed to provide test results to one open statistical procedure for a given combination of test type and vehicle family. Each test shall be reported only once and all tests (valid, not valid, fail or pass, etc.) shall be reported.

Each ISC statistical procedure shall remain open until an outcome is reached when the statistical procedure arrives to a pass or fail decision for the sample in accordance with paragraph 5.10.5. However, if an outcome is not reached

within 12 months of the opening of a statistical folder, the granting type approval authority shall close the statistical folder unless it decides to complete testing for that statistical folder within the following 6 months.

5.10.2. Pooling of ISC results

Test results from other actors may be pooled for the purposes of a common statistical procedure. The pooling of test results shall require the written consent from all the interested parties providing test results to a pool of results, and a notification to the type approval authorities prior to the start of testing. One of the parties shall be designated as leader of the pool and be responsible for data reporting and communication with the granting type approval authority.

5.10.3. Pass/Fail/Invalid outcome for a single test

An ISC emissions test shall be considered as 'passed' for one or more pollutants when the emissions result is equal or below the emission limit set out in paragraph 6.3.10. of UN Regulation No. 154 for that type of test.

An emissions test shall be considered as 'failed' for one or more pollutants when the emissions result is greater than the corresponding emission limit for that type of test. Each failed test result shall increase the 'f' count (see paragraph 5.10.5.) by 1 for that statistical instance.

An ISC emissions test shall be considered invalid if it does not respect the requirements of the tests referred to in paragraph 5.3. Invalid test results shall be excluded from the statistical procedure and the test shall be repeated with the same vehicle in order to have a valid test.

The results of all ISC tests shall be submitted to the granting type approval authority within ten working days from the execution of each test on a single vehicle. The test results shall be accompanied by a comprehensive test report at the end of the tests. The results shall be incorporated in the sample in chronological order of execution.

The granting type approval authority shall incorporate all valid emission test results to the relevant open statistical procedure until a 'sample fail' or a 'sample pass' outcome is reached in accordance with paragraph 5.10.5.

5.10.4. Treatment of Outliers

The presence of outlying results in the sample statistical procedure may lead to a 'fail' outcome in accordance with the procedures described below:

- (a) Outliers shall be categorised as mild, intermediate or extreme.
- (b) An emissions test result shall be considered as a mild outlier if it is more than the applicable emission limit but less than 1.3 times the applicable emission limit. The presence of a mild outlier only counts in the number of failed results in paragraph 5.10.5. below.
- (c) An emissions test result shall be considered as an intermediate outlier if it is equal or greater than 1.3 times the applicable emission limit. The presence of two such outliers in a sample shall lead to a fail of the sample.
- (d) An emissions result shall be considered as an extreme outlier if it is equal or greater than 2.5 times the applicable emission limit. The presence of one such outlier in a sample shall lead to a fail of the sample. In such case, the plate number of the vehicle shall be communicated to the manufacturer and to the granting type approval authority. This possibility shall be communicated to the vehicle owners before testing.

5.10.5. Pass/Fail decision for a sample

For the purposes of deciding on a pass/fail result for the sample, 'p' is the count of passed results, and 'f' is the count of failed results. Each passed test result shall increase the 'p' count by 1 and each failed test result shall increase the 'f' count by 1 for the relevant open statistical procedure.

Upon the incorporation of valid emission test results to an open instance of the statistical procedure, the type approval authority shall perform the following actions:

- (a) update the cumulative sample size 'n' for that instance to reflect the total number of valid emissions tests incorporated to the statistical procedure;
- (b) following an evaluation of the results, update the count of passed results 'p' and the count of failed results 'f';
- (c) compute the number of extreme and intermediate outliers in the sample in accordance with paragraph 5.10.4.;
- (d) check whether a decision is reached with the procedure described below.

The decision depends on the cumulative sample size 'n', the passed and failed result counts 'p' and 'f', as well as the number of intermediate and/or extreme outliers in the sample. For the decision on a pass/fail of an ISC sample the granting type approval authority shall use the decision chart in Figure 4/2. The charts indicate the decision to be taken for a given cumulative sample size 'n' and failed count result 'f'.

Two decisions are possible for a statistical procedure for a given combination of vehicle family, emissions test type and pollutant:

'Sample pass' outcome shall be reached when the applicable decision chart from Figure 4/2 gives a 'PASS' outcome for the current cumulative sample size 'n' and the count of failed results 'f'.

'Sample fail' decision shall be reached, for a given cumulative sample size 'n', when at least one of the following conditions is fulfilled:

- (a) the applicable decision chart from Figure 4/2 gives a 'FAIL' decision for the current cumulative sample size 'n' and the count of failed results 'f';
- (b) there are two "FAIL" decisions with intermediate outliers;
- (c) there is one "FAIL" decision with an extreme outlier.

If no decision is reached, the statistical procedure shall remain open and further results shall be incorporated into it until a decision is reached or the procedure is closed in accordance with paragraph 5.10.1.

Figure 4/2

Decision chart for the statistical procedure for vehicles (where ‘UND’ means undecided)

<i>Failed result count f</i>	10								FAIL
	9							FAIL	FAIL
	8						FAIL	FAIL	FAIL
	7					FAIL	FAIL	FAIL	FAIL
	6				FAIL	FAIL	FAIL	FAIL	FAIL
	5			FAIL	FAIL	FAIL	UND	UND	PASS
	4		FAIL	FAIL	UND	UND	UND	UND	PASS
	3	FAIL	FAIL	UND	UND	UND	UND	PASS	PASS
	2	UND	UND	UND	UND	PASS	PASS	PASS	PASS
	1	UND	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	
		3	4	5	6	7	8	9	10
<i>Cumulative sample size n</i>									

6. Compliance Assessment

- 6.1. Within 10 working days of the end of the ISC testing for the sample as referred to in paragraph 5.10.5., the granting type approval authority shall start detailed investigations with the manufacturer in order to decide whether the ISC family (or part of it) complies with the ISC rules and whether it requires remedial measures. For multistage or special purpose vehicles the granting type approval authority shall also perform detailed investigations when there are at least three faulty vehicles with the same fault or five flagged vehicles in the same ISC family, as set out in paragraph 5.10.6.
- 6.2. The granting type approval authority shall ensure that sufficient resources are available to cover the costs for compliance assessment. Without prejudice to national law, those costs shall be recovered by fees that can be levied on the manufacturer by the granting type approval authority. Such fees shall cover all testing or auditing needed in order for an assessment on compliance to be reached.
- 6.3. On the request of the manufacturer, the granting type approval authority may extend the investigations to vehicles in service of the same manufacturer belonging to other ISC families which are likely to be affected by the same defects.
- 6.4. The detailed investigation shall take no more than 60 working days after the start of the investigation by the granting type approval authority. The granting type approval authority may conduct additional ISC tests designed to determine why vehicles have failed during the original ISC tests. The additional tests shall be conducted under similar conditions as the original ISC failed ISC tests.

Upon the request of the granting type approval authority, the manufacturer shall provide additional information, showing in particular the possible cause

of the failures, which parts of the family might be affected, whether other families might be affected, or why the problem which caused the failure at the original ISC tests is not related to in-service conformity, if applicable. The manufacturer shall be given the opportunity to prove that the in-service conformity provisions have been complied with.

- 6.5. Within the deadline set out in paragraph 6.4., the granting type approval authority shall take the decision on the compliance or the non-compliance. In case of non-compliance, the granting type approval authority shall define the remedial measures for the ISC family according to paragraph 7. It shall notify them to the manufacturer.
7. Remedial Measures
- 7.1. The manufacturer shall establish a plan of remedial measures and submit it to the granting type approval authority within 45 working days of the decision on the compliance or non-compliance referred to in paragraph 6.5. That period may be extended by up to an additional 30 working days where the manufacturer demonstrates to the granting type approval authority that further time is required to investigate the non-compliance.
- 7.2. The remedial measures required by the granting type approval authority shall include reasonably designed and necessary tests on components and vehicles in order to demonstrate the effectiveness and durability of the remedial measures.
- 7.3. The manufacturer shall assign a unique identifying name or number to the plan of remedial measures. The plan of remedial measures shall include at least the following:
- (a) a description of each vehicle emission type included in the plan of remedial measures;
 - (b) a description of the specific modifications, alterations, repairs, corrections, adjustments or other changes to be made to bring the vehicles into conformity including a brief summary of the data and technical studies which support the decision of the manufacturer as to the particular remedial measures to be taken;
 - (c) a description of the method by which the manufacturer will inform the vehicle owners of the planned remedial measures;
 - (d) a description of the proper maintenance or use, if any, which the manufacturer stipulates as a condition of eligibility for repair under the plan of remedial measures, and an explanation of the need for such condition;
 - (e) a description of the procedure to be followed by vehicle owners to obtain correction of the non-conformity; that description shall include a date after which the remedial measures shall be taken, the estimated time for the workshop to perform the repairs and where they can be done;
 - (f) an example of the information transmitted to the vehicle owner;
 - (g) a brief description of the system which the manufacturer uses to assure an adequate supply of component or systems for fulfilling the remedial action, including information on when an adequate supply of the components, software or systems needed to initiate the application of remedial measures will be available;
 - (h) an example of all instructions to be sent to the repair shops which will perform the repair;
 - (i) a description of the impact of the proposed remedial measures on the emissions, fuel consumption, driveability, and safety of each vehicle

emission type, covered by the plan of remedial measures, including supporting data and technical studies;

- (j) where the plan of remedial measures includes a recall, a description of the method for recording the repair shall be submitted to the granting type approval authority. If a label is used, an example of it shall also be submitted.

