United Nations ECE/TRANS/WP.29/GRPE/2025/16

Economic and Social Council

Distr.: General
30 July 2025

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on Pollution and Energy

Ninety third session
Geneva, 14-17 October 2025
Item 3(a) of the provisional agenda
Light vehicles:
UN Regulations Nos. 68 (Measurement of the maximum speed, including electric vehicles), 83 (Emissions of M_1 and N_1 vehicles), 101 (CO_2 emissions/fuel consumption), 103 (Replacement pollution control devices) and 154 (Worldwide harmonized Light vehicles Test Procedures (WLTP))

Proposal for a new Series of amendments to UN Regulation No. 83 (Emissions of M_1 and N_1 vehicles)

Submitted by the experts from the European Commission and the International Organization of Motor Vehicle Manufacturers *

This document proposes a new Series of amendments [09] to UN Regulation No. 83, as a consolidated version. The new series adds new requirements introduced by Euro 7 in the EU, including, amongst others, on manipulation devices and manipulation strategies; and on anti-tampering, security and cybersecurity. In addition the new series introduces extended lifetime provisions, as well as In-Service Conformity requirements for in-vehicle battery durability. The Type 2 test has been removed from this new series.

* In accordance with the programme of work of the Inland Transport Committee for 2025 as outlined in proposed programme budget for 2025 (A/79/6 (Sect. 20), table 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

Contents

Page [*]

[*] Page number will be added at a later stage prior to WP.29 submission

1. Scope

This Regulation establishes technical requirements for the type approval of motor vehicles with regard to 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 for emissions and battery durability; anti-tampering, security and cybersecurity; and manipulation devices and manipulation strategies.

1.1. This Regulation shall apply to vehicles of categories M_1, and N_1 .†

At the request of the manufacturer, for vehicles of category N_2 between 3.5 and 5 tonnes maximum mass originating from a type of vehicle of category N_1, the approval authority may grant an emission type-approval if the vehicle meets the requirements for a type of vehicle of category N_1.

[At the manufacturer's request, type approval granted under this Regulation may be extended from vehicles mentioned above to special purpose vehicles of categories M_1, and N_1 . 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 fulfil the requirements for a vehicle type with regard to emissions in accordance with paragraph 3.0.1. of UN Regulation No. 154.

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. "*In-service conformity*" or "ISC" means the activities carried out on vehicles in circulation, systems, separate technical units or components with the purpose of verifying compliance with the durability requirements set out in this Regulation;

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.

† 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 Annex 4 of UN Regulation No. 168.

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.

2.41. "*Manipulation device*" means any element of design that results in a vehicle not complying with the requirements of this Regulation when driven but not under a regulatory test, despite it resulting in the vehicle appearing to be compliant when tested, or that manipulates data related to sensors, fuel or electric energy consumption, electric range or battery durability;

2.42. "*Manipulation strategy*" means a strategy that results in a vehicle not complying with the requirements of this Regulation when driven but not under regulatory test, despite it resulting in the vehicle appearing to be compliant when tested, or that manipulates data related to sensors, fuel or electric energy consumption, electric range or battery durability;

2.43. "*Tampering*" means the inactivation, or modification of the engine or electric motor, vehicle pollution control devices and system, propulsion system, traction battery, odometer, OBFCM device, OBD or OBM system, including any software or other logical control elements of those systems and their data, resulting in the vehicle not complying with this Regulation;

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

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

2.46. "Electric Range" refers to the range that would be determined by the range test procedure used for certification of the vehicle, if the test was performed at the

present point in the lifetime of the vehicle and with the originally installed battery.

2.47. "Certified range" ($Range_{certified}$) refers to the electric driving range that was determined during certification of the vehicle, according to Appendix 3 to Annex C1 of Regulation No. 154.04.

2.48. "Measured range" ($Range_{measured}$) means the electric range determined at the present point in the lifetime of the vehicle by the test procedure used for certification, according to Appendix 3 to Annex C1 of Regulation No. 154.04.

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

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

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

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

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

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

2.55. "On-board SOCR" ($SOCR_{read}$) means an estimate of state of certified range produced by an SOCR monitor.

2.56. "On-board SOCE" ($SOCE_{read}$) means an estimate of state of certified energy produced by an SOCE monitor.

2.57. "Measured SOCR" ($SOCR_{measured}$) means the state of certified range as determined by the measured range divided by the certified range, according to paragraph 3.1.2. of Annex 5 to this Regulation.

2.58. "Measured SOCE" ($SOCE_{measured}$) means the state of certified energy as determined by dividing the measured usable battery energy by the certified usable battery energy.

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

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

2.61. "SOCX" means State of Certified Energy or State of Certified Range, as applicable.

2.xx. [Consider adding definitions for "main lifetime" and "additional lifetime"].

3. Application for approval

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

3.1.1. The application referred to in paragraph 3.1. shall be drawn up in accordance with the model of the information document set out in Annex 1 to this Regulation.

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

(a) All relevant documentation to technically justify the absence of manipulation devices and manipulation strategies.

(b) A declaration of compliance with the requirements on anti-tampering, security and cybersecurity systems (Annex 2 Appendix 2);

(c) If applicable, a declaration of compliance with the requirements of the Type 3 test on crankcase gas emissions (Annex 2 Appendix 1);

(d) Where appropriate, copies of other type approvals with the relevant data to enable extension of approvals;

(e) Demonstration of compliance with UN Regulation No. 85 or UN Regulation No. 177 (if applicable), Level 1a or Level 2 of UN Regulation No. 154, UN Regulation No. 168 on RDE (if applicable), [UN Regulation No. [xxx] on brake particle emissions], [and UN Regulation No. [xxx] on On-Board Monitoring (OBM) and Environmental Vehicle Passport (EVP)].

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 purpose of paragraph 3.1.2.(a)., the manufacturer shall comply with Annex 7 to this Regulation on tests, methods and procedures to establish the absence of manipulation devices and manipulation strategies

3.3.2.1. These tests, methods and procedures include the roles and responsibilities assigned to vehicle manufacturers, type-approval authorities, and other actors that shall ensure the absence of manipulation devices and manipulation strategies and are specified in Annex 7.

3.3.3. For the purposes of paragraph 3.1.2.(b) of this Regulation, the provisions relating to anti-tampering, security and cybersecurity shall be those set out in Annex 9.

3.3.4. 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.

3.3.5. 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.

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

3.4. Vehicles of category M_1 or N_1 shall be approved with [emission characters as specified in Table A3/1, Annex 3], taking into account the corresponding

utility factor determined in accordance with the value specified in Table A8.App5/1 of Appendix 5 to 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 approval[‡].

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. [xxx]) 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.

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*83R09/01/[EX]*0123*01

The first extension of the Approval numbered 0123, issued by the United Kingdom to Series of Amendments 09, Supplement 01, which is an Approval according to emission standard [‘Euro xx’].

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

[‡] 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

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; in-service conformity; anti-tampering, security and cybersecurity; and manipulation devices and manipulation strategies are met.

[In addition, the technical measures taken by the manufacturer must be such as to ensure that the tailpipe 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 [ten years or 200,000 km], whichever comes first.]

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. Reserved

5.1.6. Reserved

5.1.7. Reserved

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

Application of test requirements for type approval and extensions										
Vehicle category	*Vehicles with positive ignition engines including hybrids*								*Vehicles with compression ignition engines including hybrids*	
	Mono fuel				*Bi-fuel*[2]			*Flex-fuel*	*Mono fuel*	
Reference fuel	Petrol	LPG	NG/Bio methane	Hydrogen (ICE)	Petrol LPG	Petrol NG/Bio methane	Petrol Hydrogen (ICE)	Petrol Ethanol (E85)	Diesel	Petrol
Crankcase emissions[1] (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 (as at type-approval)	Yes (as at type-approval)	Yes (as at type-approval)	Yes (as at type-approval)	Yes	Yes

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

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

5.3.3.1. This test[, if required,] 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

Test temperature 266 K (-7 °C)			
Vehicle category	*Class*	*Mass of carbon monoxide (CO) L_1 (g/km)*	*Mass of hydrocarbons (HC) L_2 (g/km)*
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.

($V_1 \leq 0.85$ L and $V_1 + V_2 \leq 1.70$ L and $V_2 \leq$ L).

6. Reserved

7. Extensions to type approvals

7.1. Reserved

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 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 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 for emissions and Annex 5 for battery durability.

9.2. The in-service conformity checks shall verify that exhaust emissions other than CO_2 and optionally evaporative emissions are effectively limited during the main and additional lifetime 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 200,000 km or 10 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 200,000 km or 10 years whichever occurs sooner.]

The requirements for in-service conformity checks are applicable until 10 years after the last vehicles of that in-service conformity family are registered that is subject to testing according to paragraph 9.4., as defined in paragraph 3 of Annex 4.

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 [calendar] year. For the European Union, this shall apply for the whole Union. For such in-service conformity 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 in accordance with paragraph 6 of Annex 4 and approve the plan of remedial measures presented by the manufacturer in accordance with paragraph 7 of 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. The procedures laid out in paragraphs 6. and 7. of Annex 4 shall be followed by the manufacturer and the granting type-approval authority and the manufacturer shall establish a plan of remedial measures and submit it to the granting type approval authority.

9.8. The manufacturer shall ensure that, throughout the lifetime 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. 168 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 [, considering the durability multiplier where applicable.]

9.9. [Add requirements relating to brake particle emissions and for OBM].

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 09 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the 09 series of amendments.

12.2. [To be developed]

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 sent[§].

[§] 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. 168 on RDE (if applicable) …….
0.2.3.4.	Roadload family …….
0.3.	Means of identification of type, if marked on the vehicle:** .....
0.3.1.	Location of that mark: .....
0.4.	Category of vehicle:†† .....
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 dimensions‡‡ (in kg and mm) (refer to drawing where applicable) .....

** 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??).

†† 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.

‡‡ 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 M_1, 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)[§§] (maximum and minimum for each variant):.....
2.8.	Technically permissible maximum laden mass as stated by the manufacturer:[***,†††]
3.	Description of energy converters and power plant.[‡‡‡] (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.[§§§]) .....
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 cycle[****]
3.2.1.3.	Engine capacity:[15] .....cm^3
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/no[9].....
3.2.16.	NG fuelling system: yes/no[9]
3.2.18.	Hydrogen fuelling system: yes/no[9]
3.4.	Engines or motor combinations
3.4.1.	Hybrid Electric Vehicle: yes/no[9]
3.4.2.	Category of Hybrid Electric vehicle Off Vehicle Charging/Not Off Vehicle Charging[9]
3.4.3.	Operating mode switch: with/without[9]
3.4.3.1.	Selectable modes.....

[§§] 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.

[***] 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.

[†††] Please fill in here the upper and lower values for each variant.

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

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

[****] Strike out what does not apply.

3.4.3.1.1. Pure electric: yes/no[9]

3.4.3.1.2. Pure fuel consuming: yes/no[9]

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. Transmission[††††]

4.5. Gearbox:.....

4.5.1. Type (manual/automatic/CVT (continuously variable transmission)[9] .....

4.6. Gear ratios.....

Index	*Internal gearbox ratios (ratios of engine to gearbox output shaft revolutions)*	*Final drive ratios (ratio of gearbox output shaft to driven wheel revolutions)*	*Total gear ratios*
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.

[††††] The specified particulars are to be given for any proposed variants.

