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Item 4.9.2. of the provisional agenda

1958 Agreement – Consideration of draft amendments to existing Regulations submitted by GRPE

Proposal for Supplement 2 to the 06 series of amendments to Regulation No. 49 (compression ignition and positive ignition (LPG and CNG) engines)

Submitted by the Working Party on Pollution and Energy*

The text reproduced below was adopted by the Working Party on Pollution and Energy (GRPE) at its sixty-sixth session (ECE/TRANS/WP.29/GRPE/66, para. 40.). It is based on ECE/TRANS/WP.29/GRPE/2013/8, as amended by para. 40 of the GRPE report (ECE/TRANS/WP.29/GRPE/66). It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee AC.1 for consideration.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106 and ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

Paragraph 2.52., amend to read:

"2.52. "Qualified deteriorated component or system" (QDC) means a component or system that has been intentionally deteriorated such as by accelerated ageing or by having been manipulated in a controlled manner and which has been accepted by the Type Approval Authority according to the provisions set out in Annex 9B to this Regulation for use when demonstrating the OBD performance of the engine system;"

Paragraph 3.1.4., add a new subparagraph (i), to read:

"...

- (h) Where appropriate, copies of other type approvals with the relevant data to enable extension of approvals and establishment of deterioration factors;
- (i) Where appropriate, the documentation packages required by this Regulation for the correct installation of the engine type-approved as separate technical unit."

Paragraph 4.6.3., amend to read:

"4.6.3. In the case of natural gas/biomethane fuelled engines, including dual-fuel engines, the manufacturer shall demonstrate the parent engines capability to adapt to any natural gas/biomethane composition that may occur across the market. This demonstration shall be carried out according to this paragraph and, in case of dual-fuel engines, also according to the additional provisions regarding the fuel adaptation procedure set out in paragraph 6.4 of Annex 15 to this Regulation."

Paragraph 4.6.5., amend to read:

"4.6.5. In the case of natural gas/biomethane engines, the ratio of the emission results "r" shall be determined for each pollutant as follows:
..."

Paragraph 4.7., amend to read:

"4.7. Requirements on restricted fuel range type-approval in case of engines fuelled with natural gas/biomethane or LPG, including dual-fuel engines.
Restricted fuel range type approval shall be granted subject to the requirements specified in paragraphs 4.7.1. to 4.7.2.3."

Paragraph 4.7.1., amend to read:

"4.7.1. Exhaust emissions type-approval of an engine running on CNG and laid out for operation on either the range of H-gases or on the range of L-gases"

Paragraph 4.7.2.1., amend to read:

"4.7.2.1. The parent engine shall meet the emission requirements on the reference fuels G_R and G_{25} in the case of CNG, on the reference fuels G_R and G_{20} in the case of LNG,, or on the reference fuels A and B in the case of LPG, as specified in Annex 5. Fine-tuning of the fuelling system is allowed between the tests. This fine-tuning will consist of a recalibration of the fuelling database, without any alteration to either the basic control strategy or the basic structure of the database. If necessary the exchange of parts that are directly related to the amount of fuel flow such as injector nozzles is allowed."

Paragraph 4.7.2.2., amend to read:

"4.7.2.2. In the case of CNG, at the manufacturer's request, the engine may be tested on the reference fuels G_R and G_{23} , or on the reference fuels G_{25} and G_{23} , in which case the type-approval is only valid for the H-range or the L-range of gases respectively."

Paragraph 4.7.2.3., amend to read:

"4.7.2.3. On delivery to the customer the engine shall bear a label as specified in paragraph 4.12.8. stating for which fuel range composition the engine has been calibrated."

Paragraph 4.12.3.3.6., add new items (g), (h), and (i) and renumber items (g) and (h) (former) into (j) and (k), to read:

"...