For the purposes of point (d), the manufacturer may not impose maintenance or use conditions which are not demonstrably related to the non-conformity and the remedial measures.

- 7.4. The repair shall be done expediently, within a reasonable time after the vehicle is received by the manufacturer for repair. Within 15 working days of receiving the proposed plan of remedial measures, the granting type approval authority shall approve it or require a new plan in accordance with paragraph 7.5.
- 7.5. When the granting type approval authority does not approve the plan of remedial measures, the manufacturer shall develop a new plan and submit it to the granting type approval authority within 20 working days of notification of the decision of the granting type approval authority.
- 7.6. If the granting type approval authority does not approve the second plan submitted by the manufacturer, it shall take all appropriate measures to restore conformity, including withdrawal of type approval where necessary.
- 7.7. The granting type approval authority shall notify its decision on remedial measures to the relevant Contracting Parties within 5 working days.
- 7.8. The remedial measures shall apply to all vehicles in the ISC family (or other relevant families identified by the manufacturer in accordance with paragraph 6.2.) that are likely to be affected by the same defect. The granting type approval authority shall decide if it is necessary to amend the type approval.
- 7.9. The manufacturer is responsible for the execution of the approved plan of remedial measures in all relevant Contracting Parties and for keeping a record of every vehicle removed from the market or recalled and repaired and the workshop which performed the repair.
- 7.10. The manufacturer shall keep a copy of the communication with the customers of affected vehicles related to the plan of remedial measures. The manufacturer shall also maintain a record of the recall campaign, including the total number of vehicles affected per Contracting Party and the total number of vehicles already recalled per Contracting Party, along with an explanation of any delays in the application of the remedial measures. The manufacturer shall provide that record of the recall campaign to the granting type approval authority, the type approval authorities of each Contracting Party every two months.
- 7.11. Contracting Parties shall take measures to ensure that the approved plan of remedial measures is applied within two years to at least 90 % of affected vehicles registered in their territory.
- 7.12. The repair and modification or addition of new equipment shall be recorded in a certificate provided to the vehicle owner, which shall include the number of the remedial campaign.
8. Annual report by the granting type approval authority
- The granting type approval authority shall make available on a publicly accessible website, free of charge and without the need for the user to reveal their identity or sign up, a report with the results of all the finalised ISC investigations of the previous year, at the latest by the 31 March of each year. In case some ISC investigations of the previous year are still open by that date, they shall be reported as soon as the investigation is finalised. The report shall contain at least the items listed in Appendix 4.

Annex 4 - Appendix 1

Criteria for vehicle selection and failed vehicles decision

The vehicle survey shall be used in order to select properly maintained and used vehicles for testing in ISC. Vehicles that have one or more of the exclusion criteria below shall be excluded from testing or otherwise repaired and then selected.

<i>Selection of Vehicles for In-Service Conformity Emissions Testing</i>				
				<i>Confidential</i>
<i>Date:</i>				<i>x</i>
<i>Name of investigator:</i>				<i>x</i>
<i>Location of test:</i>				<i>x</i>
<i>Country of registration:</i>			<i>x</i>	
		<i>x =</i>	<i>X = Checked</i>	
<i>Vehicle Characteristics</i>		<i>Exclusion</i>	<i>and reported</i>	
		<i>Criteria</i>		
<i>Registration plate number:</i>			<i>x</i>	<i>x</i>
<i>Mileage and age of vehicle:</i> <i>The vehicle must comply with the rules in regards to mileage and age in paragraph 9. of this Regulation, otherwise it cannot be selected. The age of the vehicle counts from the date of first registration</i>		<i>x</i>		
<i>Date of first registration:</i>			<i>x</i>	
<i>VIN:</i>			<i>x</i>	<i>x</i>
<i>Emission class and character:</i>			<i>x</i>	
<i>Country of registration:</i> <i>The vehicle must be registered in the Contracting Party</i>		<i>x</i>	<i>x</i>	
<i>Model:</i>			<i>x</i>	
<i>Engine code:</i>			<i>x</i>	
<i>Engine volume (l):</i>			<i>x</i>	
<i>Engine power (kW):</i>			<i>x</i>	
<i>Gearbox type (auto/manual):</i>			<i>x</i>	
<i>Drive axle (FWD/AWD/RWD):</i>			<i>x</i>	

<i>Tyre size (front and rear if different):</i>		<i>x</i>	
<i>Is the vehicle involved in a recall or service campaign?</i> <i>If yes: Which one? Has the campaign repairs already been done?</i> <i>The repairs must have been done before the start of the ISC testing</i>	<i>x</i>	<i>x</i>	
Vehicle Owner Interview <i>(the owner will only be asked the main questions and shall have no knowledge of the implications of the replies)</i>			
<i>Name of the owner (only available to the accredited inspection body or laboratory/Technical service)</i>			<i>x</i>
<i>Contact (address / telephone) (only available to the accredited inspection body or laboratory/Technical service)</i>			<i>x</i>
<i>How many owners did the vehicle have?</i>		<i>x</i>	
<i>Did the odometer not work?</i> <i>If yes, the vehicle cannot be selected.</i>	<i>x</i>		
<i>Was the vehicle used for one of the following?</i>			
<i>As car used in show-rooms?</i>		<i>x</i>	
<i>As a taxi?</i>		<i>x</i>	
<i>As delivery vehicle?</i>		<i>x</i>	
<i>For racing / motor sports?</i>	<i>x</i>		
<i>As a rental car?</i>		<i>x</i>	
<i>Has the vehicle carried heavy loads over the specifications of the manufacturer?</i> <i>If yes, the vehicle cannot be selected.</i>	<i>x</i>		
<i>Have there been major engine or vehicle repairs?</i>		<i>x</i>	
<i>Have there been unauthorised major engine or vehicle repairs?</i> <i>If yes, the vehicle cannot be selected.</i>	<i>x</i>		
<i>Has there been an unauthorised power increase/tuning?</i> <i>If yes, the vehicle cannot be selected.</i>	<i>x</i>		
<i>Was any part of the emissions after-treatment and/or the fuel system replaced? Were original parts used?</i> <i>If original parts were not used, the vehicle cannot be selected.</i>	<i>x</i>	<i>x</i>	

<p>Was any part of the emissions after-treatment system permanently removed?</p> <p>If yes, the vehicle cannot be selected</p>	x		
<p>Were there any unauthorised devices installed (Urea killer, emulator, etc)?</p> <p>If yes, the vehicle cannot be selected</p>	x		
<p>Was the vehicle involved in a serious accident? Provide a list of damage and repairs done afterwards</p>		x	
<p>Has the car been used with a wrong fuel type (i.e. gasoline instead of diesel) in the past? Has the car been used with non-commercially available fuel (black market, or blended fuel?)</p> <p>If yes, the vehicle cannot be selected.</p>	x		
<p>Did you use air-fresher, cockpit-spray, brake cleaner or other high hydrocarbon emission source around the vehicle during the last month?</p> <p>If yes, the vehicle cannot be selected for evaporative testing.</p>	x		
<p>Was there a gasoline spill in the inside or outside of the vehicle during the last 3 months?</p> <p>If yes, the vehicle cannot be selected for evaporative testing.</p>	x		
<p>Did anyone smoke in the car during the last 12 months?</p> <p>If yes, the vehicle cannot be selected for evaporative testing</p>	x		
<p>Did you apply corrosion protection, stickers, under seal protection, on any other potential sources of volatile compounds to the car?</p> <p>If yes, the vehicle cannot be selected for evaporative testing</p>	x		
<p>Was the car repainted?</p> <p>If yes, the vehicle cannot be selected for evaporative testing</p>	x		
<p>Where do you use your vehicle more often?</p>			
% motorway		x	
% rural		x	
% urban		x	
<p>Did you drive the vehicle in a non-Contracting Party for more than 10 % of driving time?</p> <p>If yes, the vehicle cannot be selected</p>	x	—	
<p>In which country was the vehicle refuelled during the last two times?</p> <p>If the vehicle was refuelled the last two times outside a state applying the compliant Fuel Standards, the vehicle cannot be selected.</p>	x		

	<i>Has a fuel additive, not approved by the manufacturer been used? If yes then the vehicle cannot be selected.</i>	x		
	<i>Has the vehicle been maintained and used in accordance with the manufacturer's instructions? If not, the vehicle cannot be selected.</i>	x		
	<i>Full service and repair history including any re-works If the full documentation cannot be provided, the vehicle cannot be selected.</i>	x		
	<i>Vehicle Examination and Maintenance</i>	<i>X = Exclusion Criteria/ F = Faulty Vehicle</i>		<i>X = checked and reported</i>
1	<i>Fuel tank level (full / empty) Is the fuel reserve light ON? If yes, refuel before test.</i>			x
2	<i>Are there any warning lights on the instrument panel activated indicating a vehicle or exhaust after-treatment system malfunctioning that cannot be resolve by normal maintenance? (Malfunction Indication Light, Engine Service Light, etc?) If yes, the vehicle cannot be selected</i>	x		
3	<i>Is the SCR light on after engine-on? If yes, the AdBlue should be filled in, or the repair executed before the vehicle is used for testing.</i>	x		
4	<i>Visual examination exhaust system Check leaks between exhaust manifold and end of tailpipe. Check and document (with photos) If there is damage or leaks, the vehicle is declared faulty.</i>	F		
5	<i>Exhaust gas relevant components Check and document (with photos) all emissions relevant components for damage. If there is damage, the vehicle is declared faulty.</i>	F		
6	<i>Evaporative system Pressurize fuel-system (from canister side), testing for leaks in a constant ambient temperature environment, FID sniff test around and in the vehicle. If the FID sniff test is not passed, the vehicle is declared faulty.</i>	F		
7	<i>Fuel sample</i>			x