6.6.2. Upper and lower limit of rolling radii/circumference:‡‡‡‡ .....

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

‡‡‡‡ Specify one or another.

[15] This value shall be calculated ($\pi = 3.1416$) and rounded off to the nearest cm^3.

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

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

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}
1st	1/1		
2nd	1/1		
3rd	1/1		
4th	1/1		
5th	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)	:	

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

2.3. 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			

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 09 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 vehicle[3]

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, 09 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 4[1]
1.9.	Hybrid electric vehicle: yes/no[1]
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/without[1]
1.10.	Engine identification: .....
1.10.1.	Engine displacement: .....
1.10.2.	Fuel supply system: direct injection/indirect injection[1]
1.10.3.	Fuel recommended by the manufacturer: .....
1.10.4.	Maximum power: …… kW at ..... min^{-1}
1.10.5.	Pressure charging device: yes/no[1]
1.10.6.	Ignition system: compression ignition / positive ignition[1]
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,§§§§] .....
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: .....

§§§§ 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:

Type 6	*CO (mg/km)*	*THC (mg/km)*
Measured value		

3. Remarks: .....

Annex 2 – Appendix 1

MANUFACTURER'S DECLARATION OF COMPLIANCE WITH THE TYPE 3 REQUIREMENTS

(Manufacturer): …..

(Address of the manufacturer): …..

Declares that the vehicles covered by this approval/the vehicles listed in Annex I to this declaration[*****] are in compliance with the Type 3 requirements:

[ ] a closed crankcase system is installed.

[ ] the crankcase emissions are routed directly or indirectly to the tailpipe of the vehicle.

[ ] the crankcase emissions are routed to any other system that prevents the emissions of crankcase gases to the atmosphere.

Done at [….. Place]

On [….. Date]

[*Name and Signature of person authorised by the Manufacturer or Manufacturer's Representative*]

Attachments

Annex I: The Vehicle Type(s), Family(ies) or vehicles described by other vehicle descriptor(s) to which this declaration applies (if applicable).

[*****] Delete what is not applicable

Annex 2 - Appendix 2

Manufacturer's declaration of compliance with the anti-tampering, security and cybersecurity requirements for the purposes of emission type-approval

(Manufacturer): …..

(Address of the manufacturer): …..

Declares that:

1. The vehicles covered by this approval/the vehicles listed in Annex I to this declaration (†††††) are in compliance with the provisions of UN Regulation No. 83 relating to the anti-tampering, security and cybersecurity;

2. The anti-tampering, security and cybersecurity information documentation in Annex II to this declaration describing the detailed technical criteria attached to this declaration is correct and complete for all vehicles to which this declaration applies;

3. Annex III to this declaration lists any exemptions applicable to these vehicles related to the anti-tampering, security and cybersecurity provisions laid down in this Regulation.

Done at [….. Place]

On [….. Date]
[*Name and signature of person authorised by the Manufacturer or Manufacturer's Representative*]

Attachments

Annex I: List of Vehicle Type(s), Family(ies) or other vehicle descriptor(s) with regard to emissions to which this declaration applies

Annex II: Anti-tampering, security and cybersecurity documentation package

Annex III: list of any exemptions and/or deficiencies applicable to these vehicles related to the anti-tampering, security and cybersecurity provisions laid down in UN Regulation No. 83

††††† Delete what is not applicable.

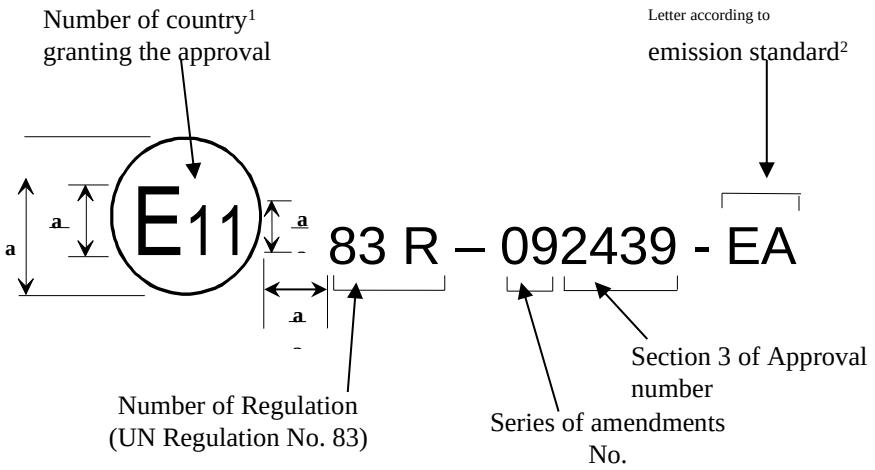
Annex 3

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.

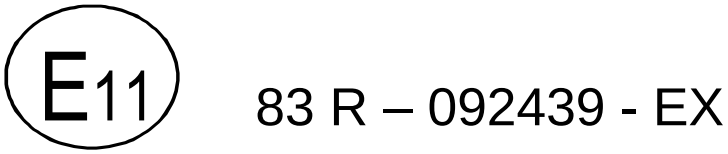
This annex outlines the appearance of this mark and gives an example how it shall be composed.

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.



a = 8 mm (minimum)

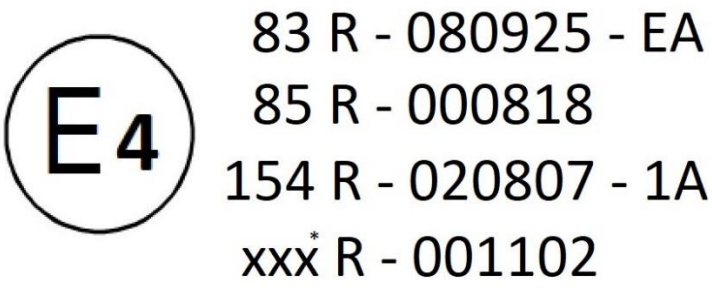
The following graphics are practical examples of how the marking should be composed.
Example 1 [To be updated]



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 09 series of amendments incorporated. Furthermore, the accompanying letter (EX) denotes that the vehicle belongs to a vehicle that meets the Euro EX 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 [To be updated]



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. 168 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.]

Table A3/1

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

[To be developed]

Annex 4

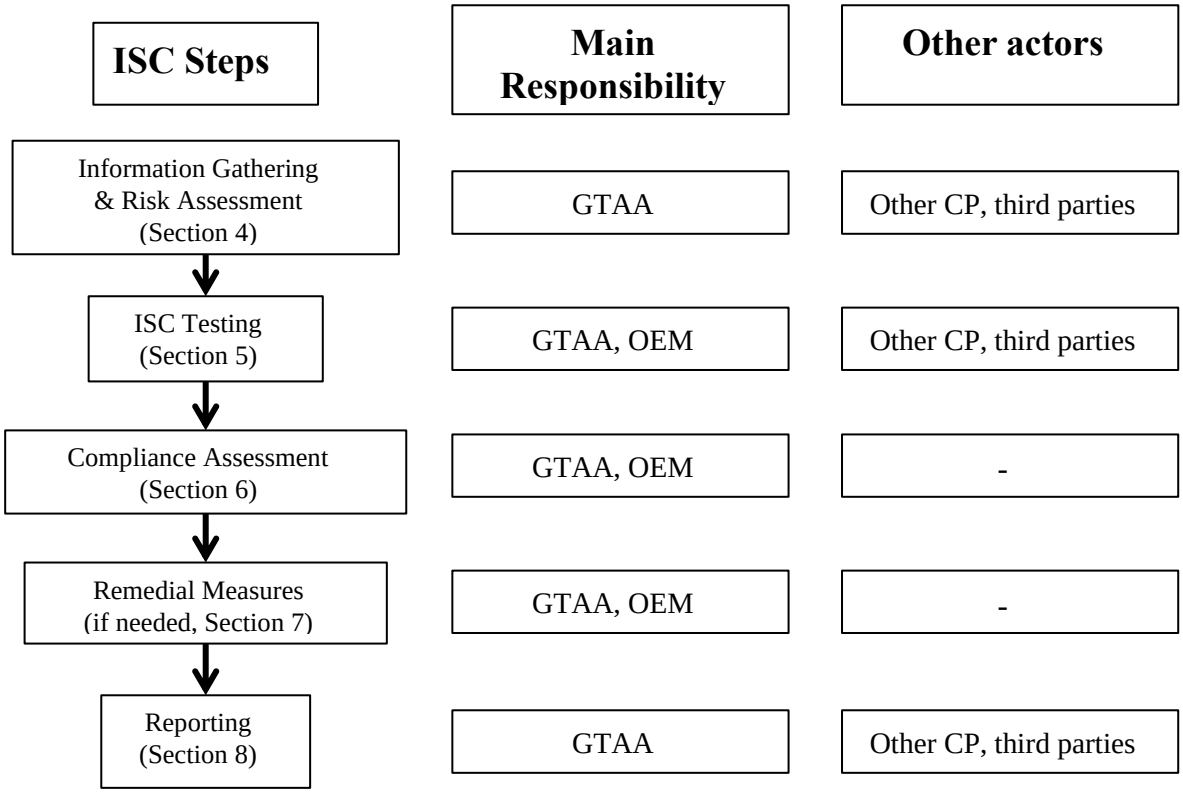
In-service conformity methodology for emissions

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 lifetime of the vehicle, as set out in paragraph 5.1.1.

2. Process description

Figure A4/1
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. 168 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. 168 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. 168 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 CO_2 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. 168 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 A4/1.

Table A4/1
Number of sample lots for ISC testing with Type 1 tests

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

Each sample lot shall include enough vehicle types (with regard to emissions), in order to ensure that at least 20 per cent 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

ID	*Input*	*Description*
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

ID	*Input*	*Description*
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.

[For vehicles that have Declared Maximum RDE values reported in the Manufacturer's RDE certificate of compliance, as described in Annex 12 of UN Regulation No. 168 which is lower than the emission limits set out in paragraph 6.1. of UN Regulation No. 168, the conformity shall be checked against these Declared Maximum RDE values. If the sample is found not to conform with the Declared Maximum RDE values, the granting type approval authority shall require the manufacturer to take corrective actions.]

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. When testing vehicles in the additional lifetime, a durability multiplier of 1.2 for adjusting the emission limits, as specified in paragraph [6.3.10. of UN Regulation No. 154, shall be used.

[Concept of main lifetime and additional lifetime to be defined in an update to this paragraph]

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’ decision 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’ decision 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 A4/2. 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' decision shall be reached when the applicable decision chart from Figure A4/2 gives a 'PASS' decision 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 A4/2 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 A4/2
Decision chart for the statistical procedure for vehicles (where 'UND' means undecided)

Failed result count f	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
	Cumulative sample size n								

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 per cent 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.