- (f) HLt in the case of the engine being approved and calibrated for a specific gas composition in either the H-range or the L-range of gases and transformable to another specific gas in either the H-range or the L-range of gases by fine tuning of the engine fuelling;
- (g) CNG_{fr} in all other cases where the engine is fuelled with CNG/biomethane and designed for operation on one restricted gas fuel range composition;
- (h) LNG_{fr} in the cases where the engine is fuelled with LNG and designed for operation on one restricted gas fuel range composition;
- (i) LPG_{fr} in the cases where the engine is fuelled with LPG and designed for operation on one restricted gas fuel range composition;
- (j) LNG₂₀ in case of the engine being approved and calibrated for a specific liquefied natural gas / liquefied biomethane composition resulting in a λ -shift factor not differing by more than 3 per cent the λ -shift factor of the G_{20} gas specified in Annex 5, and the ethane content of which does not exceed 1.5 per cent;
- (k) LNG in case of the engine being approved and calibrated for any other liquefied natural gas / liquefied biomethane composition."

Insert a new paragraph *4.12.3.4.*, to read:

"4.12.3.4. In addition to the marking on the engine, the approval mark may also be retrievable via the instrument cluster. It shall then be readily available for inspection and the access instructions included in the user manual of the vehicle."

Paragraph 4.12.8., amend to read:

"4.12.8. Labels for natural gas/biomethane and LPG fuelled engines

In the case of natural gas and LPG fuelled engines with a restricted fuel range type-approval, the following labels are applicable:"

Paragraph 5.1.4.1., amend to read:

"5.1.4.1. The documentation package required by paragraph 3. enabling the Approval Authority to evaluate the emission control strategies and the systems on-board the vehicle and engine to ensure the correct operation of NO_x control measures, as well as the documentation packages required in Annex 10 (off-

cycle emissions), Annexes 9A and 9B (OBD) and Annex 15 (dual-fuel engines), shall be made available in the two following parts:

..."

Paragraph 5.1.4.3., amend to read:

"5.1.4.3. The extended documentation package shall include:

- (a) Information on the operation of all AES and BES, including a description of the parameters that are modified by any AES and the boundary conditions under which the AES operate, and indication of which AES and BES are likely to be active under the conditions of the test procedures set out in Annex 10;
- (b) A description of the fuel system control logic, timing strategies and switch points during all modes of operation;
- (c) A full description of the inducement system required in Annex 11, including the associated monitoring strategies;
- (d) The description of the anti-tampering measures considered in paragraph 3.1.4. (b) and in paragraph 3.2.4. (a)."

Add a new paragraph 5.2.4., to read:

"5.2.4. For the dilute testing of positive ignition engines by using an exhaust dilution system, it is permitted to use analyser systems that meet the general requirements and calibration procedures of Regulation No. 83. In this case, the provisions of paragraph 9. and Appendix 2 to Annex 4 shall not apply.

However, the test procedures in paragraph 7. of Annex 4 and the emission calculations provided in paragraph 8. of Annex 4 shall apply."

Paragraph 5.3., table 1 and notes, amend to read:

"5.3. Emission limits

Table 1 provides the emissions limits that apply to this Regulation.

Table 1

Emission Limits

| | <i>Limit values</i> | | | | | | | |
|---|-----------------------|------------------------|-------------------------|-----------------------------------|------------------------------------|--------------------------------|----------------------------|-----------------------------|
| | <i>CO</i> (mg/kWh) | <i>THC</i> (mg/kWh) | <i>NMHC</i> (mg/kWh) | <i>CH₄</i> (mg/kWh) | <i>NO_x*</i> (mg/kWh) | <i>NH₃</i> (ppm) | <i>PM mass</i> (mg/kWh) | <i>PM number</i> (#/kWh) |
| WHSC (CI) | 1,500 | 130 | | | 400 | 10 | 10 | 8.0 x 10 ¹¹ |
| WHTC (CI) | 4,000 | 160 | | | 460 | 10 | 10 | 6.0 x 10 ^{11**} |
| WHTC (PI) | 4,000 | | 160 | 500 | 460 | 10 | 10 | 6.0 x 10 ^{11**} |
| <i>Notes:</i> | | | | | | | | |
| PI Positive Ignition | | | | | | | | |
| CI Compression Ignition | | | | | | | | |
| * The admissible level of NO ₂ component in the NO _x limit value may be defined at a later stage. | | | | | | | | |
| ** The limit shall apply as from the dates set out in row B of table 1 in Appendix 9 to Annex I. | | | | | | | | |