	Collect fuel sample from the fuel tank.			
8	<i>Air filter and oil filter</i> Check for contamination and damage and change if damaged or heavily contaminated or less than 800 km before the next recommended change.			x
9	<i>Window washer fluid (only for evaporative testing)</i> Remove window washer fluid and fill tank with hot water.			x
10	<i>Wheels (front & rear)</i> Check whether the wheels are freely moveable or blocked by the brake. <i>If not, the vehicle cannot be selected.</i>	x		
11	<i>Tyres (only for evaporative testing)</i> Remove spare tyre, change to stabilised tyres if the tyres were changes less than 15,000 km ago. Use summer and all season tyres only.			x
12	<i>Drive belts & cooler cover</i> <i>In case of damage, the vehicle is declared faulty. Document with photos</i>	F		
13	<i>Check fluid levels</i> Check the max. and min. levels (engine oil, cooling liquid) / top up if below minimum			x
14	<i>Filler flap (only for evaporative testing)</i> Check overfill line within filler flap is completely free of residues or flush the hose with hot water.			x
15	<i>Vacuum hoses and electrical wiring</i> Check all for integrity. <i>In case of damage, the vehicle is declared faulty. Document with photos</i>	F		
16	<i>Injection valves / cabling</i> Check all cables and fuel lines. <i>In case of damage, the vehicle is declared faulty. Document with photos</i>	F		
17	<i>Ignition cable (gasoline)</i> Check spark plugs, cables, etc. In case of damage, replace them.			x
18	<i>EGR & Catalyst, Particle Filter</i> Check all cables, wires and sensors. <i>In case of tampering, the vehicle cannot be selected.</i> <i>In case of damage the vehicle is declared Faulty, Document with photos</i>	x/F		

19	<p><i>Safety condition</i></p> <p>Check tyres, vehicle's body, electrical and braking system status are in safe conditions for the test and respect road traffic rules.</p> <p><i>If not, the vehicle cannot be selected.</i></p>	x		
20	<p><i>Semi-trailer</i></p> <p>Are there electric cables for semi-trailer connection, where required?</p>			x
21	<p><i>Aerodynamic modifications</i></p> <p>Verify no aftermarket aerodynamics modification that cannot be removed before testing was made (roof boxes, load racking, spoilers, etc.) and no standard aerodynamics components are missing (front deflectors, diffusers, splitters, etc.).</p> <p><i>If yes, the vehicle cannot be selected. Document with photos.</i></p>	x		
22	<p><i>Check if less than 800 km away from next scheduled service, if yes, then perform the service.</i></p>			x
23	<p><i>All checks requiring OBD connections to be performed before and/or after the end of testing</i></p>			
24	<p><i>Powertrain Control Module calibration part number and checksum</i></p>			x
25	<p><i>OBD diagnosis (before or after the emissions test)</i></p> <p>Read Diagnostic Trouble Codes & Print error log</p>			x
26	<p><i>OBD Service Mode 09 Query (before or after the emissions test)</i></p> <p>Read Service Mode 09. Record the information.</p>			x
27	<p><i>OBD mode 7 (before or after the emissions test)</i></p> <p>Read Service Mode 07. Record the information</p>			
<p><i>Remarks for: Repair / replacement of components / part numbers</i></p>				

Annex 4 - Appendix 2

Rules for performing Type 4 tests during in-service conformity

Type 4 tests for in-service conformity shall be performed in accordance with Annex C3 of UN Regulation No. 154, with the following exceptions:

- (a) vehicles tested with the Type 4 test shall be at least 12 months of age.
- (b) the canister shall be considered aged and therefore the Canister Bench Ageing procedure shall not be followed.
- (c) the canister shall be loaded outside the vehicle, following the procedure described for this purpose in Annex C3 of UN Regulation No. 154 and shall be removed and mounted to the vehicle following the repair instructions of the manufacturer. An FID sniff test (with results less than 100 ppm at 20 °C) shall be made as close as possible to the canister before and after the loading to confirm that the canister is mounted properly.
- (d) the tank shall be considered aged and therefore no Permeability Factor shall be added in the calculation of the result of the Type 4 test.

Annex 4 - Appendix 3

ISC report

The following information shall be included in the detailed ISC report:

1. Test Date
2. Unique Number of ISC Report
3. Date of approval by authorised representative
4. Date of transmission to GTAA
5. The name and address of the manufacturer;
6. The name, address, telephone and fax numbers and e-mail address of the responsible testing laboratory;
7. The model name(s) of the vehicles included in the test plan;
8. Where appropriate, the list of vehicle types covered within the manufacturer's information, i.e. for tailpipe emissions, the in-service family;
9. The numbers of the type approvals applicable to these vehicle types within the family, including, where applicable, the numbers of all extensions and field fixes/recalls (re-works);
10. Details of extensions, field fixes/recalls to those type approvals for the vehicles covered within the manufacturer's information (if requested by the type approval authority);
11. The period of time over which the information was collected;
12. The ISC checking procedure, including where applicable:
 - (a) vehicle sourcing method;
 - (b) vehicle selection and rejection criteria (including the answers to the table in Appendix 1, including photos);
 - (c) test types and procedures used for the programme;
 - (d) geographical area(s) within which the manufacturer has collected information;
 - (e) sample lot number and sampling plan used;
13. The results of the ISC procedure, including:
 - (a) identification of the vehicles included in the programme (whether tested or not). The identification shall include the Table in Appendix 1 without the confidential items.
 - (b) test data for tailpipe emissions:
 - test fuel specifications (e.g. test reference fuel or market fuel),
 - test conditions (temperature, humidity, dynamometer inertia weight),
 - dynamometer settings (e.g. road load, power setting),
 - test results and calculation of pass/fail;
 - (c) test data for evaporative emissions:
 - test fuel specifications (e.g. test reference fuel or market fuel),
 - test conditions (temperature, humidity, dynamometer inertia weight),

- dynamometer settings (e.g. road load, power setting),
- test results and calculation of pass/fail.

Annex 4 - Appendix 4

Annual ISC report by the granting Type Approval Authority

Title

- A. Brief overview and main conclusions
- B. ISC activities performed by the manufacturer in the previous year:
 - (1) Information gathering by manufacturer
 - (2) ISC testing (including planning and selection of families tested, and final results of tests)
- C. ISC activities performed by the other actors in the previous year:
 - (3) Information gathering and risk assessment
 - (4) ISC testing (including planning and selection of families tested, and final results of tests)
- D. ISC activities performed by the granting type approval authority in the previous year:
 - (5) Information gathering and risk assessment
 - (6) ISC testing (including planning and selection of families tested, and final results of tests)
 - (7) Detailed investigations
 - (8) Remedial measures
- E. Assessment of the yearly expected emissions decrease due to any ISC remedial measures
- F. Lessons Learned (including for performance of instruments used)
- G. Report of other invalid tests

Annex 4 - Appendix 5

Transparency lists

Table 1
Transparency List 1

<i>ID</i>	<i>Input</i>	<i>Type of data</i>	<i>Unit</i>	<i>Description</i>
1	Emission TA number	Text	--	UN Regulation No.154 approval number; UN Regulation No. [xxx] on RDE approval number (if applicable)
1a	Emission Type approval Date	Date	--	Date of emission type approval
2	Interpolation Family ID (IP ID)	Text	--	As reported in UN Regulation No. 154, Annex A2, Addendum to type approval communication item 0.1: Interpolation Family Identifier as defined in paragraph 6.2.2. of the same regulation
5	ATCT family ID	Text	--	As reported in paragraph 0.2.3.2. of Annex A1 of UN Regulation No. 154
7	RL family ID of vehicle H or RM family ID	Text	--	As reported in paragraph 0.2.3.4.1. of Annex A1 of UN Regulation No. 154
7a	RL family ID of vehicle L (if relevant)	Text	--	As reported in paragraph 0.2.3.4.2 of Annex A1 of UN Regulation No. 154
7b	RL family ID of vehicle M (if relevant)	Text	--	As reported in UN Regulation No. 154, Annex A1 – Appendix 1, paragraph 1.4.2. Road load parameters
13	Drive wheels of vehicle in family	Enumeration (Front, Rear, 4 Wheel Drive)	--	Paragraph 1.7. of the Addendum to Annex A2 of UN Regulation No. 154
14	Chassis Dyno configuration during TA test	Enumeration (Single Axle, Dual Axle)	--	As in paragraph 2.4.2.4. of Annex B6 to UN Regulation No. 154
18	Driver selectable mode(s) used during the TA tests (pure ICE) or for charge sustaining test (NOVC-HEV, OVC-HEV, NOVC-FCHV)	Possible formats: pdf, jpg. ¹³ The name of the file shall be a UUID ¹⁴ , unique inside the package.	--	State and describe mode(s) used in type approval. In cases of predominant mode this will be only one entry. Alternatively the best and worst case modes need to be described. Description of modes that need to be used for TA tests as in paragraph 2.6.6. of Annex B6 to UN Regulation No. 154
19	Driver selectable mode(s) used during the TA tests for charge depleting test (OVC-HEV)	Possible formats: pdf, jpg. ¹³ The name of the file shall be a UUID ¹⁴ , unique inside the package.	--	State and describe mode(s) used in type approval. In cases of predominant mode this will be only one entry. Alternatively the best and worst case modes need to be described. Description of modes that need to be used for TA tests as in paragraph 3.2.3. of Annex B8 to UN Regulation No. 154
20	Idling engine speed for vehicles with manual	Number	rpm	Paragraph 3.2.1.6. of Annex A1 of UN Regulation No. 154