Selection of Vehicles for In-Service Conformity Emissions Testing			
	x = Exclusion Criteria	*X = Checked and reported*	*Confidential*
Date:			*x*
Name of investigator:			*x*
Location of test:			*x*
Country of registration:		*x*	
Vehicle Characteristics			
Registration plate number:		*x*	*x*
Mileage and age of vehicle: *The vehicle must comply with the rules with 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*	*x*		
Date of first registration:		x	
VIN:		*x*	x
Emission class and character:		*x*	
Country of registration: *The vehicle must be registered in the Contracting Party*	*x*	*x*	
Model:		*x*	
Engine code:		*x*	
Engine volume (l):		*x*	
Engine power (kW):		*x*	
Gearbox type (auto/manual):		*x*	
Drive axle (FWD/AWD/RWD):		*x*	

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

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

Has a fuel additive, not approved by the manufacturer been used? *If yes then the vehicle cannot be selected.*		*x*		
Has the vehicle been maintained and used in accordance with the manufacturer's instructions? *If not, the vehicle cannot be selected.*		*x*		
Full service and repair history including any re-works *If the full documentation cannot be provided, the vehicle cannot be selected.*		*x*		
	Vehicle Examination and Maintenance	*X = Exclusion Criteria/* *F = Faulty Vehicle*		*X = checked and reported*
1	*Fuel tank level (full / empty)* Is the fuel reserve light ON? *If yes, refuel before test.*			*x*
2	*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*	*x*		
3	*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.*	*x*		
4	*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.*	*F*		
5	*Exhaust gas relevant components* Check and document (with photos) all emissions relevant components for damage. *If there is damage, the vehicle is declared faulty*.	*F*		
6	*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*.	*F*		
7	*Fuel sample*			*x*

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

19	*Safety condition* Check tyres, vehicle's body, electrical and braking system status are in safe conditions for the test and respect road traffic rules. *If not, the vehicle cannot be selected.*	*x*		
20	*Semi-trailer* Are there electric cables for semi-trailer connection, where required?			*x*
21	*Aerodynamic modifications* 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.). *If yes, the vehicle cannot be selected. Document with photos.*	*x*		
22	*Check if less than 800 km away from next scheduled service, if yes, then perform the service.*			*x*
23	*All checks requiring OBD connections to be performed before and/or after the end of testing*			
24	*Powertrain Control Module calibration part number and checksum*			*x*
25	*OBD diagnosis (before or after the emissions test)* Read Diagnostic Trouble Codes & Print error log			*x*
26	*OBD Service Mode 09 Query (before or after the emissions test)* Read Service Mode 09. Record the information.			*x*
27	*OBD mode 7 (before or after the emissions test)* Read Service Mode 07. Record the information			*x*
	Remarks for: Repair / replacement of components / part numbers			

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

ID	*Input*	*Type of data*	*Unit*	*Description*
1	Emission TA number	Text	--	UN Regulation No.154 approval number; UN Regulation No. 168 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 6.2.1. 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 for RL and paragraph 0.2.3.5. for RM
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. The name of the file shall be a UUID, 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. The name of the file shall be a UUID, 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	1. CO, PM, PN, NO_X, NMHC and THC for monofuel gasoline vehicles and all bi-fuel and flex-fuel vehicles. 2. CO, NO_X, NMHC and THC for monofuel LPG and NG vehicles. 3. NO_X for monofuel H_2 vehicles. 4. NO_X, THC+NO_X, CO, PM and PN for all diesel vehicles. 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
31b	Multiplicative Deterioration Factors (DF) fuel 1, fuel 2 (if relevant)	Table values	no units	Table defining deterioration factors per each pollutant. 1. CO, PM, PN, NO_X, NMHC and THC for monofuel gasoline vehicles and all bi-fuel and flex-fuel vehicles. 2. CO, NO_X, NMHC and THC for monofuel LPG and NG vehicles. 3. NO_X for monofuel H_2 vehicles. 4. NO_X, THC+NO_X, CO, PM and PN for all diesel vehicles. 5. Empty if additive DF factors are provided. Paragraph 2.1.1.1.1. of Appendix 1 to Annex A1 of UN Regulation No. 154
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)	Optional 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 The name of the file shall be a UUID, 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 The name of the file shall be a UUID, 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. 168 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(Mono-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/Direct 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

Field	*Type of data*	*Description*
TVV	Text	Unique identifier of the Type, Variant, Version of the vehicle
PEMS Family ID	Text	Paragraph 6.5.2. of UN Regulation No. 168 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 track BX Chassis-cab or chassis-cowl)	Type of bodywork
Emission TA Number	Text	UN Regulation No.154 approval number;

		UN Regulation No. 168 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)
OBM Family Identifier	Text	As affixed in the Declaration of Compliance with OBM, EVP and in-vehicle display of environmental data requirements of UN Regulation No. [XXX] on On-Board Monitoring (OBM)

Annex 5

In-service conformity methodology for battery durability

1. The manufacturer shall perform the in-service conformity tests as described in paragraph 1 of Annex C1 of Regulation No. 154. Responsible authorities and other third parties bodies may perform in-service verification tests.

2. Information gathering

The following information shall be made available to the authorities by the manufacturer in a format to be agreed between the authorities and the manufacturer: annual report on relevant warranty claims; and annual statistics on repairs for both batteries and other systems that might influence the electric energy consumption of the vehicle. Such information shall be made available once a year for each battery durability family for the duration of the period of 8 years after the last vehicle of this family is [sold/produced].

3. Part A: Verification of SOCR/SOCE monitors

3.1. Obligations for the manufacturer

3.1.1. Frequency of verifications

The manufacturer shall complete the procedure for in-use verification for Part A with a frequency agreed with the authorities, until 8 years after the last vehicle of each monitor family as defined in paragraph 6.3.12.1. of UNR 154 is [sold/produced] and report the results of the verification to the authorities. The authorities may decide to proceed with their own verification of Part A, at a frequency and magnitude based on risk assessment, or request more information from the manufacturers.

The verification of the monitors shall not be mandatory if the annual sales of the monitor family are less than 5,000 vehicles in Contracting Parties applying this Regulation for the previous year. Such families may still be selected to be tested for Part A, at the request of the responsible authorities.

3.1.2. Verification procedure

In order to verify the SOCR/SOCE monitors, the values for electric range and UBE shall be measured at the time of the verification and the related values from the monitors shall be collected before the verification test procedure. To support future improvement of the Regulation, indicator values shall be collected again after the verification test procedure. Those indicators read after the verification test procedure shall not be considered in the Part A verification.

The measured SOCR and measured SOCE values shall be determined by dividing the measured values for electric range and UBE by the certified values for electric range and UBE, respectively, and the results expressed in per cent.

$$SOCE_{measured} = \frac{UBE_{measured}}{UBE_{certified}} \cdot 100$$

$$SOCR_{measured} = \frac{Range_{measured}}{Range_{certified}} \cdot 100$$

In cases where $UBE_{measured}$ is higher than the $UBE_{certified}$, the $SOCE_{measured}$ shall be set to 100 per cent. In cases where $Range_{measured}$ is higher than the $Range_{certified}$, the $SOCR_{measured}$ shall be set to 100 per cent.

3.1.3. Statistical Method for Pass/Fail decision for a sample of vehicles

Separate statistics shall be calculated for the SOCR monitor and the SOCE monitor.

An adequate number of vehicles (at least 3 and not more than 16) shall be selected from the same monitor family for testing following a vehicle survey (see Appendix 1 to Annex C1 of UN Regulation No. 154) which contains information designed to ensure that the vehicle has been properly used and maintained according to the specifications of the manufacturer. The following statistics shall be used to take a decision on the accuracy of the monitor.

For evaluating the SOCR/SOCE monitors normalised values shall be calculated:

$$x_i = SOCX_{read,i} - SOCX_{measured,i}$$

Where

$SOCX_{read,i}$ is the on-board SOCR/SOCE read from the vehicle i ; and

$SOCX_{measured,i}$ is the measured SOCR/SOCE of the vehicle i.

For the total number of N tests and the normalised values of the tested vehicles, x_1, x_2, … x_N, the average X_{tests} and the standard deviation s shall be determined:

$$x_{tests} = \frac{(x_1 + x_2 + x_3 + \cdots + x_N)}{N}$$

and

$$s = \sqrt{\frac{(x_1 - x_{tests})^2 + (x_2 - x_{tests})^2 + \cdots + (x_N - x_{tests})^2}{N - 1}}$$

For each N tests $3 \leq N \leq 16$, one of the three following decisions can be reached, where the factor A shall be set at 5:

(a) Pass the family if $x_{tests} \leq A - (t_{P1,N} + t_{P2,N}) \cdot s$

(b) Fail the family if $x_{tests} > A + (t_{F1,N} - t_{F2}) \cdot s$

(c) Take another measurement if:

$$A - (t_{P1,N} + t_{P2,N}) \cdot s < X_{tests} \leq A + (t_{F1,N} - t_{F2}) \cdot s$$

where the parameters $t_{P1,N}$, $t_{P2,N}$, $t_{F1,N}$, and t_{F2} are taken from Table 3.

As at the current stage no accuracy requirements are set for the SOCR monitor, separate statistics for the SOCR monitors shall not be calculated for verification purposes. Separate statistics for the SOCR monitor shall be calculated once accuracy requirements are set for Part A in a future amendment of this Regulation.

Table 3
Pass/fail decision criteria for the sample size

	PASS		*FAIL*	
Tests (N)	$t_{P1,N}$	$t_{P2,N}$	$t_{F1,N}$	t_{F2}
3	1.686	0.438	1.686	0.438
4	1.125	0.425	1.177	0.438
5	0.850	0.401	0.953	0.438
6	0.673	0.370	0.823	0.438
7	0.544	0.335	0.734	0.438
8	0.443	0.299	0.670	0.438
9	0.361	0.263	0.620	0.438
10	0.292	0.226	0.580	0.438
11	0.232	0.190	0.546	0.438
12	0.178	0.153	0.518	0.438
13	0.129	0.116	0.494	0.438
14	0.083	0.078	0.473	0.438
15	0.040	0.038	0.455	0.438
16	0.000	0.000	0.438	0.438

[3.1.4. Corrective measures for the SOCR and SOCE monitors

A fail decision for the sample means that the monitors fail to report accurately the durability of the system and appropriate action shall be taken by the manufacturer with the agreement of the responsible authority. This may lead to the requirement that the manufacturer repairs or replaces the faulty monitor including the relevant sensors or by applying software measures in all affected vehicles in the monitor family.

A pass decision or correction of the non-compliance is required for proceeding with Part B.

SOCR monitors shall not lead to a fail decision but shall be monitored in view of setting the accuracy requirements for Part A in a future amendment of this Regulation.]

[3.2. The approval authority may decide to conduct Part A test as described in the paragraphs from 3.1.1. to 3.1.4.]

4. Part B: Verification of Battery Durability

4.1. Obligations of the manufacturers:

4.1.1. Frequency of verifications

Data shall be collected yearly by the manufacturer from a [statistically adequate] sample of vehicles within the same battery durability family selected randomly from a variety of climate conditions. The decision on the number of the vehicles in the sample may be taken by the manufacturer based on risk assessment methodology, but in principle should not be less than 500.

If the number of vehicles in the sample is less than 500, a maximum of 5 per cent of the values may be excluded from the sample. In such a case, the manufacturer needs to use good engineering judgement.

If the number of vehicles in the sample is equal to or more than 500, then all vehicles shall be included in the sample. The data read shall be those of the SOCR and SOCE monitors (and other relevant data, such as those defined in

Appendix 2 to Annex C1 of UNR Regulation No. 154). SOCR monitors of vehicles of category N and SOCR monitors of category M vehicles shall be collected only for monitoring purposes as long as Table 2 of Annex C1 of UNR Regulation No. 154 does not contain any MPR's for SOCR.

[4.1.2. The manufacturer shall provide to the responsible authorities a certificate of compliance which declares that the vehicle type complies with the requirements as stated in paragraph 1.3 of Annex C1 of UN Regulation No. 154.]