"

Paragraph 6.2., split into 6.2. and 6.2.1. and amend to read:

- "6.2. Installation of a type-approved engine on a vehicle
- 6.2.1. The installation of an engine type-approved as a separate technical unit on a vehicle shall, in addition, comply with the following requirements:
- (a) As regard to the compliance of the OBD system, the installation shall, according to Appendix 1 of Annex 9B, meet the manufacturer's installation requirements as specified in Part 1 of Annex 1;
 - (b) As regard to the compliance of the system ensuring the correct operation of NO_x control measures, the installation shall, according to Appendix 4 of Annex 11, meet the manufacturer's installation requirements as specified in Part 1 of Annex 1;
 - (c) The installation of a dual-fuel engine type-approved as a separate technical unit on a vehicle shall, in addition, meet the specific installation requirements and the manufacturer's installation requirements set out in Annex 15."

Paragraph 6.2.1. (former), delete.

Paragraphs 8.3.3.3 and 8.3.3.4., amend to read:

- "8.3.3.3. For diesel, ethanol (ED95), petrol, E85, LNG₂₀, LNG and LPG fuelled, including dual-fuel, engines, all these tests may be conducted with the applicable market fuels. However, at the manufacturer's request, the reference fuels described in Annex 5 may be used. This implies tests, as described in paragraph 4.
- 8.3.3.4. For CNG engines, including dual-fuel engines, all these tests may be conducted with market fuel in the following way:
- ..."

Paragraph 8.3.3.5., amend to read:

- "8.3.3.5. Non-compliance of gas and dual-fuel engines
- In the case of dispute caused by the non-compliance of gas fuelled engines, including dual-fuel engines, when using a market fuel, the tests shall be performed with each reference fuel on which the parent engine has been tested, and, at the request of the manufacturer, with the possible additional third fuel, as referred to in paragraphs 4.6.4.1. and 4.7.1.2., on which the parent engine may have been tested.
- When applicable, the result shall be converted by a calculation, applying the relevant factors "r", "r_a" or "r_b" as described in paragraphs 4.6.5., 4.6.6.1. and 4.7.1.3.. If r, r_a or r_b are less than 1, no correction shall take place.
- The measured results and, when applicable, the calculated results shall demonstrate that the engine meets the limit values with all relevant fuels (for example fuels 1, 2 and, if applicable, the third fuel in the case of natural gas engines, and fuels A and B in the case of LPG engines)."

Paragraphs 8.4.1., 8.4.2, and 8.4.3., amend to read:

- "8.4.1. ...
- An engine shall be randomly taken from series production and subjected to the tests described in Annex 9B and in the case of dual-fuel engines to the

additional tests required by paragraph 7 of Annex 15. The tests may be carried out on an engine that has been run-in up to a maximum of 125 hours.

- 8.4.2. The production is deemed to conform if this engine meets the requirements of the tests described in Annex 9B and in the case of dual-fuel engines to the additional tests required by paragraph 7 of Annex 15.
- 8.4.3. If the engine taken from the series production does not satisfy the requirements of paragraph 8.4.1., a further random sample of four engines shall be taken from the series production and subjected to the tests described in Annex 9B and in the case of dual-fuel engines to the additional tests required by paragraph 7 of Annex 15. The tests may be carried out on engines that have been run-in, up to a maximum of 125 hours."

Paragraphs 13.3.2 and 13.3.3. amend to read

- "13.3.2. As from 1 September 2015, type-approvals granted to this Regulation as amended by the 06 series of amendments, which do not comply with the requirement of paragraph 13.2.2., shall cease to be valid.
- 13.3.3. As from 31 December 2016, type-approvals granted to this Regulation as amended by the 06 series of amendments, which do not comply with the requirements of paragraph 13.2.3., shall cease to be valid."