	transmission fuel 1, fuel 2 (if relevant)			
21	No. of gears for vehicles with manual transmission	Number	--	Paragraph 1.13.2. of the Addendum to Annex A2 of UN Regulation No. 154
23	Tyre dimensions of the test vehicle front/rear/middle, for vehicles with manual transmission	Text	--	Paragraph 1.1.8. of Appendix 1 to Annex A1 of UN Regulation No. 154 Use 1 for tyre dimensions of front wheels, 2 for tyre dimensions of rear wheels, 3 for tyre dimensions of middle wheels (if applicable)
24 + 25	Full load power curve with additional safety margin (ASM) for vehicles with manual transmission, fuel 1, fuel 2 (if relevant)	Table values	rpm vs. kW vs. %	The full load power curve over the engine speed range from n_{idle} to n_{rated} or n_{max} , or $ndv(ngv_{max}) \times v_{max}$, whichever is higher together with ASM (if used for gearshift calculation) from paragraph 1.2.4. of Appendix 1 to Annex A1 of UN Regulation No. 154 Example of table values can be found in UNECE Regulation 154, Annex B2, Table A2/1
26	Additional information for gearshift calculation for vehicles with manual transmission, fuel 1, fuel 2 (if relevant)	See table in example	See table in example	Paragraph 1.2.4. of Appendix 1 to Annex A1 of UN Regulation No. 154
29	ATCT FCF fuel 1, fuel 2 (if relevant)	Number	--	One value per each fuel in case of Bi-fuel and Flex-fuel vehicle. Always match Fuel 1 with its ATCT FCF and Fuel 2 with its ATCT FCF. As defined in paragraph 3.8.1. of Annex B6a to UN Regulation No. 154,
30a	Additive Ki factor(s) for vehicles equipped with periodically regenerating systems	Table values	g/km for CO ₂ , mg/km for all the rest	Table defining the values for CO, NO _x , PM, THC (mg/km), and for CO ₂ (g/km). Empty if multiplicative Ki factors are provided or for vehicles that do not have any periodically regenerating systems. Paragraph 2.1.1.1.1. of Appendix 1 to Annex A1 of UN Regulation No. 154 for pollutants and paragraph 2.1.1.2.1. for CO ₂
30b	Multiplicative Ki factors(s) for vehicles equipped with periodically regenerating systems	Table values	no units	Table defining the values for CO, NO _x , PM, THC, and for CO ₂ . Empty if additive Ki factors are provided or for vehicles that do not have any periodically regenerating systems. Paragraph 2.1.1.1.1. of Appendix 1 to Annex A1 of UN Regulation No. 154 for pollutants and paragraph 2.1.1.2.1. for CO ₂
31a	Additive Deterioration Factors (DF) fuel 1, fuel 2 (if relevant)	Table values	(mg/km except for PN	Table defining deterioration factors per each pollutant.

			which is #/km	<p>1. CO, PM, PN, NO_x, NMHC and THC for monofuel gasoline vehicles and all bi-fuel and flexifuel vehicles.</p> <p>2. CO, NO_x, NMHC and THC for monofuel LPG and NG vehicles.</p> <p>3. NO_x for monofuel H₂ vehicles.</p> <p>4. NO_x, THC+NO_x, CO, PM and PN for all diesel vehicles.</p> <p>5. Empty if multiplicative DF factors are provided. Paragraph 2.1.1.1.1. of Appendix 1 to Annex A1 of UN Regulation No. 154</p>
31b	Multiplicative Deterioration Factors (DF) fuel 1, fuel 2 (if relevant)	Table values	no units	<p>Table defining deterioration factors per each pollutant.</p> <p>1. CO, PM, PN, NO_x, NMHC and THC for monofuel gasoline vehicles and all bi-fuel and flexifuel vehicles.</p> <p>2. CO, NO_x, NMHC and THC for monofuel LPG and NG vehicles.</p> <p>3. NO_x for monofuel H₂ vehicles.</p> <p>4. NO_x, THC+NO_x, CO, PM and PN for all diesel vehicles.</p> <p>Empty if additive DF factors are provided. Paragraph 2.1.1.1.1. of Appendix 1 to Annex A1 of UN Regulation No. 154</p>
32	Battery voltage for all REESS	Number	V	As defined in paragraph 4.1. of Appendix 2 to Annex B6 of UN Regulation No. 154 (DIN EN 60050-482)
33	K correction coefficient only for NOVC and OVC-HEVs	Table	(g/km)/(Wh/km)	For NOVC and OVC-HEVs correction of CS CO ₂ emissions as defined in paragraph 2. of Appendix 2 to Annex B8 of UN Regulation No. 154
42	Regeneration recognition	Document pdf or jpg ¹³ The name of the file shall be a UUID ¹⁴ , unique inside the package.		Description by vehicle manufacturer on how to recognize that a regeneration occurred during a test
43	Regeneration completion	Document pdf or jpg ¹³ The name of the file shall be a UUID ¹⁴ , unique inside the package.	-	Description of the procedure to complete the regeneration
44a	Index Number of the transition cycle for VL	Number	-	For OVC-HEV vehicles only. Number of CD tests performed until break-off criteria is met. Paragraph 2.1.1.4.1.4. of Appendix 1 to Annex A1 of UN Regulation No. 154
49	Propulsion Type	Enumeration Pure ICE, OVC-HEV, NOVC-HEV	--	Propulsion type as defined in paragraph 6.3.1.2.(a) of UN Regulation No. [xxx] on RDE

50	Ignition Type	Enumeration Positive ignition, Compression ignition	--	Ignition Type as reported in paragraph 3.2.1.1. of Annex A1 of UN Regulation No. 154
51	Fuel Operating Mode	Enumeration(Mon o-fuel, Bi-fuel, Flex-fuel)	--	Vehicle Fuel Type as reported in paragraph 3.2.2.4. of Annex A1 of UN Regulation No. 154
52	Fuel Type fuel 1, fuel 2 (if relevant)	Enumeration (Petrol, Diesel, LPG, NG/Biomethane, Ethanol (E85), Hydrogen).	--	Fuel Type as reported in paragraph 3.2.2.1. of Annex A1 of UN Regulation No. 154. In the case of Bi-fuel and Flex-fuel vehicle list both fuels.
53	Transmission type	Enumeration (Manual, Automatic, CVT)	--	Transmission Type as reported in paragraph 4.5.1. of Annex A1 of UN Regulation No. 154
54	Engine Capacity	Number	cm ³	Engine Capacity as reported in paragraph 3.2.1.3. of Annex A1 of UN Regulation No. 154
55	Method of engine fuelling fuel 1, fuel 2 (if relevant)	Enumeration Direct/Indirect/Di rect and Indirect		Method of engine fuelling as declared by OEM. Paragraph 1.10.2. of the Addendum to Annex A2 of UN Regulation No. 154

Table 2
Transparency list 2

<i>Field</i>	<i>Type of data</i>	<i>Description</i>
TVV	Text	Unique identifier of the Type, Variant, Version of the vehicle
PEMS Family ID	Text	Paragraph 6.5.2. of UN Regulation No. [xxx] on RDE
Make	Text	Trade name of manufacturer
Commercial name	Text	Commercial names of the TVV
Other name	Text	Free text
Category and class	Enumeration (M1, N1 class I, N1 class II, N1 class III, M2)	Category and class of vehicle
Bodywork	Enumeration (AA Saloon; AB Hatchback, AC Station Wagon, AD Coupe, AE Convertible, AF Multi-purpose vehicle AG Truck station wagon BA Lorry, BB Van, BC Tractor unit for semi-trailer BD Road tractor BE Pick-up truck BX Chassis-cab or chassis-cowl)	Type of bodywork
Emission TA Number	Text	UN Regulation No.154 approval number; UN Regulation No. [xxx] on RDE approval number (if applicable)
WVTA Number	Text	Identifier of the Whole Vehicle Type Approval
Evap family ID	Text	As reported in paragraph 0.2.3.7. of Appendix 1 to Annex A1 of UN Regulation No. 154
Rated Engine Power fuel 1, fuel 2 (if relevant)	Number	Paragraph 3.2.1.8. of Annex A1 of UN Regulation No. 154
Twin tyres	Yes/No	Declared by OEM
Fuel Tank Capacities (discreet values)	Number	Fuel tank(s) capacity(ies)
Sealed tank	Yes/No	Paragraph 3.2.12.2.5.5.3. of Annex A1 to UN Regulation No. 154
WMI used in this WVTA+TVV	Text	Declared by the OEM (ISO 3779)

Annex 5

Type 2 test

(Carbon monoxide emission test at idling speed)