4.2. The responsible authority of a contracting party applying this regulation may decide to perform a Part B verification. In this case the manufacturer shall make available the yearly collected data to the authorities in a format agreed with the authorities. From that data, a statistically adequate sample of vehicles within the same battery durability family shall be selected randomly from a variety of climate conditions. The decision on the number of the vehicles in the sample may be taken by the responsible authority based on risk assessment methodology, but in principle should not be less than 500.

If the number of vehicles in the sample is less than 500, then on the request of the manufacturer and with the agreement of the responsible authority, a maximum of 5 per cent of the values may be excluded from the sample. In such a case, the manufacturer needs to provide adequate information on the reason behind the exclusion for each vehicle to the authority.

If the number of vehicles in the sample is equal to or more than 500, then all vehicles shall be included in the sample. The data read shall be those of the SOCR and SOCE monitors (and other relevant data, such as those defined in Appendix 2 to Annex C1 of UNR Regulation No. 154). SOCR monitors of vehicles of category N and SOCR monitors of category M vehicles shall be collected only for monitoring purposes as long as Table 2 of Annex C1 of UNR Regulation No. 154 does not contain any MPR's for SOCR.

4.3. Pass/Fail Criteria for the battery durability family

A battery durability family shall pass if equal to or more than 90 per cent of monitor values read from the vehicle sample are above the MPR*i* or DPR*i*.A battery durability family shall fail if less than 90 per cent of monitor values read from the vehicle sample are above the MPR*i* or DPR*i*.

5. Part C: Verification of reported virtual distance

5.1. Verification procedure

A verification of the reported virtual distance is only required if the manufacturer is requesting to apply the equivalent virtual distance option. In order to verify the virtual distance read from the vehicle, a test shall be performed with adequate and representative use of the vehicle in V2X or non-traction purposes, if applicable, to verify whether the increase in virtual distance reported is accurate. The total discharge energy during this use shall be measured in order to calculate the measured virtual distance. The verification procedure use case (including the minimum amount of discharged energy corresponding to at least 50 km virtual distance. This shall be agreed and approved by the responsible authority. If 50 km virtual distance cannot be reached with a fully charged battery, virtual distance required for verification shall be set to a value recommended by the manufacturer.

Table 4
The following steps shall be performed to determine the necessary verification results:

Step nr.	Input	Description	Output
Step 1	n.a.	Read the initial virtual distance and the worst case certified energy consumption of Part B family according to Appendix 2 to Annex C1 of UNR Regulation No. 154	$d_{virt,on\text{-}board,init}$ (km) $EC_{Part\ B}$ (Wh/km)
Step 2	n.a.	Perform the V2X-use case and measure the discharged energy	$E_{V2X,meas}$ (Wh)
Step 3	n.a.	Read the final virtual distance according to Appendix 2 to Annex C1 of UNR Regulation No. 154	$d_{virt,on\text{-}board,final}$ (km)
Step 4	From Step 1: $d_{virt,on\text{-}board,init}$ (km) $EC_{Part\ B}$ (Wh/km) From Step 2: $E_{V2X,meas}$ (Wh) From Step 3: $d_{virt,on\text{-}board,final}$ (km)	Calculate the delta of on-board virtual distance: $\Delta d_{virt,onboard} = d_{virt,onb,final} - d_{virt,onb,init}$ Calculate the measured virtual distance: $\Delta d_{virt,meas} = \frac{E_{V2X,meas}}{EC_{Part\ B}}$	$\Delta d_{virt,on\text{-}board}$ (km) $\Delta d_{virt,meas}$ (km)

5.2. Pass or fail of reported virtual distance

An agreed verification procedure use case (as mentioned in paragraph 5.1.) shall be performed with an adequate number of vehicles (at least 1 and not more than 4) used in V2X or non-traction purposes. The verification of the reported virtual distance shall lead to a fail in the verification procedure if the reported delta virtual distance $\Delta d_{virt,on\text{-}board}$ according to Table 4 is more than 5 per cent higher than the measured virtual distance $\Delta d_{virt,meas}$ according to Table 4. The following statistics shall be used to take a decision on the accuracy of the virtual distance.

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 V2X energy test results to an open instance of the statistical procedure, the responsible authority shall perform the following actions:

(a) update the cumulative sample size 'n' for that instance to reflect the total number of valid 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) 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'. For the decision on a pass/fail of a verification sample the responsible authority shall use the decision chart in Table 5. The chart

indicates 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 vehicle family:

(a) ‘Sample pass’ outcome shall be reached when the decision chart from Table 5 gives a "PASS" outcome for the current cumulative sample size 'n' and the count of failed results 'f'.

(b) ‘Sample fail’ decision shall be reached when, for a given cumulative sample size 'n', when the applicable decision chart from Table 5 gives a "FAIL" decision for the current cumulative sample size 'n' and the count of failed results 'f'.

If no decision is reached, the statistical procedure shall remain open and further results shall be incorporated into it until a decision is reached.

Table 5
Decision chart for Part C pass/fail verification

Failed result count ‘f’				
3			FAIL	FAIL
2		UND	UND	PASS
1	UND	PASS	PASS	PASS
0	PASS	PASS	PASS	PASS
	1	2	3	4
			n	

Note: ‘UND’ means undecided

5.3. Corrective measures for reported virtual distance

A fail decision for the sample means that the virtual distance calculators (algorithm) fail to report accurately the virtual distance of the system and appropriate action shall be taken by the manufacturer with the agreement of the responsible authority. This may lead to the requirement that the manufacturer repairs or replaces the faulty virtual distance calculator in all affected and future vehicles in the battery durability family, to correct already reported virtual distances for this family and to repeat the procedure for verification of Part B in order to confirm the pass or fail.

6. Process flow charts for Part A and Part B

The flow charts below illustrate the various steps in the verification process of Part A (Figure 1) and Part B (Figure 2).

Figure 1
Flow chart for Part A: Verification of Monitors

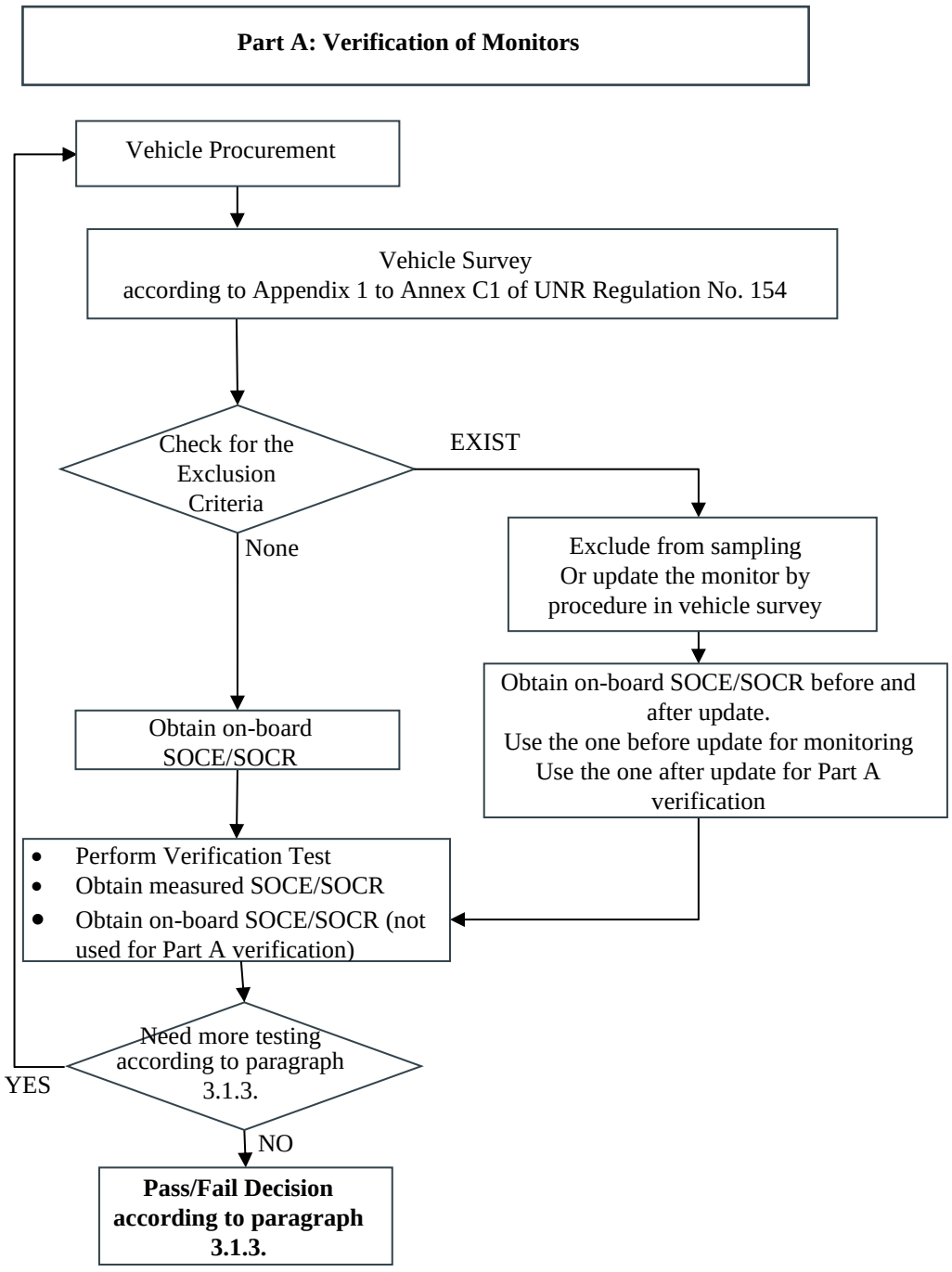
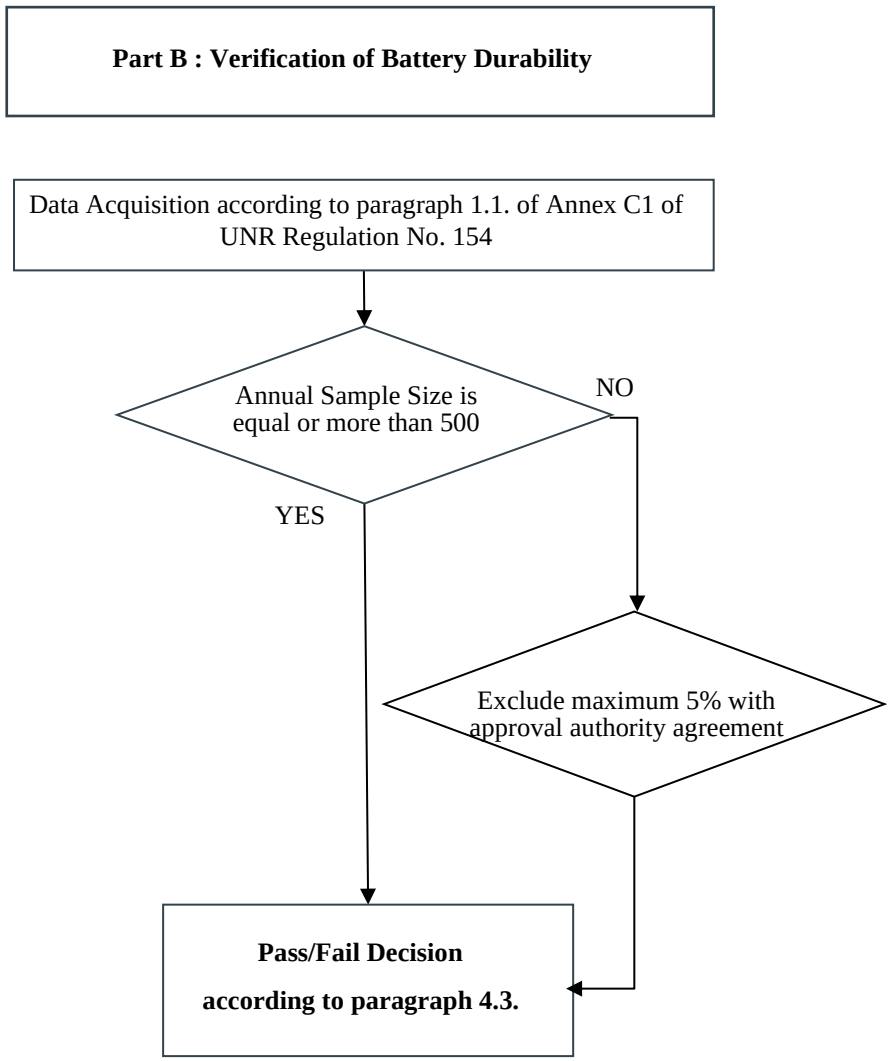


Figure 2
Flow chart for Part B : Verification of Battery Durability



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[, if required,] on a vehicle with positive-ignition engine, which has been, subjected to the Type 1 test, as specified in UN Regulation No. 154.