Annex 1, table in Part 1, amend to read:

"

| | | | | | | | |
|-----------------|--|--|--|--|--|--|--|
| ... | ... | | | | | | |
| 3.2.1.1.1. | Type of dual-fuel engine: Type 1A/Type 1B/Type 2A/Type 2B/Type 3B ^{1,14} | | | | | | |
| 3.2.1.1.2. | Gas Energy Ratio over the hot part of the WHTC test-cycle:% ¹⁴ | | | | | | |
| ... | ... | | | | | | |
| 3.2.1.6.2. | Idle on Diesel: yes/no ^{1,14} | | | | | | |
| 3.2.2.2. | Heavy duty vehicles Diesel/Petrol/LPG/NG-H/NG-L/NG-HL/Ethanol (ED95)/ Ethanol (E85)/LNG/LNG ₂₀ ^{1,15} | | | | | | |
| ... | ... | | | | | | |
| 3.2.9.3. | Maximum allowable exhaust back pressure at rated engine speed and at 100 % load (compression ignition engines only) (kPa) ⁷ | | | | | | |
| 3.2.9.7.1. | Acceptable exhaust system volume (vehicle and engine system): (dm ³) | | | | | | |
| 3.2.9.7.2. | Volume of the exhaust system that is part of the engine system:dm ³ | | | | | | |
| ... | ... | | | | | | |
| 3.2.12.2.7.0.5. | When appropriate, manufacturer reference of the Documentation for installing in a vehicle an OBD equipped engine system | | | | | | |
| ... | ... | | | | | | |
| 3.2.12.2.8.1. | Systems to ensure the correct operation of NO _x control measures | | | | | | |
| 3.2.12.2.8.2. | Driver inducement system | | | | | | |
| 3.2.12.2.8.2.1. | Engine with permanent deactivation of the driver inducement, for use by the rescue services or in vehicles designed and constructed for use by the armed services, civil defence, fire services and forces responsible for maintaining public order: Yes/No ¹ | | | | | | |
| 3.2.12.2.8.2.2. | Activation of the creep mode 'disable after restart'/'disable after | | | | | | |

| | | | | | | | | |
|-----------------|--|--|--|--|--|--|--|--|
| | fuelling/'disable after parking' ^{1,7} | | | | | | | |
| 3.2.12.2.8.3. | Number of OBD engine families within the engine family considered when ensuring the correct operation of NO _x control measures | | | | | | | |
| 3.2.12.2.8.3.1. | List of the OBD engine families within the engine family considered when ensuring the correct operation of NO _x control measures (when applicable) | OBD engine family 1: OBD engine family 2: etc... | | | | | | |
| 3.2.12.2.8.3.2. | Reference number of the OBD engine family considered when ensuring the correct operation of NO _x control measures the parent engine / the engine member belongs to | | | | | | | |
| | | | | | | | | |
| 3.2.12.2.8.6. | Lowest concentration of the active ingredient present in the reagent that does not activate the warning system (CD _{min}) (% vol) | | | | | | | |
| 3.2.12.2.8.8.5. | Heated/non-heated reagent tank and dosing system (see point 2.4 of Annex 11) | | | | | | | |
| ... | ... | | | | | | | |
| 3.2.17. | Specific information related to gas and dual fuel engines for heavy-duty vehicles (in the case of systems laid out in a different manner, supply equivalent information) (if applicable) | | | | | | | |
| ... | ... | | | | | | | |
| 3.2.17.9. | When appropriate, manufacturer reference of the documentation for installing the dual-fuel engine in a vehicle ¹⁴ | | | | | | | |
| | | | | | | | | |
| 3.5.4. | CO ₂ emissions for heavy duty engines | | | | | | | |
| 3.5.4.1. | CO ₂ mass emissions WHSC test ¹⁶ : (g/kWh) | | | | | | | |
| 3.5.4.2. | CO ₂ mass emissions WHSC test in diesel mode ¹⁷ : g/kWh | | | | | | | |
| 3.5.4.3. | CO ₂ mass emissions WHSC test in dual-fuel mode ¹⁴ (if applicable): g/kWh | | | | | | | |
| 3.5.4.4. | CO ₂ mass emissions WHTC test ¹⁶ : (g/kWh) | | | | | | | |
| 3.5.4.5. | CO ₂ mass emissions WHTC test in diesel mode ¹⁷ : g/kWh | | | | | | | |
| 3.5.4.6. | CO ₂ mass emissions WHTC test in dual-fuel mode ¹⁴ : g/kWh | | | | | | | |
| 3.5.5. | Fuel consumption for heavy duty engines | | | | | | | |
| 3.5.5.1. | Fuel consumption WHSC test ¹⁶ : (g/kWh) | | | | | | | |
| 3.5.5.2. | Fuel consumption WHSC test in diesel mode ¹⁷ : g/kWh | | | | | | | |
| 3.5.5.3. | Fuel consumption WHSC test in dual-fuel mode ¹⁴ : g/kWh | | | | | | | |
| 3.5.5.4. | Fuel consumption WHTC test ^{5,16} : (g/kWh) | | | | | | | |
| 3.5.5.5. | Fuel consumption WHTC test in diesel mode ¹³ : g/kWh | | | | | | | |
| 3.5.5.6. | Fuel consumption WHTC test in dual-fuel mode ¹⁴ : g/kWh | | | | | | | |