1. Introduction

This annex describes the procedure for the Type 2 test defined in paragraph 5.3.2. of this Regulation.
2. Conditions of measurement
 - 2.1. The fuel shall be the reference fuel as specified in Annexes 10 and 10a to this Regulation.
 - 2.2. During the test, the environmental temperature shall be between 293 and 303 K (20 and 30 °C). The engine shall be warmed up until all temperatures of cooling and lubrication means and the pressure of lubrication means have reached equilibrium.
 - 2.2.1. Vehicles that are fuelled either with petrol or with LPG or NG/biomethane shall be tested with the reference fuel(s) used for the Type 1 test as specified in UN Regulation No. 154.
 - 2.3. In the case of vehicles with manually-operated or semi-automatic-shift gearboxes, the test shall be carried out with the gear lever in the "neutral" position and with the clutch engaged.
 - 2.4. In the case of vehicles with automatic-shift gearboxes, the test shall be carried out with the gear selector in either the "neutral" or the "parking" position.
 - 2.5. Components for adjusting the idling speed
 - 2.5.1. Definition

For the purposes of this Regulation, "*components for adjusting the idling speed*" means controls for changing the idling conditions of the engine which may be easily operated by a mechanic using only the tools described in paragraph 2.5.1.1. of this annex. In particular, devices for calibrating fuel and air flows are not considered as adjustment components if their setting requires the removal of the set-stops, an operation which cannot normally be performed except by a professional mechanic.
 - 2.5.1.1. Tools which may be used to control components for adjusting the idling speed: screwdrivers (ordinary or cross-headed), spanners (ring, open-end or adjustable), pliers, Allen keys.
 - 2.5.2. Determination of measurement points
 - 2.5.2.1. A measurement at the setting in accordance with the conditions fixed by the manufacturer is performed first;
 - 2.5.2.2. For each adjustment component with a continuous variation, a sufficient number of characteristic positions shall be determined.
 - 2.5.2.3. The measurement of the carbon-monoxide content of exhaust gases shall be carried out for all the possible positions of the adjustment components, but for components with a continuous variation only the positions defined in paragraph 2.5.2.2. of this annex shall be adopted.
 - 2.5.2.4. The Type 2 test shall be considered satisfactory if one or both of the two following conditions is met:
 - 2.5.2.4.1. None of the values measured in accordance with paragraph 2.5.2.3. of this annex exceed the limit values set out in paragraph 5.3.2.2. of this Regulation;

- 2.5.2.4.2. The maximum content obtained by continuously varying one of the adjustment components while the other components are kept stable does not exceed the limit value, this condition being met for the various combinations of adjustment components other than the one which was varied continuously.
- 2.5.2.5. The possible positions of the adjustment components shall be limited:
- 2.5.2.5.1. On the one hand, by the larger of the following two values: the lowest idling speed which the engine can reach; the speed recommended by the manufacturer, minus 100 revolutions per minute;
- 2.5.2.5.2. On the other hand, by the smallest of the following three values:
 The highest speed the engine can attain by activation of the idling speed components;
 The speed recommended by the manufacturer, plus 250 revolutions per minute;
 The cut-in speed of automatic clutches.
- 2.5.2.6. In addition, settings incompatible with correct running of the engine shall not be adopted as measurement settings. In particular, when the engine is equipped with several carburettors all the carburettors shall have the same setting.
- 2.6. Additional requirements for Hybrid Electric Vehicles
- The vehicles shall be tested with the fuel consuming engine running. The manufacturer shall provide a "service mode" that makes execution of this test possible.
- If necessary, the special procedure provided for in paragraph 5.1.6. to this Regulation shall be used.
3. Sampling of gases
- 3.1. The sampling probe shall be inserted into the exhaust pipe to a depth of at least 300 mm or into the pipe connecting the exhaust with the sampling bag and as close as possible to the exhaust.
- 3.2. The concentration in CO (C_{CO}) and CO₂ (C_{CO_2}) shall be determined from the measuring instrument readings or recordings, by use of appropriate calibration curves.
- 3.3. The corrected concentration for carbon monoxide regarding four-stroke engines is:
- $$C_{CO\ corr} = C_{CO} \frac{15}{C_{CO} + C_{CO_2}} \text{ (per cent vol.)}$$
- 3.4. The concentration in C_{CO} (see paragraph 3.2. of this annex) measured according to the formulae contained in paragraph 3.3. of this annex need not be corrected if the total of the concentrations measured ($C_{CO} + C_{CO_2}$) is for four-stroke engines at least:
- | | | |
|-----|-------------------|---------------|
| (a) | For petrol | 15 per cent |
| (b) | For LPG | 13.5 per cent |
| (c) | For NG/biomethane | 11.5 per cent |

Annex 6

Type 3 test

(Verifying emissions of crankcase gases)

1. Introduction

This annex describes the procedure for the Type 3 Test defined in paragraph 5.3.3. of this Regulation.
2. General provisions
 - 2.1. The Type 3 test shall be carried out on a vehicle with positive- ignition engine, which has been, subjected to the Type 1 test, as specified in UN Regulation No. 154, and the Type 2 test, as applicable.
 - 2.2. The engines tested shall include leak-proof engines other than those so designed that even a slight leak may cause unacceptable operating faults (such as flat-twin engines).
 - 2.3. The road load coefficients to be used shall be those for vehicle low (VL). If VL does not exist, then the VH road load shall be used. In that case VH shall be defined in accordance with point 4.2.1.1.1. of Annex B4 to UN Regulation No. 154. In case the interpolation method is used VL and VH shall be specified in accordance with point 4.2.1.1.2. of Annex B4 to UN Regulation No. 154. Alternatively, the manufacturer may choose to use road loads that have been determined in accordance with the provisions of Appendix 7a or Appendix 7b to Annex 4a of the 07 series of amendments to UN Regulation No. 83 for a vehicle included in the interpolation family.
3. Test conditions
 - 3.1. Idling shall be regulated in conformity with the manufacturer's recommendations.
 - 3.2. The measurement shall be performed in the following three sets of conditions of engine operation:

<i>Condition number</i>	<i>Vehicle speed (km/h)</i>
1	Idling
2	50 ±2 (in 3rd gear or "drive")
3	50 ±2 (in 3rd gear or "drive")

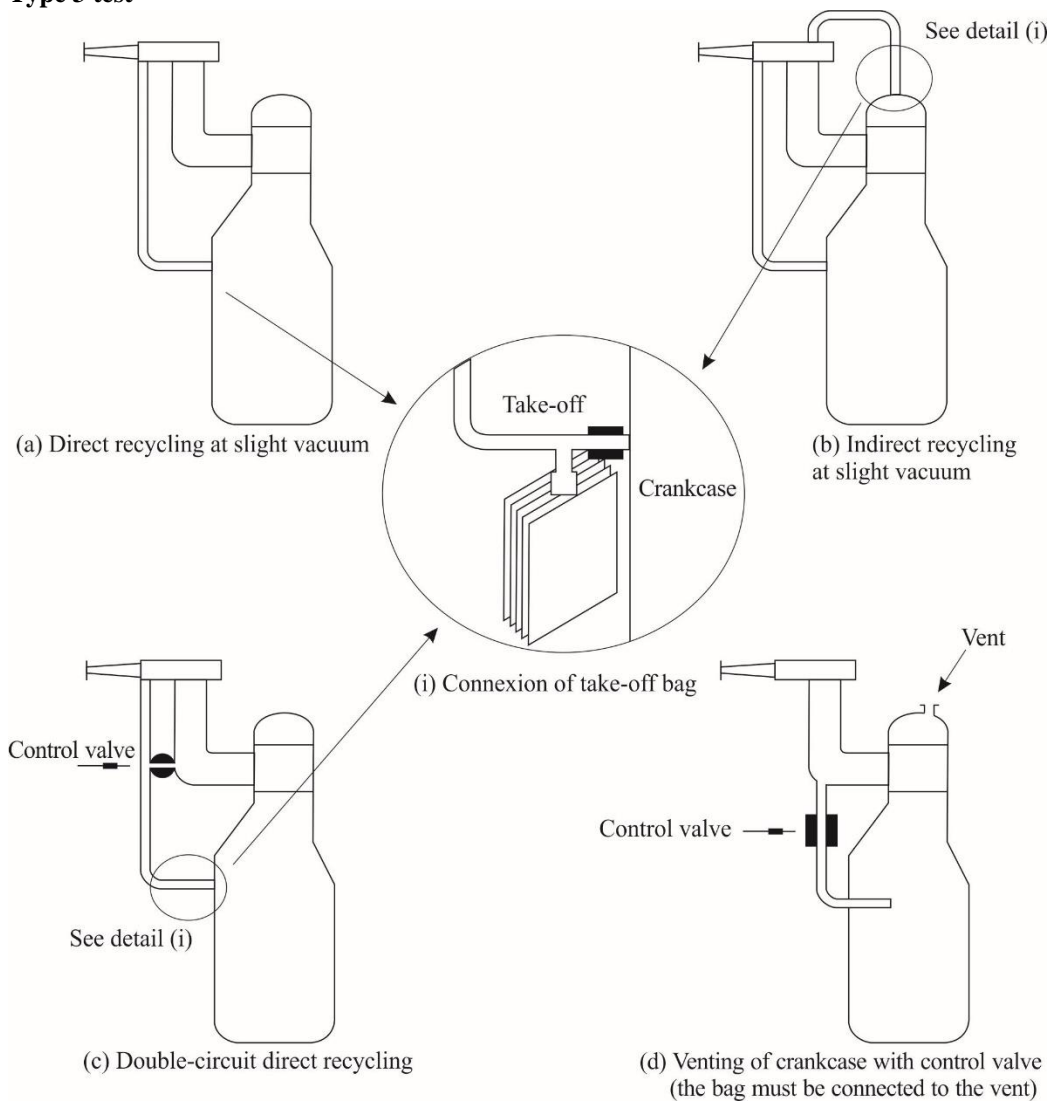
<i>Condition number</i>	<i>Power absorbed by the brake</i>
1	Nil
2	That corresponding to the setting for Type 1 test, as specified in UN Regulation No. 154, at 50 km/h
3	That for conditions No. 2, multiplied by a factor of 1.7

- 3.3. Additional requirements for Hybrid Electric Vehicles
 - 3.3.1. The vehicles shall be tested with the fuel consuming engine running. The manufacturer shall provide a "service mode" that makes execution of this test possible.
 - 3.3.2. The tests shall be carried out only for conditions 1 and 2 of paragraph 3.2. If for any reasons it is not possible to test on condition 2, alternatively another

steady speed condition (with fuel consuming engine running under load) should be carried out.