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 paragraph 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 paragraph 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:

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

Condition number	*Power absorbed by the brake*
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.

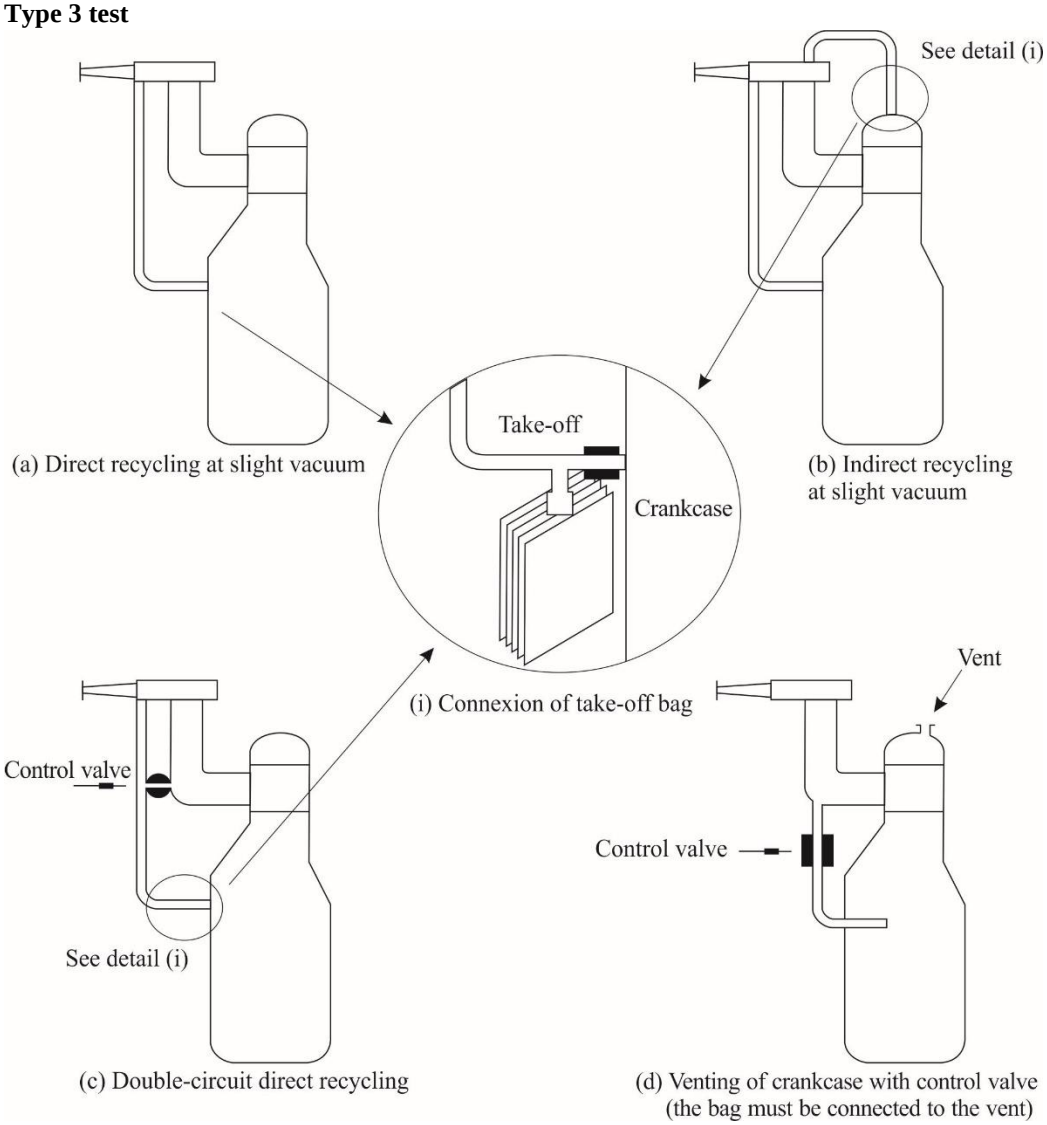
6.5. Remark

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


See detail (i)
(a) Direct recycling at slight vacuum
Take-off
Crankcase
(b) Indirect recycling at slight vacuum
(i) Connexion of take-off bag
Vent
Control valve
Control valve
See detail (i)
(c) Double-circuit direct recycling
(d) Venting of crankcase with control valve (the bag must be connected to the vent)

Annex 7

Manipulation devices and manipulation strategies

1. Introduction

1.1. This Annex sets out the tests, methods and procedures for establishing the absence of manipulation devices and manipulation strategies as specified in paragraph 3. of this Regulation

1.2. This Annex also specifies the documentation that ensures the proper monitoring and enforcement of rules related to manipulation devices and manipulation strategies. It aims to strengthen emissions control mechanisms, enhance transparency, and ensure that vehicles comply with regulatory requirements for the lifetime of the vehicles, particularly the exhaust emission and evaporative emission limits set out in UN Regulation No. 154 and UN Regulation No. 168 and the test conditions therein, as well as the prohibition of manipulation devices and manipulation strategies.

1.3. Specifications for methodologies, tests and procedures that relate to data integrity, such as manipulation of data related to sensors, fuel or electric energy consumption, electric range or battery durability, are provided for in UN Regulation No. [XXX] on On-Board Monitoring (OBM).

1.4. This Annex also sets out roles and responsibilities for the actors involved to ensure compliance with the above-mentioned regulatory requirements and prohibition of manipulation devices and manipulation strategies.

1.5. For the purposes of this Annex, manipulation devices and manipulation strategies should be construed as set out in paragraphs 2.41. and 2.42. of this Regulation. The notion of manipulation strategy shall be distinguished from respectively the notions of ‘Base Emission Strategies (BES)’ and ‘Auxiliary Emission Strategies (AES)’ which are defined in respectively paragraphs 2.38. and 2.39. of this Regulation, and which relate to documentation requirements under this Annex.

2. General requirements – tests and methodologies

2.1. Referring to the provisions of paragraphs 2.41. and 2.42. of this Regulation, (i) manipulation devices and manipulation strategies related to emissions (exhaust, evaporative or other) and (ii) manipulation devices and manipulation strategies related to data integrity should be distinguished.

2.2. When assessing situations that could involve the use of manipulation devices or manipulation strategies for exhaust and evaporative emissions, a broad assessment and interpretation of those situations should be made. Any devices or strategies that reduce the effectiveness of exhaust and non-exhaust emission limits and testing condition requirements under this Regulation, that cause a non-compliant vehicle to appear compliant or that falsify test results, should be considered when determining whether manipulation devices or manipulation strategies exist. Market surveillance authorities should apply dedicated screening tests and enforcement measures to prevent the circumvention of the requirements of [UN Regulations in the field of light-duty vehicle emissions.]

2.3. The assessment of such situations as part of type-approval should distinguish and identify specific situations where the reduction of effectiveness of exhaust and evaporative emission control is justified by technical reasons and is not due to manipulation. This is particularly relevant in driving conditions that are adjacent to one or more boundary conditions of a regulated emissions test. For such situations, manufacturers shall comply with criteria for the declaration of technically justified emission control strategies that are only active for a specific set of ambient or operating conditions, thereby documenting and

explaining the reduction of the effectiveness of emission control that may be observed (for instance, the dosing of reagent may stop at very low temperatures due to physical limitations of hardware). These technically justified emission strategies shall satisfy strict criteria to demonstrate that they are acceptable and that therefore they do not constitute a manipulation device or manipulation strategy . The methodology for the assessment and approval of AES is specified in Appendix 1 to this Annex.

2.4. Manufacturers shall ensure that no vehicle is equipped with manipulation devices or strategies related to data integrity .

2.5. Manufacturers shall not introduce software or calibration updates that manipulate data related to sensors, fuel or electric energy consumption, electric range or battery durability, either before or after the placing in the market.

2.6. Manufacturers shall disclose any software and calibration updates affecting the integrity of data related to sensors, fuel or electric energy consumption, electric range or battery durability to the granting type-approval authority.

3. Technical requirements - documentation

3.1. Manufacturers shall document Auxiliary Emission Strategies (AES) at type-approval. For the type-approval authorities to be able to assess the proper use of AES, considering the prohibition of manipulation devices and manipulation strategies, the manufacturer shall provide an extended documentation package, as described in Appendix 1 to this Annex.

3.2. The extended documentation shall remain strictly confidential. It may be kept by the approval authority, or, at the discretion of the approval authority, may be retained by the manufacturer. In the case the manufacturer retains the documentation package, that package shall be identified and dated by the approval authority once reviewed and approved. It shall be made available for inspection by the approval authority at the time of approval or at any time during the validity of the approval.

3.3. Manufacturers shall also provide to the approval authorities a formal documentation package, as described in Appendix 2 to this Annex, 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 manipulation device or manipulation strategy.

3.4. Manufacturers shall make the formal documentation package available to all type-approval authorities, technical services, market surveillance authorities, recognised third parties and the Commission upon request.

3.5. Manufacturers shall introduce an indicator (AES flag or timer) to indicate when a vehicle runs in a mode where an AES that has been documented in the extended documentation package is active instead of BES mode. The indicator shall be available via the serial port of the standard diagnostic connector upon request of a generic scan-tool. The AES that is running shall be identifiable via the formal documentation package.

4. Roles and responsibilities

4.1. This paragraph sets out roles and responsibilities for the actors involved to ensure compliance with regulatory requirements:

- For vehicle manufacturers: it introduces criteria for the declaration of justified auxiliary emission control strategies that are active for a specific purpose and in response to a specific set of ambient or operating conditions. These emission control strategies shall satisfy strict technical criteria to demonstrate that they do not constitute a manipulation device or manipulation strategy .
- For type-approval authorities: it introduces criteria for the approval of technically justified emission control strategies. The approval of such

emission control strategies relies on the concept of 'Auxiliary Emission Strategies' (AES), which is adapted from the Euro 6 legal framework. This Annex supports the documentation of AES and clarifies their role in aiding emissions measurement and monitoring through on-board monitoring systems (OBM).