| | | | | | | | | |
|-----|-----|--|--|--|--|--|--|--|
| ... | ... | | | | | | | |
|-----|-----|--|--|--|--|--|--|--|

"

Annex 1, table in Part 2, amend to read:

"

| | | | | | | | | |
|-----------------|--|--|--|--|--|--|--|--|
| ... | ... | | | | | | | |
| 3.2.2.4.1. | Dual-fuel vehicle: yes/no ¹ | | | | | | | |
| ... | ... | | | | | | | |
| 3.2.9.7. | Complete exhaust system volume (vehicle and engine system) (dm ³) | | | | | | | |
| 3.2.9.7.1. | Acceptable exhaust system volume (vehicle and engine system) dm ³ | | | | | | | |
| | | | | | | | | |
| 3.2.12.2.7. | On-board-diagnostic (OBD) system | | | | | | | |
| | | | | | | | | |
| 3.2.12.2.7.8. | OBD components on-board the vehicle | | | | | | | |
| 3.2.12.2.7.8.0. | Alternative approval as defined in paragraph 2.4. of Annex 9A of this Regulation used: Yes/No ¹ | | | | | | | |
| 3.2.12.2.7.8.1. | OBD components on-board the vehicle | | | | | | | |
| 3.2.12.2.7.8.2. | When appropriate, manufacturer reference of the documentation package related to the installation on the vehicle of the OBD system of an approved engine | | | | | | | |
| 3.2.12.2.7.8.3. | Written description and/or drawing of the MI ¹⁰ | | | | | | | |
| 3.2.12.2.7.8.4. | Written description and/or drawing of the OBD off-board communication interface ¹⁰ | | | | | | | |
| 3.2.12.2.7.8.5. | OBD Communication protocol standard: ⁴ | | | | | | | |
| | | | | | | | | |
| 3.2.12.2.8.1. | Systems to ensure the correct operation of NO _x control measures | | | | | | | |
| 3.2.12.2.8.2. | Driver inducement system | | | | | | | |
| 3.2.12.2.8.2.1. | Engine with permanent deactivation of the driver inducement, for use by the rescue services or in vehicles designed and constructed for use by the armed services, civil defence, fire services and forces responsible for maintaining public order: Yes/No ¹ | | | | | | | |
| 3.2.12.2.8.2.2. | Activation of the creep mode 'disable after restart'/'disable after fuelling'/'disable after parking' ^{1,7} | | | | | | | |
| ... | ... | | | | | | | |
| 3.2.12.2.8.8. | Components on-board the vehicle of the systems ensuring the correct operation of NO _x control measures | | | | | | | |
| 3.2.12.2.8.8.1. | List of components on-board the vehicle of the systems ensuring the correct operation of NO _x control measures | | | | | | | |
| 3.2.12.2.8.8.2. | When appropriate, manufacturer reference of the documentation package related to the installation on the vehicle of the system ensuring the correct operation of NO _x control measures of an | | | | | | | |

| | | | | | | | |
|-----------------|--|--|--|--|--|--|--|
| | approved engine | | | | | | |
| 3.2.12.2.8.8.3. | Written description and/or drawing of the warning signal ¹⁰ | | | | | | |
| | | | | | | | |
| 3.2.12.2.8.8.5. | Heated/non-heated reagent tank and dosing system (see point 2.4 of Annex 11) | | | | | | |

"

Annex 1, notes following the table in Part 2, amend to read:

"...