4. Test method
 - 4.1. For the operation conditions as listed in paragraph 3.2. of this annex, reliable function of the crankcase ventilation system shall be checked.
5. Method of verification of the crankcase ventilation system
 - 5.1. The engine's apertures shall be left as found.
 - 5.2. The pressure in the crankcase shall be measured at an appropriate location. It is recommended to measure the pressure at the dip-stick hole, if feasible.
 - 5.3. The vehicle shall be deemed satisfactory if, in every condition of measurement defined in paragraph 3.2. of this annex, the pressure measured in the crankcase does not exceed the atmospheric pressure prevailing at the time of measurement.
 - 5.4. For the test by the method described above, the pressure in the intake manifold shall be measured to within ± 1 kPa.
 - 5.5. The vehicle speed as indicated at the dynamometer shall be measured to within ± 2 km/h.
 - 5.6. The pressure measured in the crankcase shall be measured to within ± 0.01 kPa.
 - 5.7. If in one of the conditions of measurement defined in paragraph 3.2. of this annex, the pressure measured in the crankcase exceeds the atmospheric pressure, an additional test as defined in paragraph 6. of this annex shall be performed if so requested by the manufacturer.
6. Additional test method
 - 6.1. The engine's apertures shall be left as found.
 - 6.2. A flexible bag impervious to crankcase gases and having a capacity of approximately five litres shall be connected to the dipstick hole. The bag shall be empty before each measurement.
 - 6.3. The bag shall be closed before each measurement. It shall be opened to the crankcase for five minutes for each condition of measurement prescribed in paragraph 3.2. of this annex.
 - 6.4. The vehicle shall be deemed satisfactory if, in every condition of measurement defined in paragraph 3.2. of this annex, no visible inflation of the bag occurs.
 - 6.5. Remark
 - 6.5.1. If the structural layout of the engine is such that the test cannot be performed by the methods described in paragraphs 6.1. to 6.4. of this annex, the measurements shall be effected by that method modified as follows:
 - 6.5.2. Before the test, all apertures other than that required for the recovery of the gases shall be closed;
 - 6.5.3. The bag shall be placed on a suitable take-off which does not introduce any additional loss of pressure and is installed on the recycling circuit of the device directly at the engine-connection aperture (see diagram below).

Type 3 test



Annex 7

Reserved

Annex 8

Type 6 test

(Verifying the average exhaust emissions of carbon monoxide and hydrocarbons after a cold start at low ambient temperature)

1. Introduction

This annex applies only to vehicles with positive ignition engines. It describes the equipment required and the procedure for the Type 6 test defined in paragraph 5.3.5. of this Regulation in order to verify the emissions of carbon monoxide and hydrocarbons at low ambient temperatures. Topics addressed in this Regulation include:

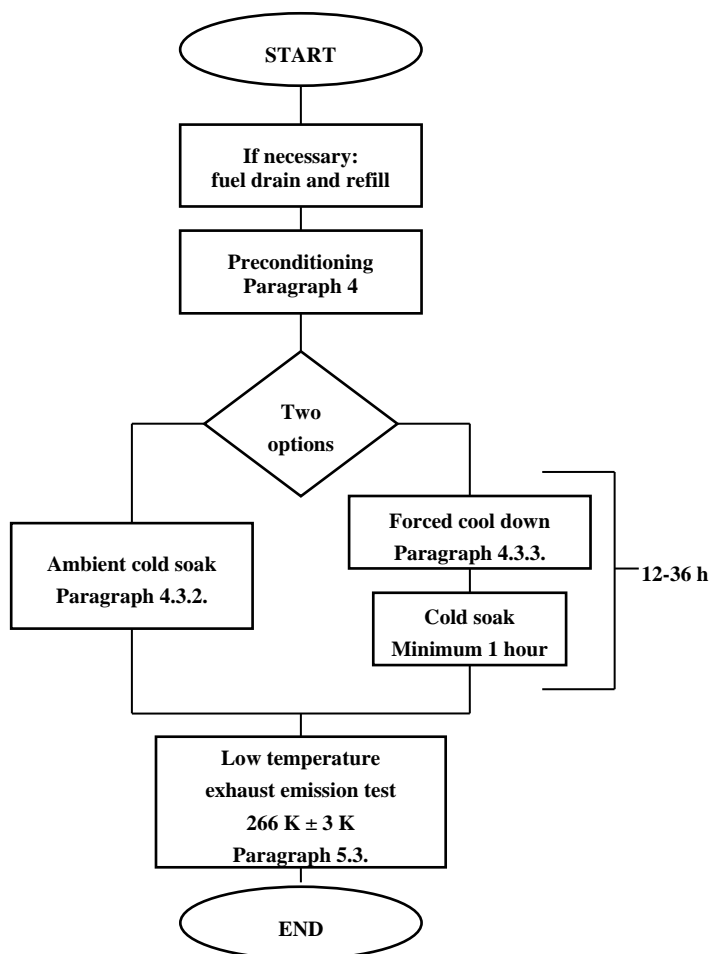
 - (a) Equipment requirements;
 - (b) Test conditions;
 - (c) Test procedures and data requirements.
2. Test equipment
 - 2.1. Summary
 - 2.1.1. This chapter deals with the equipment needed for low ambient temperature exhaust emission tests of positive ignition engined vehicles. Equipment required and specifications are equivalent to the requirements for the NEDC based Type I test as specified Annex 4a to the 07 series of amendments to this Regulation, with appendices, if specific requirements for the Type 6 test are not prescribed. Paragraphs 2.2. to 2.6. of this annex describe deviations applicable to Type 6 low ambient temperature testing.
 - 2.2. Chassis dynamometer
 - 2.2.1. The requirements of Appendix 1 to Annex 4a to the 07 series of amendments to this Regulation apply. The dynamometer shall be adjusted to simulate the operation of a vehicle on the road at 266 K (-7 °C). Such adjustment may be based on a determination of the road load force profile at 266 K (-7 °C). Alternatively the driving resistance determined according to Appendix 7 to Annex 4a to the 07 series of amendments to this Regulation may be adjusted for a 10 per cent decrease of the coast-down time. The Technical service may approve the use of other methods of determining the driving resistance.
 - 2.2.2. For calibration of the dynamometer the provisions of Appendix 1 to Annex 4a to the 07 series of amendments to this Regulation apply.
 - 2.3. Sampling system
 - 2.3.1. The provisions of Appendix 2 and Appendix 3 to Annex 4a to the 07 series of amendments to this Regulation apply.
 - 2.4. Analytical equipment
 - 2.4.1. The provisions of Appendix 3 to Annex 4a to the 07 series of amendments to this Regulation apply, but only for carbon monoxide, carbon dioxide, and total hydrocarbon testing.
 - 2.4.2. For calibrations of the analytical equipment the provisions of Annex 4a to the 07 series of amendments to this Regulation apply.
 - 2.5. Gases
 - 2.5.1. The provisions of paragraph 3. of Appendix 3 to Annex 4a to the 07 series of amendments to this Regulation apply, where they are relevant.

- 2.6. Additional equipment
- 2.6.1. For equipment used for the measurement of volume, temperature, pressure and humidity the provisions in paragraph 4.6. of Annex 4a to the 07 series of amendments to this Regulation apply.
- 3. Test sequence and fuel
- 3.1. General requirements
- 3.1.1. The test sequence in Figure A8/1 shows the steps encountered as the test vehicle undergoes the procedures for the Type 6 test. Ambient temperature levels encountered by the test vehicle shall average: 266 K (-7 °C) \pm 3 K and shall not be less than 260 K (-13 °C), or more than 272 K (-1 °C).

The temperature may not fall below 263 K (-10 °C), or exceed 269 K (-4 °C) for more than three consecutive minutes.
- 3.1.2. The test cell temperature monitored during testing shall be measured at the output of the cooling fan (paragraph 5.2.1. of this annex). The ambient temperature reported shall be an arithmetic average of the test cell temperatures measured at constant intervals no more than one minute apart.
- 3.2. Test procedure

The Part One, urban driving cycle, according to Figure A4a/1 in Annex 4a to the 07 series of amendments to this Regulation, consists of four elementary urban cycles which together make a complete Part One cycle.
- 3.2.1. Start of engine, start of the sampling and the operation of the first cycle shall be in accordance with Table A4a/1 and Figure A4a/1 in Annex 4a to the 07 series of amendments to this Regulation.
- 3.3. Preparation for the test
- 3.3.1. For the test vehicle the provisions of paragraph 3.2. of Annex 4a to the 07 series of amendments to this Regulation apply. For setting the equivalent inertia mass on the dynamometer the provisions of paragraph 6.2.1. of Annex 4a to the 07 series of amendments to this Regulation apply.