- For market surveillance authorities: it sets a framework for the detection of manipulation devices and manipulation strategies using dedicated screening tests and enforcement measures.
- For recognised third parties and Contracting Parties: it sets out roles in the performance of screening tests.

4.2. Roles and responsibilities of vehicle manufacturers

4.2.1. Manufacturers shall ensure the absence of manipulation devices and manipulation strategies related to emissions under the scope of this Regulation: manufacturers shall ensure that no vehicle is equipped with manipulation devices or strategies .

4.2.2. Manufacturers shall document software updates to vehicles in service that reduce the effectiveness of emissions control strategies after type-approval.

4.2.3. Manufacturers shall disclose any software updates or calibrations affecting exhaust emissions control systems to the granting type-approval authority.

4.2.4. Manufacturers shall document Auxiliary Emission Strategies (AES) as part of type-approval as specified in paragraph 3 'Technical requirements – documentation'.

4.2.5. The manufacturer shall cooperate with the type-approval authority to allow them to select up to a maximum of 5 AES that will be monitored by OBM according to Annex 4 of UN Regulation No. [XXX] on On-Board Monitoring (OBM)

4.3. Roles and responsibilities of type-approval authorities

4.3.1. At the request of the manufacturer, the approval authority shall conduct a preliminary assessment of the AES for new vehicle types with regard to emissions, together with the selection of AES according to paragraph 4.2.5. 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.

4.3.2. The type-approval authority shall make a preliminary assessment based on the extended documentation package, as described in point (b) of Appendix 2 to this Annex, provided by the manufacturer. The approval authority shall make the assessment in accordance with the methodology described in Appendix 1 to this Annex. The type-approval authority may deviate from that methodology in exceptional and duly justified cases.

4.3.3. The preliminary assessment of the AES for new vehicle types with regard to emissions shall remain valid for the purposes of type-approval for a period of 18 months. That period may be extended by the type-approval authority by a further 12 months at the request of the manufacturer.

4.3.4. In cooperation with the manufacturer, the type-approval authority shall select up to a maximum of 5 AES that will be monitored by OBM according to Annex 4 of UN Regulation No. [XXX] on On-Board Monitoring (OBM). The selection of AES shall prioritise those AES with the greatest expected impact by combination of their effect upon emissions when they are active and their expected rate of activation while the vehicles are in use.

4.3.5. The extended documentation package shall be identified and dated by the type-approval authority. If the extended documentation package is kept by the type-

approval authority, it shall be retained for at least 10 years after the approval is granted.

4.3.6. The type-approval authority shall evaluate the documentation of software updates that reduce the effectiveness of emissions control strategies after type-approval and extend the approval as appropriate as long as the requirements continue to be met.

4.3.7. The type-approval authority may test the functionality of the AES flag or timer to indicate when a vehicle runs in AES mode instead of BES mode.

4.3.8. Type-approval authorities shall ensure a harmonised assessment of Auxiliary Emission Strategies (AES). A list of AES which were deemed non-acceptable by type-approval authorities shall be compiled yearly by the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party and made available to the public by Contracting Parties at the latest by end of March of the following year, in case there were AES which were deemed non-acceptable by the Forum or similar entity.

4.4. Roles and responsibilities of market surveillance authorities

4.4.1. Market surveillance authorities may conduct screening tests to detect manipulation devices and manipulation strategies related to emissions.

4.4.2. Market surveillance authorities should decide case-by-case which methods are best suited, based on an appropriate risk assessment which considers possible non-compliance, the likelihood of its occurrence, and other possible indicators, like the severity of the occurrence.

4.4.2. The search for manipulation devices or strategies could include two distinct cases:

Case A) ‘Boundary detection”: manipulation devices or strategies that use the regulated test boundaries or surrogates thereof as triggers (such as ambient temperature, altitude, trip duration, fuel consumed and driving dynamics ranges), or;

Case B) ‘Test detection’: manipulation devices or strategies triggered by the presence of test equipment (e.g., backpressure increase at the tailpipe, signals on rear ultrasonic sensors, connection of a data recorder on the OBD port) or the vehicle localization (i.e., anything informing the vehicle that it is being tested on road for tailpipe emissions). These ‘Test detection’ manipulation devices or manipulation strategies apply primarily to on-road tests with PEMS, since vehicles tested in the laboratory usually need to use a special ‘chassis dynamometer mode’ to allow emissions testing without triggering safety devices, etc.

4.4.3. For all screening test campaigns, it shall be necessary, as a minimum, to include testing the vehicle with the regulatory methodologies. This is an important step to make sure that the vehicle is free of malfunctioning, poor maintenance or other similar issues, which would unduly increase the level of emissions.

4.4.4. To detect the presence of manipulation devices or strategies according to Case A, it is necessary that the vehicles are tested under variations of the regulated testing conditions referred to as ‘modalities’. The set of modalities is not fixed but instead kept open due to the need to detect specific technology behaviours in response to a complex set of parameters and the need to keep an unpredictable character.

4.4.6. Market surveillance authorities shall enforce the prohibition of manipulation devices and manipulation strategies related to emissions. If a manipulation device or strategy related to emissions is identified, market surveillance authorities shall proceed in accordance with [Chapter XI of Regulation (EU) 2018/858] or equivalent provisions in other Contracting Parties.

4.4.7. Market surveillance authorities shall ensure a uniform application of criteria for the assessment of screening tests by having regard to the latest version of the relevant non-binding guidance published by the European Commission or equivalent for other Contracting Parties and to the information available within the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party.

4.5. Roles and responsibilities of Contracting Parties and recognised third parties

4.5.1. Contracting Parties and recognised third parties may conduct screening tests to detect manipulation devices and manipulation strategies related to emissions according to paragraph 4.4.1.

Annex 7 - Appendix 1

Methodology for the assessment and approval of AES and BES

This appendix provides a structured approach for assessing and approving Auxiliary Emission Strategies (AES) and Base Emission Strategies.

1. Documentation of AES and BES

1.1. Manufacturers shall include a technical description of their BES in the extended documentation package according to Appendix 2.

1.2. Manufacturers shall document all AES, with the possible omission of certain AES according to paragraph 1.5. Manufacturers shall justify the use of an AES that is documented based on one or more of the following criteria:

a. The AES is necessary for the safe operation of the vehicle.

b. The AES is necessary to avoid sudden and irreparable damage to a powertrain‡‡‡‡‡ component.

c. The AES is only active during engine start.

d. The AES is necessary due to physical limitations of the emission control system.

1.3. For each AES that is documented, manufacturers shall submit:

- A description of the technical motivation for the AES. This will be substantiated by supporting evidence, such as durability tests or risk analyses, demonstrating why the AES is technically necessary;
- A description of the precise conditions that lead to the activation and de-activation of the AES. This shall include, as appropriate, engine parameters, ambient parameters and any other relevant condition;
- An estimation of the emissions and CO_2 impact of the AES when it is active;
- An estimation of the expected rate of activation of the AES while the vehicles are in use.

1.4. The information referred to in paragraph 1.3. shall be included in the extended documentation package according to Appendix 2.

1.5. Manufacturers may omit any AES from the extended documentation package provided they meet one or more of the following conditions:

- The AES does not lead to the exceedance of limit values defined in UN Regulation No. 154 while it is active;
- The AES does not reduce the effectiveness of the emission control systems while it is active;
- The conditions that lead to the activation of the AES are substantially included in the test procedures.

‡‡‡‡‡ As defined in Mutual Resolution No. 2 (M.R.2) of the 1958 and 1998 Agreements of UNECE

2. Assessment of AES and BES

2.1. Authorities shall approve a BES that satisfies the documentation requirements of paragraph 1.1.

2.2. Authorities shall approve an AES that is documented if it is technically justified by one or more criteria under paragraph 1.2., provided that the following criteria are also met:

- The technical motivation for the AES is satisfactory and supported by appropriate evidence;
- The conditions that lead to the activation and de-activation of the AES are set according to technical characteristics of the emission control systems concerned and not to the boundary conditions or other conditions covered by a regulatory test.

3. Approval of AES and BES

The type-approval authority shall approve the AES and BES submitted by the manufacturer based on the contents of the extended documentation package.

The extended documentation package shall be limited to 100 pages.

The extended documentation package may be complemented with annexes and other attached documents, containing additional and complementary elements, if necessary. The manufacturer shall send a new consolidated version of the extended documentation package (with tracked changes) to the type-approval authority every time changes are introduced to the AES. The new version of the AES shall be evaluated and approved by the type-approval authority.

The extended documentation package shall include a declaration of the software versions and calibrations used to control these AES/BES, including the appropriate checksums or reference values of these software versions and calibrations, as well as 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 or calibration that has an impact on the AES/BES. Manufacturers may request to use an alternative to a checksum if it provides an equivalent level of traceability for software version and calibration management.

The extended documentation package shall also include a declaration of the manufacturer on the absence of manipulation devices or manipulation strategies. The approval of the extended documentation package shall not constitute proof of the absence of manipulation devices or manipulation strategies.

Annex 7 - Appendix 2

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**
1. Emission Type-approval Number(s)	List of emission type-approval number(s) covered by this BES-AES declaration: including type-approval reference, software reference, calibration number or checksums of each version and of each relevant Control Unit such as engine and aftertreatment ones
Method of reading of software and calibration version	E.g. scan-tool explanation
2. Base Emission Strategies	
BES x	Description of strategy x
BES y	Description of strategy y
3. Auxiliary Emission Strategies	
Presentation of the AESs	Hierarchical relations among AES: which AES takes precedence if more than one is present
AES x	— AES description and justification — Measured and/or modelled parameters for AES activation — Other parameters used to activate the AES — Increase of pollutant and CO_2 emissions during the use of AES compared to BES — Estimation of the expected rate of activation of the AES while the vehicles are in use
AES y	As above

Extended Documentation Package

The extended documentation package shall be structured as follows:

Extended Documentation Package for AES Application No YYY/OEM

Parts	**Paragraph**	**Point**	**Explanation**
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 which part is modified
		Description of the (emission) types concerned	
		Attached documents table	List of all attached documents
		Cross references	(Indicate where to find each requirement of the regulation)
		Declaration on absence of manipulation devices and manipulation strategies	+ signature
Core document	0	Acronyms/abbreviations	
	1	GENERAL DESCRIPTION	
	1.1	Engine general presentation	Description of main characteristics: displacement, aftertreatment, …
	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 characterisation 3.x.3 Action mode of AES - Parameters used 3.x.4 Effect of AES on pollutants and CO_2 3.x.5 Estimation of the expected rate of activation of the AES while the vehicles are in use
	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 type-approval reference, software reference, calibration number, checksums of each version and of each control unit (engine and/or after-treatment if any)
Attached documents		Technical note for AES justification nº xxx	Risk assessment or justification by testing or example of sudden damage, if any
		Technical note for AES justification nº 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 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 annex 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) ±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

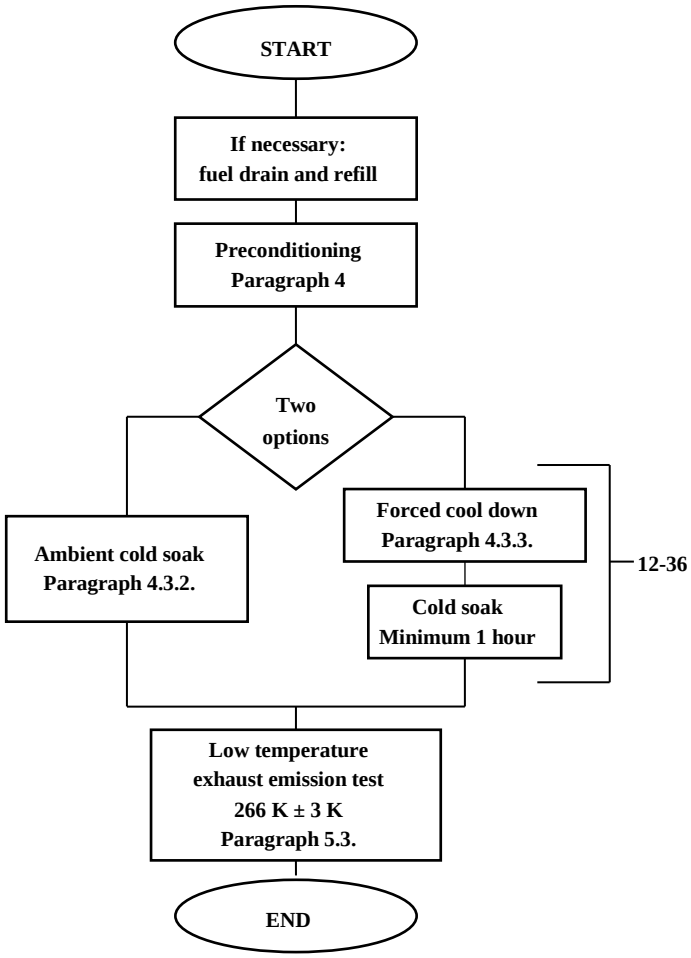
The Part One, urban driving cycle, according to Figure A4a/1 in Annex 4a to the 07 series of amendments to this Regulation, consists of four elementary urban cycles which together make a complete Part One cycle.

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 paragraph 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) ±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 K (-7 °C) ± 2 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 K (-7 °C) ± 2 K, prior to the low ambient temperature exhaust emission test. The ambient temperature (dry bulb) during this period shall average 266 K (-7 °C) ± 3 K and shall not be less than 260 K (-13 °C) or more than 272 K (-1 °C).

In addition, the temperature may not fall below 263 K (-10 °C) or exceed 269 K (-4 °C), for more than three consecutive minutes.

4.3.4. If the vehicle is stabilised at 266 K (-7 °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 K (-7 °C) ± 3 K 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) or exceed 269 K (-4 °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 ±5 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.

If frictional losses of the dynamometer can be stabilized without warming the dynamometer, the test can start following the dynamometer manufacturer's recommendations. The manufacturer shall provide documentation on the validation of the systems upon request of the responsible authority.

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 K (-7 °C) ± 2 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.

Annex 9

Anti-tampering, security and cybersecurity

1. Introduction

This Annex lays down measures regarding the type-approval of anti-tampering, security and cybersecurity systems.

2. Definitions

For the purposes of this Annex, the definitions in UN Regulation No 155 shall apply.

‘Attacks’ shall be understood as comprising tampering attempts, attempts to circumvent security and cyber-attacks.

3. Requirements for type-approval

3.1. Responsibilities of manufacturers

It is the responsibility of the manufacturer that the vehicle type (with regard to emissions) is equipped with sufficient anti-tampering, security and cybersecurity measures to make it resistant against tampering, cybersecurity and security threats arising in all phases of its life-cycle.

To fulfil this responsibility, the vulnerabilities that may lead to tampering shall be minimised to the fullest extent possible, based on the best available knowledge at the time of type-approval, for all the following systems:.

(a) fuel and reagent injection system,

(b) engine and engine control units,

(c) traction batteries and related management systems,

(d) odometer,

(e) pollution control systems,

(f) electric motor and related control units,

(g) OBFCM device,

(h) OBD system,

(i) OBM system, and

(j) EVP.

This shall be deemed to be complied with when:

a) the vehicle type with regard to emissions satisfies the requirements of UN Regulation No 155

and

b) the manufacturer’s vulnerability/threat analysis and risk assessment consider, where applicable:

i) for fuel and reagent injection system, engine and engine control units and pollution control systems, the manufacturer’s vulnerability/threat analysis and risk assessment considers at least the high-level vulnerabilities/threats, examples of vulnerabilities or attack methods, and examples of mitigations of Table 4.1 of Appendix 1 to this Annex.

ii) for the OBM system, OBD system and OBFCM device the manufacturer’s vulnerability/threat analysis and risk assessment considers at least the high-level vulnerabilities/threats, examples

of vulnerability or attack method, and examples of mitigations of Table 4.2 of Appendix 1 to this Annex.

iii) for the odometer, the total distance indicated and total distance values are protected according to UN Regulation No 39 as amended by the 02 series of amendments.

iv) for traction batteries and related management systems, electric motor and related control units and environmental vehicle passport, the manufacturer's vulnerability/threat analysis and risk assessment considers at least the high-level vulnerabilities/threats, examples of vulnerabilities or attack methods, and examples of mitigations of Table 4.3 of Appendix 1 to this Annex.

Without prejudice to requirements of paragraph 7.2.2.2(g) of UN Regulation No 155, the manufacturer shall monitor for, detect, respond to and inform the approval authority on evidences of successful attacks on any of the systems listed above in this paragraph.

3.2. Responsibilities of approval authorities

Without prejudice to the requirements of paragraph 5.1.1. of UN Regulation No 155, type-approval authorities shall verify whether the vulnerability/threat analysis and risk assessment conducted by the manufacturer is appropriate and sufficient. This verification shall ensure that the vulnerabilities and threats of the tables in Appendix 1 have been appropriately managed by the manufacturer. The examples in these tables shall be used as reference.

The type-approval authority may require additional documentation to verify that the proposed mitigation actions are correctly implemented.

Type-approval authorities are encouraged to exchange best practices and experiences within the framework of the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party.

3.3. Responsibilities of market surveillance authorities

Following the requirements in [Article 8 to Regulation (EU) 2018/858, or equivalent provisions in other Contracting Parties], the market surveillance authorities shall carry out regular tests to verify whether anti-tampering, security and cybersecurity measures are sufficient. Market surveillance authorities shall be responsible for vehicle selection, application of testing methods, follow-up activities, reporting and corrective or restrictive measures.

3.3.1. Vehicle selection for market surveillance

When carrying out market surveillance tests, the market surveillance authorities shall select the vehicle types with regards to emissions to be tested based on a risk assessment. Vehicle types (with regards to emissions) deemed to pose a greater risk according to the risk assessment shall be prioritised for testing according to paragraph 3.3.2.

The risk assessment shall consider the following aspects:

a. Evidence that effective tampering products are widely available on the market for use on certain vehicle types with regard to emissions;

b. Evidence of known vulnerabilities affecting certain vehicle types with regard to emissions;

c. Evidence about the prevalence of tampering for certain vehicle types with regard to emissions (including, among others, OBM data submitted by vehicle manufacturers);

d. The number of vehicles in circulation belonging to certain vehicle types with regards to emissions;

e. Other relevant information, including test results of recognised third parties and information exchanged in the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party.

3.3.2. Testing methods

Market surveillance authorities may employ any test method to establish whether vehicles belonging to a certain vehicle type with regard to emissions are sufficiently protected against attacks which could affect the proper operation of systems listed in paragraph 3.1. Market surveillance authorities are encouraged to exchange best practices and experiences within the framework of the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party.

The good state of each test vehicle shall be verified before conducting the tests, ensuring in particular the proper operation of systems listed in paragraph 3.1. and that they have not been subject to attacks in the scope of the tests. The verification shall ensure that no relevant fault code is stored nor any relevant warning light is on, that none of the pollutant monitoring statuses is in 'Error' and that the tampering detection level as set out in Annex 4 of UN Regulation No. [XXX] on On-Board Monitoring (OBM) reported by the OBM is 'Normal'.

This verification shall also include, where appropriate, the performance of an ex-ante Type 1 or RDE test according to this Regulation. The attack test shall not proceed unless the emission results of the ex-ante test fulfil the applicable emission limits.

The tests conducted by market surveillance authorities shall aim to reproduce the attacks likely to be experienced by certain vehicle types with regard to emissions in the field due to a high benefit-cost ratio. These may include attempts to tamper with vehicles by exploiting existing tampering, security and cybersecurity vulnerabilities, or by installing tampering products that are available on the market. The selection of attacks shall be based on the risk assessment described in paragraph 3.3.1.

3.3.3. Test evaluation

The market surveillance authority shall determine the outcome of the test by evaluating the effects of the attack on exhaust emissions or on the integrity of the data used by the systems listed in paragraph 3.1., taking account of the response of the vehicle to the attacks. The authority shall come to a 'pass', 'follow-up' or 'fail' decision on one or both aspects, as appropriate according to the nature of the attack.

A 'pass' outcome requires no further action.

A 'follow-up' outcome shall be followed by the activities described in paragraph 3.3.4.

A 'fail' outcome shall be followed by the activities described in paragraph 3.3.5.

Following the attack, the market surveillance authority may condition the vehicle by driving it over a certain distance, over multiple trips, or in other conditions that are deemed appropriate for the attack to be detected.

3.3.3.1. Evaluation of effects on exhaust emissions (pollutants monitored by OBM)

After the attack and optional conditioning, an ex-post Type 1 or RDE test shall be performed. The ex-ante and ex-post tests shall be of the same type. If two RDE tests are driven, the tests shall be performed over the same route, with similar driving behaviour, and under comparable environmental and traffic conditions.

Following the ex-post emissions test, the test outcome shall be determined for each pollutant monitored by the OBM system. The test outcome shall be considered a ‘pass’ if one of the following is observed:

a. Exhaust emissions do not increase substantially from those of the ex-ante emissions test. A substantial increase shall be understood as an exhaust emissions increase by more than 100 per cent of the applicable emission limit and where emissions of the ex-post test are above the applicable OBD threshold.

b. Exhaust emissions are substantially increased to a level of up to 2.5 times the applicable emission limit, while the tampering detection level is set to ‘Level 1’ or higher.

c. Exhaust emissions are substantially increased to a level equal or higher than 2.5 times the applicable emission limit, while the tampering detection level is set to ‘Level 2’ and the corresponding OBM status has transitioned to ‘Error’.

If the test outcome is not a direct ‘pass’, the vehicle may be conditioned further to allow more evaluation time for the OBM system to transition the pollutant monitoring statuses and tampering detection level.

When, after further conditioning, the monitoring statuses or tampering detection level do not transition in such a way that they lead to a ‘pass’ outcome, the test outcome shall be considered a ‘follow-up’ if one of the following outcomes is observed:

a. Exhaust emissions are substantially increased to a level of up to 2.5 times the applicable emission limit, while the tampering detection level is set to ‘Level 0’.

b. Exhaust emissions are substantially increased to a level equal or higher than 2.5 times the applicable emission limit, while the corresponding OBM status has transitioned to ‘Error’ and the tampering detection level is set to ‘Level 1’ or lower.

If the outcome is neither a ‘pass’ nor a ‘follow-up’, it shall be considered a ‘fail’.

Vehicles not equipped with an OBM system shall be excluded from the evaluation of the effects on exhaust emissions according to this paragraph.