Figure A8/1
Procedure for low ambient temperature test



- 3.4. Test fuel
- 3.4.1. The test fuel shall comply with the specifications given in paragraph 2. of Annex 10 to this Regulation.
- 3.5. The road load coefficients to be used shall be those for vehicle low (VL). If VL does not exist then the vehicle high (VH) road load shall be used. In that case VH shall be defined in accordance with point 4.2.1.1.1. of Annex B4 to UN Regulation No. 154. In case the interpolation method is used VL and VH shall be specified in accordance with point 4.2.1.1.2. of Annex B4 to UN Regulation No. 154. The dynamometer shall be adjusted to simulate the operation of a vehicle on the road at -7°C . Such adjustment may be based on a determination of the road load force profile at -7°C . Alternatively, the driving resistance determined may be adjusted for a 10 per cent decrease of the coast-down time. The Technical service may approve the use of other methods for determining the driving resistance.
4. Vehicle preconditioning
- 4.1. Summary
- 4.1.1. To ensure reproducible emission tests, the test vehicles shall be conditioned in a uniform manner. The conditioning consists of a preparatory drive on a chassis dynamometer followed by a soak period before the emission test according to paragraph 4.3. of this annex.

- 4.2. Preconditioning
- 4.2.1. The fuel tank(s) shall be filled with the specified test fuel. If the existing fuel in the fuel tank(s) does not meet the specifications contained in paragraph 3.4.1. of this annex, the existing fuel shall be drained prior to the fuel fill. The test fuel shall be at a temperature less than or equal to 289 K (+16 °C). For the above operations the evaporative emission control system shall neither be abnormally purged nor abnormally loaded.
- 4.2.2. The vehicle is moved to the test cell and placed on the chassis dynamometer.
- 4.2.3. The preconditioning consists of one complete driving cycle, Parts One and Two, according to Tables A4a/1 and A4a/2 and Figure A4a/1 of Annex 4a to the 07 series of amendments to this Regulation. At the request of the manufacturer, vehicles with a positive ignition engine may be preconditioned with one Part One and two Part Two driving cycles.
- 4.2.4. During the preconditioning the test cell temperature shall remain relatively constant and not be higher than 303 K (30 °C)
- 4.2.5. The drive-wheel tyre pressure shall be set in accordance with the provisions of paragraph 6.2.3. of Annex 4a to the 07 series of amendments to this Regulation.
- 4.2.6. Within ten minutes of completion of the preconditioning, the engine shall be switched off.
- 4.2.7. If requested by the manufacturer and approved by the Technical service, additional preconditioning may in exceptional cases be allowed. The Technical service may also choose to conduct additional preconditioning. The additional preconditioning consists of one or more driving schedules of the Part One cycle as described in Table A4a/1 and Figure A4a/1 of Annex 4a to the 07 series of amendments to this Regulation. The extent of such additional preconditioning shall be recorded in the test report.
- 4.3. Soak methods
- 4.3.1. One of the following two methods, to be selected by the manufacturer, shall be utilised to stabilise the vehicle before the emission test.
- 4.3.2. Standard method
- The vehicle is stored for not less than 12 hours nor for more than 36 hours prior to the low ambient temperature exhaust emission test. The ambient temperature (dry bulb) during this period shall be maintained at an average temperature of: 266 K (-7 °C) \pm 3 K during each hour of this period and shall not be less than 260 K (-13 °C) nor more than 272 K (-1 °C). In addition, the temperature may not fall below 263 K (-10 °C) nor more than 269 K (-4 °C) for more than three consecutive minutes.
- 4.3.3. Forced method
- The vehicle shall be stored for not more than 36 hours prior to the low ambient temperature exhaust emission test.
- 4.3.3.1. The vehicle shall not be stored at ambient temperatures which exceed 303 K (30 °C) during this period.
- 4.3.3.2. Vehicle cooling may be accomplished by force-cooling the vehicle to the test temperature. If cooling is augmented by fans, the fans shall be placed in a vertical position so that the maximum cooling of the drive train and engine is achieved and not primarily the sump. Fans shall not be placed under the vehicle.

- 4.3.3.3. The ambient temperature need only be stringently controlled after the vehicle has been cooled to $266\text{ K }(-7\text{ }^\circ\text{C}) \pm 2\text{ K}$, as determined by a representative bulk oil temperature.

A representative bulk oil temperature is the temperature of the oil measured near the middle of the oil sump, not at the surface or at the bottom of the oil sump. If two or more diverse locations in the oil are monitored, they shall all meet the temperature requirements.

- 4.3.3.4. The vehicle shall be stored for at least one hour after is has been cooled to $266\text{ K }(-7\text{ }^\circ\text{C}) \pm 2\text{ K}$, prior to the low ambient temperature exhaust emission test. The ambient temperature (dry bulb) during this period shall average $266\text{ K }(-7\text{ }^\circ\text{C}) \pm 3\text{ K}$, and shall not be less than $260\text{ K }(-13\text{ }^\circ\text{C})$ or more than $272\text{ K }(-1\text{ }^\circ\text{C})$.

In addition, the temperature may not fall below $263\text{ K }(-10\text{ }^\circ\text{C})$ or exceed $269\text{ K }(-4\text{ }^\circ\text{C})$, for more than three consecutive minutes.

- 4.3.4. If the vehicle is stabilised at $266\text{ K }(-7\text{ }^\circ\text{C})$, in a separate area and is moved through a warm area to the test cell, the vehicle shall be destabilised in the test cell for at least six times the period the vehicle is exposed to warmer temperatures. The ambient temperature (dry bulb) during this period shall average $266\text{ K }(-7\text{ }^\circ\text{C}) \pm 3\text{ K}$ and shall not be less than $260\text{ K }(-13\text{ }^\circ\text{C})$ nor more than $272\text{ K }(-1\text{ }^\circ\text{C})$.

In addition, the temperature may not fall below $263\text{ K }(-10\text{ }^\circ\text{C})$ or exceed $269\text{ K }(-4\text{ }^\circ\text{C})$, for more than three consecutive minutes.

5. Dynamometer procedure

5.1. Summary

- 5.1.1. The emission sampling is performed over a test procedure consisting of the Part One cycle (Annex 4a to the 07 series of amendments to this Regulation, Table A4a/1 and Figure A4a/1). Engine start-up, immediate sampling, operation over the Part One cycle and engine shut-down make a complete low ambient temperature test, with a total test time of 780 seconds. The exhaust emissions are diluted with ambient air and a continuously proportional sample is collected for analysis. The exhaust gases collected in the bag are analysed for hydrocarbons, carbon monoxide, and carbon dioxide. A parallel sample of the dilution air is similarly analysed for carbon monoxide, total hydrocarbons and carbon dioxide.

5.2. Dynamometer operation

5.2.1. Cooling fan

- 5.2.1.1. A cooling fan is positioned so that cooling air is appropriately directed to the radiator (water cooling) or to the air intake (air-cooling) and to the vehicle.

- 5.2.1.2. For front-engined vehicles, the fan shall be positioned in front of the vehicle, within 300 mm of it. In the case of rear-engined vehicles or if the above arrangement is impractical, the cooling fan shall be positioned so that sufficient air is supplied to cool the vehicle.

- 5.2.1.3. The fan speed shall be such that, within the operating range of 10 km/h to at least 50 km/h, the linear velocity of the air at the blower outlet is within $\pm 5\text{ km/h}$ of the corresponding roller speed. The final selection of the blower shall have the following characteristics:

- (a) Area: at least 0.2 m^2 ;
- (b) Height of the lower edge above ground: approximately 20 cm.

As an alternative the blower linear air speed shall be at least 6 m/s (21.6 km/h). At the request of the manufacturer, for special vehicles (e.g. vans, off-road) the height of the cooling fan may be modified.