3.3.3.2. Evaluation of effects on exhaust emissions (pollutants not monitored by OBM)

After the attack and optional conditioning, an ex-post Type 1 or RDE test shall be performed. The ex-ante and ex-post tests shall be of the same type. If two RDE tests are driven, the tests shall be performed over the same route, with similar driving behaviour, and under comparable environmental and traffic conditions.

Following the ex-post emissions test, for all pollutants not monitored by the OBM system, the test outcome shall be considered a ‘follow-up’ when the pollutants are substantially increased to a level above the applicable OBD threshold values as specified in paragraph 6.8.2 of UN Regulation No 154 while the malfunction indicator (MI) is not activated. In any other case, it shall be considered a ‘pass’.

If the test outcome is not a direct ‘pass’, the vehicle may be conditioned further to allow more evaluation time for the OBD system to activate the malfunction indicator.

3.3.3.3. Evaluation of effects on the integrity of data

Following the attack and optional conditioning, the outcome shall be considered a ‘pass’ when the attack is unsuccessful in modifying data of the systems listed in paragraph 3.1.

If the attack is successful in modifying data of the systems listed in paragraph 3.1., the outcome shall be evaluated by the market surveillance authority on the following two criteria:

a. Impact: what the relevance of data modification is in terms of impact on the environment;

b. Response: whether the vehicle responded by adequately conveying information about the invalidity of the modified data.

When the impact is regarded as insignificant, the outcome shall be considered a 'pass'.

When the impact is regarded as significant, and the response is deemed adequate by the authority, the outcome shall be considered a 'pass'.

When the impact is regarded as significant and the response is deemed inadequate, the outcome shall be considered a 'follow-up'. In such cases, the market surveilance authority shall contact the manufacturer to inform them of the outcome of the test, the characteristics of the vehicle and the nature of the tests performed.

The manufacturer may propose further conditioning to allow additional time for the vehicle to respond to the attack, or repeated tests on similar vehicles. Following the further conditioning or repeated tests, the response of the vehicle shall be evaluated. If the vehicle response is still deemed inadequate by the market surveillance authority, the outcome shall be confirmed as a 'follow-up'. If the response of the vehicle is deemed adequate, the outcome shall be considered a 'pass'.

3.3.4. Follow-up activities

In the case of an attack with an outcome considered as 'follow-up', it shall be investigated in detail, where necessary in cooperation with the manufacturer and the granting type-approval authority, to establish:

a. which vulnerabilities were exploited and whether these were identified at the time of type-approval;

b. in case that vulnerabilities were identified at the time of type-approval, whether the mitigation measures have been properly applied;

c. whether the vulnerabilities apply to other vehicle types with regard to emissions.

Without prejudice to requirements of Chapter XI of Regulation (EU) 2018/858 or equivalent provisions in other Contracting Parties, the manufacturer shall, within a period agreed with the market surveillance authority, propose a technical solution to the market surveillance authority to increase the resistance of the vehicle against attacks, either by effectively mitigating the exploitation of the vulnerability or by implementing methods to detect the attack and initiate an appropriate response, along with a plan to implement this technical solution. The market surveillance authority shall evaluate the technical solution and accompanying implementation plan and request modifications where appropriate.

When the technical solution and implementation plan are accepted by the market surveillance authority, the manufacturer shall proceed with the implementation of the technical solution as agreed with the market surveillance authority.

When the technical solution and implementation plan fail to satisfy the market surveillance authority, the outcome shall be considered a 'fail'.

The results of the investigation of attacks with a 'follow-up' outcome shall be brought to the attention of to the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party.

3.3.5. Reporting, corrective and administrative measures following a ‘fail’ outcome

A ‘fail’ outcome upon an attack shall be investigated in detail, where necessary in cooperation with the manufacturer and the granting type-approval authority, to establish:

a. which vulnerabilities were exploited and whether these were identified at the time of type-approval;

b. in case that vulnerabilities were identified at the time of type-approval, whether the mitigation measures have been properly applied;

c. whether the vulnerabilities apply to other vehicle types with regard to emissions.

The details of tests with a ‘fail’ outcome shall be reported to the manufacturer, and the market surveillance authorities shall require the manufacturer to take measures in accordance with [Chapter XI of Regulation (EU) 2018/858 or equivalent provisions in other Contracting Parties] to ensure that the exploited vulnerability is effectively mitigated, preferably by an over-the-air software update of the relevant vehicle systems according to UN Regulation No 156.

In determining the appropriateness of corrective measures, authorities shall consider the state of technology of the vehicle type with regard to emissions, the technical feasibility of possible mitigations and the likelihood of exploitation of the vulnerability (approximated by the benefit-cost ratio of the attack). The manufacturer may, with appropriate supporting evidence, demonstrate that a vulnerability cannot be effectively mitigated or that an appropriate response from the tampering detection cannot be realised, due to technical limitations of the vehicle’s architecture. If the manufacturer comprehensively demonstrates to the market surveillance authority that a mitigation is not technically feasible, the manufacturer shall not be required to provide corrective measures.

The results of the investigation of attacks with a ‘fail’ outcome shall be brought to the attention of the EU Forum for Exchange of Information on Enforcement or similar entity in a Contracting Party. In case of vulnerabilities that cannot be effectively mitigated due to technical limitations are identified, the Forum or similar entity shall consider requesting corresponding additional mitigations in future type approvals.

3.4. Roles and responsibilities for Contracting Parties and recognised third parties

Contracting Parties and recognised third parties may verify whether vehicles belonging to a certain vehicle type with regard to emissions are sufficiently protected against tampering attempts, security and cybersecurity attacks affecting the systems listed in paragraph 3.1. according to the methods described in paragraph 3.3.2.

4. Administrative provisions

4.1. Administrative provisions for anti-tampering, security and cybersecurity

Documentation to demonstrate compliance with paragraph 3.1. shall be made available by the manufacturer in two parts:

(a) The formal documentation package for the approval, according to documentation requirements in UN Regulation No. 155 paragraph 3.3., which shall be supplied to the type-approval authority at the time of submission of the type approval application. This documentation package shall be used by the type-approval authority as the basic reference for the approval process. The type-approval authority shall ensure that this documentation package remains available for at least 10 years counted from the time when production of the vehicle type (with regard to emissions) is definitively discontinued.

(b) Additional material relevant to the requirements of this regulation may be retained by the manufacturer, but made open for inspection at the time of type-approval. The manufacturer shall ensure that any material made open for inspection at the time of type approval remains available for at least a period of 10 years counted from the time when production of the vehicle type (with regard to emissions) is definitively discontinued.

In cases where information is shown to be covered by intellectual property rights or to constitute specific know-how of the manufacturer or of their suppliers, the manufacturer or their suppliers shall make available sufficient information to enable the checks referred to in this Regulation to be made properly. Such information shall be treated on a confidential basis.

The manufacturer shall provide a manufacturer's declaration of compliance with the anti-tampering, security and cybersecurity requirements of this Regulation for the purposes of type-approval. This declaration shall use the format provided in Appendix 2 to Annex 2.

Annex 9 - Appendix 1

High-level vulnerabilities/threats, examples of vulnerabilities or attack methods, and examples of mitigations

The manufacturers, while analysing the vulnerabilities/threats and assessing the risks for the systems listed in paragraph 3.1. of this annex, shall consider all relevant vulnerabilities or attack methods associated with each high-level vulnerability/threat, and implement proportionate mitigations to protect the vehicle type with regard to emissions as appropriate. Examples of vulnerabilities or attack methods to be considered and examples of mitigations to be implemented are included in Table 4.1, Table 4.2 and Table 4.3 for each high-level vulnerability/threat of each system. The examples referring to Annex 5, Part A and Part B of UN Regulation No 155 shall be considered in the context of the specific system to which they apply.

Table 4.1.
High-level vulnerabilities/threats, examples of vulnerabilities or attack methods and example of mitigations

System	*High-level vulnerability/threat*	*Examples of vulnerabilities or attack methods*	*Examples of mitigations*
Pollution control systems	Unauthorised modification of engine/sensor control unit (ECU/SCU) data or software code	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 9.1, 12.1, 17.1, 18.3	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised software injection via ECU flashing tools to disable or alter emission control components, suppress OBD/OBM inducement, or prevent DTCs	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 28.2, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of emission-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware
	Manipulation of communication messages inside the vehicle through data modifications	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 11.3, 20.3, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Injection, interception or alteration of vehicle communication messages (e.g., CAN), for example by emulators	Measures to detect malicious internal messages or activity e.g., plausibility checks, timing analysis or certificate-based authentication to maintain emission data integrity
	Manipulation of signals inside the vehicle through hardware modifications	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 11.1, 25.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised alteration or manipulation of emission-related signals (e.g., ambient or exhaust temperature) by physical	Diagnostic functions, plausibility checks or anomaly detection systems

System	*High-level vulnerability/threat*	*Examples of vulnerabilities or attack methods*	*Examples of mitigations*
		modifications, for example by modifiers	
Fuel and reagent system	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 9.1, 20.4, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised modification of engine control software to modify fuel or reagent injection e.g., altering injected quantity	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 25.1, 27.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of fuel or reagent-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware
Engine and engine control units	Unauthorised modification of ECU data or software code	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 9.1, 20.4, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Installing unauthorised firmware to modify engine functional parameters	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU hardware	Vulnerabilities or attack methods in Annex 5, Part A of UN Regulation No 155: 11.3, 18.3, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of engine control units	Access prevention or detection measures e.g., with tamper resistant or tamper evident hardware

Table 4.2.
High-level vulnerabilities/threats, examples of vulnerabilities or attack methods and example of mitigations

System	*High-level vulnerability/threat*	*Examples of vulnerabilities or attack methods*	*Examples of mitigations*
OBM system	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 9.1, 20.4, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Modifying or disabling vehicle data reported by the OBM system	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 25.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of OBM-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware
OBD system	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 19.1, 18.3, 20.4, 20.5, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Installing unauthorised firmware to modify diagnostic behaviour	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 25.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of OBD-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware
OBFCM device	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 9.1, 20.4, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Modifying fuel consumption data reported by the device	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 25.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of OBFCM-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware

Table 4.3.
High-level vulnerabilities/threats, examples of vulnerabilities or attack methods and example of mitigations

System	*High-level vulnerability/threat*	*Examples of vulnerabilities or attack methods*	*Examples of mitigations*
Traction batteries and related management systems	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 12.2, 20.3, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Altering software to modify charging/discharging rates and battery durability data	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 27.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of battery-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware
Electric Motor and Related Control Units	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 5.1, 9.1, 20.4, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Installing unauthorised firmware to modify inverter or motor controllers	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 25.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units of electric motor-related components	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware
Environmental Vehicle Passport (EVP)	Unauthorised modification of ECU/SCU data or software code	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 9.1, 20.4, 23.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Modifying environmental data related to the EVP	Access control techniques/designs and secure software update procedures e.g., update authentication, integrity check, secure boot process
	Unauthorised access and modification to ECU/SCU hardware	Vulnerabilities in Annex 5, Part A of UN Regulation No 155: 25.1, 32.1	Corresponding mitigations in Annex 5, Part B of UN Regulation No 155
		Unauthorised access to and modification of internal circuit of control units to modify environmental data related to the EVP	Access prevention or detection measures e.g., with tamper-resistant or tamper-evident hardware

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/1	-	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	% (m/m)		0.005	ASTM 0161 3
(as acetic acid CH_3COOH)	mg/1		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.