- 5.2.1.4. The vehicle speed as measured from the dynamometer roll(s) shall be used (paragraph 1.2.6. of Appendix 1 to Annex 4a to the 07 series of amendments to this Regulation).
- 5.2.2. Reserved
- 5.2.3. Preliminary testing cycles may be carried out if necessary, to determine how best to actuate the accelerator and brake controls so as to achieve a cycle approximating to the theoretical cycle within the prescribed limits, or to permit sampling system adjustment. Such driving shall be carried out before "START" according to Figure A8/1.
- 5.2.4. Humidity in the air shall be kept low enough to prevent condensation on the dynamometer roll(s).
- 5.2.5. The dynamometer shall be thoroughly warmed as recommended by the dynamometer manufacturer, and using procedures or control methods that assure stability of the residual frictional power.
- 5.2.6. The time between dynamometer warming and the start of the emission test shall be no longer than 10 minutes if the dynamometer bearings are not independently heated. If the dynamometer bearings are independently heated, the emission test shall begin no longer than 20 minutes after dynamometer warming.
- 5.2.7. If the dynamometer power is to be adjusted manually, it shall be set within one hour prior to the exhaust emission test phase. The test vehicle may not be used to make the adjustment. The dynamometer, using automatic control of pre-selectable power settings, may be set at any time prior to the beginning of the emission test.
- 5.2.8. Before the emission test driving schedule may begin, the test cell temperature shall be $266\text{ K } (-7\text{ }^{\circ}\text{C}) \pm 2\text{ K}$, as measured in the air stream of the cooling fan with a maximum distance of 1.5 m from the vehicle.
- 5.2.9. During operation of the vehicle the heating and defrosting devices shall be shut off.
- 5.2.10. The total driving distance or roller revolutions measured are recorded.
- 5.2.11. A four-wheel drive vehicle shall be tested in a two-wheel drive mode of operation. The determination of the total road force for dynamometer setting is performed while operating the vehicle in its primary designed driving mode. At the request of the manufacturer a four-wheel drive vehicle shall be tested in its primary drive mode of operation.
- 5.3. Performing the test
- 5.3.1. The provisions of paragraph 6.4., excluding 6.4.1.2., of Annex 4a to the 07 series of amendments to this Regulation apply in respect of starting the engine, carrying out the test and taking the emission samples. The sampling begins before or at the initiation of the engine start-up procedure and ends on conclusion of the final idling period of the last elementary cycle of the Part One (urban driving cycle), after 780 seconds.
- The first driving cycle starts with a period of 11 seconds idling as soon as the engine has started.
- 5.3.2. For the analysis of the sampled emissions the provisions of paragraph 6.5., excluding paragraph 6.5.2., of Annex 4a to the 07 series of amendments to this Regulation apply. In performing the exhaust sample analysis the Technical service shall exercise care to prevent condensation of water vapour in the exhaust gas sampling bags.
- 5.3.3. For the calculations of the mass emissions the provisions of paragraph 6.6. of Annex 4a to the 07 series of amendments to this Regulation apply.

- 5.4. Additional requirements for Hybrid Electric Vehicles
 - 5.4.1. For OVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as specified for condition B of the NEDC based Type I test (paragraphs 3.1.3. and 3.2.3. of Annex 14 to the 07 series of amendments to this Regulation) .
 - 5.4.2. For NOVC vehicles, the measurements of emissions of pollutants shall be carried out under the same conditions as in the NEDC based Type I test as set out in Annex 4a to the 07 series of amendments to this Regulation.
- 6. Other requirements
 - 6.1. Irrational emission control strategy
 - 6.1.1. Any irrational emission control strategy which results in a reduction in effectiveness of the emission control system under normal operating conditions at low temperature driving, so far as not covered by the standardised emission tests, may be considered a defeat device.

Annex 9

Reserved

Annex 10

Specifications of reference fuels

1. Specifications of reference fuels for testing vehicles to the emission limits
 - 1.1 The specification for the reference fuels to be used shall be those set out in Annex B3 of UN Regulation No. 154.
2. Specifications of reference fuel to be used for testing vehicles equipped with positive ignition engines at low ambient temperature – Type 6 Test

Type: Petrol (E10)

Parameter	Unit	Limits ¹		Test method
		Minimum	Maximum	
Research octane number, RON ²		95.0	98.0	EN ISO 5164
Motor octane number, MON ²		85.0	89.0	EN ISO 5163
Density at 15 °C	kg/m ³	743.0	756.0	EN ISO 12185
Vapour pressure (DVPE)	kPa	56.0	95.0	EN 13016-1
Water content		max 0.05 Appearance at -7 °C: Clear & Bright		EN 12937
Distillation:				
– evaporated at 70 °C	% v/v	34.0	46.0	EN ISO 3405
– evaporated at 100 °C	% v/v	54.0	62.0	EN ISO 3405
– evaporated at 150 °C	% v/v	86.0	94.0	EN ISO 3405
– final boiling point	°C	170	195	EN ISO 3405
Residue	% v/v	—	2.0	EN ISO 3405
Hydrocarbon analysis:				
– olefins	% v/v	6.0	13.0	EN 22854
– aromatics	% v/v	25.0	32.0	EN 22854
– benzene	% v/v	-	1.00	EN 22854 EN 238
– saturates	% v/v	report		EN 22854
Carbon/hydrogen ratio		report		
Carbon/oxygen ratio		report		
Induction period ³	minutes	480	—	EN ISO 7536
Oxygen content ⁴	% m/m	3.3	3.7	EN 22854
Solvent washed gum (Existent gum content)	mg/100ml	—	4	EN ISO 6246
Sulphur content ⁵	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Copper corrosion 3hrs, 50 °C		—	Class 1	EN ISO 2160
Lead content	mg/l	—	5	EN 237
Phosphorus content ⁶	mg/l	—	1.3	ASTM D 3231
Ethanol ⁴	% v/v	9.0	10.0	EN 22854

¹ The values quoted in the specifications are ‘true values’. In establishment of their limit values the terms of ISO 4259 Petroleum products - Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility). Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

² A correction factor of 0.2 for MON and RON shall be subtracted for the calculation of the final result in accordance with EN 228:2008.

³ The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils shall not be added.

- ⁴ Ethanol is the only oxygenate that shall be intentionally added to the reference fuel. The Ethanol used shall conform to EN 15376.
- ⁵ The actual sulphur content of the fuel used for the Type 6 test shall be reported.
- ⁶ There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

Type: Ethanol (E75)

Parameter	Unit	Limits ¹		Test method ²
		Minimum	Maximum	
Research octane number, RON		95	-	EN ISO 5164
Motor octane number, MON		85	-	EN ISO 5163
Density at 15 °C	kg/m ³	report		EN ISO 12185
Vapour pressure	kPa	50	60	EN ISO 1 30 16-1 (DVPE)
Sulphur content ^{3, 4}	mg/kg	-	10	EN ISO 20846 EN ISO 20884
Oxidation stability	minutes	360	-	EN ISO 7536
Existent gum content (solvent washed)	mg/100ml	-	4	EN ISO 6246
Appearance shall be determined at ambient temperature or 15 °C whichever is higher.		Clear and bright, visibly free of suspended or precipitated contaminants		Visual inspection
Ethanol and higher alcohols ⁷	% (V/V)	70	80	EN 1601 EN 13132 EN 1451 7
Higher alcohols (C ₃ - C ₈)	% (V/V)	-	2	
Methanol		-	0.5	
Petrol ⁵	% (V/V)	Balance		EN 228
Phosphorus	mg/l	0.3 ⁶		EN 15487 ASTM D 3231
Water content	% (V/V)	-	0.3	ASTM E 1064 EN 15 489
Inorganic chloride content	mg/l	-	1	ISO 6227 - EN 15492
pHe		6.5	9	ASTM D 6423 EN 15490
Copper strip corrosion (3h at 50 °C)	Rating	Class I		EN ISO 2160
Acidity (as acetic acid CH ₃ COOH)	% (m/m)		0.005	ASTM 0161 3
	mg/l		40	EN 15491
Carbon/hydrogen ratio		report		
Carbon/oxygen ratio		report		

¹ The values referred to in the specifications are "true values". When establishing the value limits, the terms of ISO 4259 Petroleum products - Determination and application of precision data in relation to methods of test were applied. When fixing a minimum value, a minimum difference of 2R above zero was taken into account. When fixing a maximum and minimum value, the minimum difference used was 4R (R = reproducibility). Notwithstanding this procedure, which is necessary for technical reasons, fuel manufacturers shall aim for a zero value where the stipulated maximum value is 2R and for the mean value for quotations of maximum and minimum limits. Where it is necessary to clarify whether fuel meets the requirements of the specifications, the ISO 4259 terms shall be applied.

² In cases of dispute, the procedures for resolving the dispute and interpretation of the results based on test method precision, described in EN ISO 4259 shall be used.

³ In cases of national dispute concerning sulphur content, either EN ISO 20846 or EN ISO 20884 shall be called up similar to the reference in the national annex of EN 228.

⁴ The actual sulphur content of the fuel used for the Type 6 test shall be reported.

⁵ The unleaded petrol content may be determined as 100 minus the sum of the percentage content of water and alcohols.

⁶ There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

⁷ Ethanol to meet specification of EN 15376 is the only oxygenate that shall be intentionally added to this reference fuel.

Annex 10a

Specifications of gaseous reference fuels

1. Specifications of gaseous reference fuels
 - 1.1. The specification for the gaseous reference fuels to be used shall be those set out in Annex B3 of UN Regulation No. 154.

Annex 11

On-Board Diagnostics (OBD) – In-use Performance Requirements

1. In addition to the requirements of Annex C5 of UN Regulation No. 154 the in-use performance requirements (IUPR) set out in paragraphs 1.1. to 1.3. shall apply.
 - 1.1. The manufacturer shall demonstrate to the type approval authority and upon request to a regional authority, that these statistical conditions are satisfied for all monitors required to be reported by the OBD system in accordance with paragraph 7.6. of Appendix 1 to Annex C5 of UN Regulation No. 154 not later than 18 months after the entry onto the market of the first vehicle type with IUPR in an OBD family and every 18 months thereafter.
 - 1.2. For the entire test sample of vehicles the manufacturer shall report to the relevant authorities all of the in-use performance data to be reported by the OBD system according to paragraph 7.6. of Appendix 1 to Annex C5 of UN Regulation No. 154 in conjunction with an identification of the vehicle being tested and the methodology used for the selection of the tested vehicles from the fleet. Upon request, the granting type approval authority shall make these data and the results of the statistical evaluation available to the regional authority and other approval authorities.
 - 1.3. Public authorities and their delegates may pursue further tests on vehicles or collect appropriate data recorded by vehicles to verify compliance with the requirements of this annex.
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