¹³ Dual fuel engines.

¹⁴ In case of a dual-fuel engine or vehicle (types as defined in Annex 15).

¹⁵ In case of a dual-fuel engine or vehicle, the type of gaseous fuel used in dual-fuel mode shall not be struck out.

¹⁶ Except for dual-fuel engines or vehicles (types as defined in Annex 15).

¹⁷ In the case of Type 1B, Type 2B, and Type 3B of dual-fuel engines (types as defined in Annex 15)."

*Annex 1, Appendix to information document, paragraph 5.1., amend to read (including the new footnote † and deleting the footnote *):*

"5.1. Engine test speeds for emissions test according to Annex 4^{2,†}

...

† In the case of dual-fuel engines of Type 1B, Type 2B, and Type 3B, types as defined in Annex 15, repeat the information in both dual-fuel and diesel mode."

*Annex 1, Appendix to information document, paragraph 5.1.1., delete (including the footnotes * and **).*

Annex 1, Appendix to information document, paragraph 5.2., amend to read:

"5.2. Declared values for power test according to Regulation No. 85 or declared values for power test in dual-fuel mode according to Regulation No. 85[†]

..."

*Annex 1, Appendix to information document, paragraphs 5.2.6 to 5.2.6.5., delete (including the footnotes * and **).*

*Annex 2A and 2C, Addendum to Type-approval Communication, paragraphs 1.1.5. and 1.1.5.1., amend to read (including the new footnote † and deleting the footnote *):*

"1.1.5. Category of engine: Diesel/Petrol/LPG/NG-H/NG-L/NG-HL/Ethanol (ED95)/ Ethanol (E85)/LNG/LNG₂₀¹

1.1.5.1. Type of dual-fuel engine: Type 1A/Type 1B/Type 2A/Type 2B/Type 3B^{1,†}

† Dual fuel engines."

Annex 2A and 2C, Addendum to Type-approval Communication, para. 1.4., amend to read:

"1.4 Emission levels of the engine/parent engine¹

Deterioration Factor (DF): calculated/fixed¹

Specify the DF values and the emissions on the WHSC (if applicable) and WHTC tests in the table below."

Annex 2A and 2C, Addendum to Type-approval Communication, table 4, amend to read (including new notes *, **, and † and deleting the former footnote **):

"Table 4
WHSC test

| WHSC test (if applicable)** | | | | | | | |
|---|-------------|--------------|----------------|--------------------------|------------------|---------------------|-------------------|
| DF | CO | THC | NMHC† | NO _x | PM Mass | NH ₃ | PM Number |
| Mult/add ¹ | | | | | | | |
| Emissions | CO (mg/kWh) | THC (mg/kWh) | NMHC† (mg/kWh) | NO _x (mg/kWh) | PM Mass (mg/kWh) | NH ₃ ppm | PM Number (#/kWh) |
| Test result | | | (mg/kWh) | | | | |
| Calculated with DF | | | | | | | |
| CO ₂ mass emission:g/kWh | | | | | | | |
| Fuel consumption:g/kWh | | | | | | | |
| <i>Notes:</i> | | | | | | | |
| * In the case of engines considered in paragraphs 4.6.3 and 4.6.6 of this Regulation, repeat the information for all fuels tested, when applicable. | | | | | | | |
| ** In the case of dual-fuel engines of Type 1B, Type 2B, and Type 3B, types as defined in Annex 15, repeat the information in both dual-fuel and diesel mode. | | | | | | | |
| † In the cases laid down in table 1 of Annex 15 for dual-fuel engines, and for positive ignition engines. | | | | | | | |

"

Annex 2A and 2C, Addendum to Type-approval Communication, table 5, amend (including new notes *, **, and † and deleting the references to the former footnote **) to read:

"Table 5
WHTC Test

| WHTC test** | | | | | | | | |
|--|-------------|--------------|----------------|----------------------------|--------------------------|------------------|---------------------|-------------------|
| DF | CO | THC | NMHC† | CH ₄ † | NO _x | PM Mass | NH ₃ | PM Number |
| Mult/add ¹ | | | | | | | | |
| Emissions | CO (mg/kWh) | THC (mg/kWh) | NMHC† (mg/kWh) | CH ₄ † (mg/kWh) | NO _x (mg/kWh) | PM Mass (mg/kWh) | NH ₃ ppm | PM Number (#/kWh) |
| Cold start | | | | | | | | |
| Hot start w/o regeneration | | | | | | | | |
| Hot start with regeneration ⁽¹⁾ | | | | | | | | |
| k _{r,u} (mult/add) ₁ | | | | | | | | |
| k _{r,d} (mult/add) ₁ | | | | | | | | |
| Weighted test result | | | | | | | | |
| Final test result with DF | | | | | | | | |
| CO ₂ mass emission:.....g/kWh | | | | | | | | |
| Fuel consumption:g/kWh | | | | | | | | |

Notes:

- * In the case of engines considered in paragraphs 4.6.3 and 4.6.6 of this Regulation, repeat the information for all fuels tested, when applicable.
- ** In the case of dual-fuel engines of Type 1B, Type 2B, and Type 3B, types as defined in Annex 15, repeat the information in both dual-fuel and diesel mode.
- ‡ In the cases laid down in table 1 of Annex 15 for dual-fuel engines, and for positive ignition engines.

Annex 3, Table 1, amend to read:

"Table 1

Letters with reference to requirements of OBD and SCR systems

| <i>Character</i> | <i>NO_x OTL¹</i> | <i>PM OTL²</i> | <i>Reagent quality and consumption</i> | <i>Additional OBD monitors³</i> | <i>Implementation dates: new types</i> | <i>Date when type approval cease to be valid</i> |
|------------------|--|---|--|--|--|--|
| A ⁴ | Row "phase-in period" of Tables 1 and 2 of Annex 9A | Performance monitoring ⁵ | Phase in ⁶ | N/A | Date of entry into force of 06 series of R49 | 31 August 2015 |
| B ⁴ | Row "phase-in period" of Tables 1 and 2 of Annex 9A | Row "phase-in period" of Table 1 of Annex 9A | Phase in ⁶ | N/A | 1 September 2014 | 31 December 2016 |
| C | Row "general requirements" of Tables 1 and 2 of Annex 9A | Row "general requirements" of Table 1 of Annex 9A | General ⁷ | Yes | 31 December 2015 | |

Notes:

- ¹ "NO_x OTL" monitoring requirements as set out in Tables 1 and 2 of Annex 9A.
- ² "PM OTL" monitoring requirements as set out in Table 1 of Annex 9A.
- ³ The requirements regarding the plan and implementation of the monitoring techniques according to paragraphs 2.3.1.2. and 2.3.1.2.1. of Annex 9A.
- ⁴ During the phase-in period set out in paragraph 4.10.7. of this Regulation, the manufacturer shall be exempted from providing the statement required by paragraph 6.4.1. of Annex 9A.
- ⁵ "Performance monitoring" requirements as set out in paragraph 2.3.2.2. of Annex 9A.
- ⁶ Reagent quality and consumption "phase-in" requirements as set out in paragraphs 7.1.1.1. and 8.4.1.1. of Annex 11.
- ⁷ Reagent quality and consumption "general" requirements as set out in paragraphs 7.1.1. and 8.4.1. of Annex 11.

Annex 4, paragraph 6.11.1., amend to read:

"6.11.1. The pressure in the crankcase shall be measured over the emissions test cycles at an appropriate location. It shall be measured at the dip-stick hole with an inclined-tube manometer.

6.11.1.1. The pressure in the intake manifold shall be measured to within ±1 kPa.

6.11.1.2. The pressure measured in the crankcase shall be measured to within ± 0,01 kPa."

Annex 6, paragraph 1.1., amend to read:

"1.1. This annex sets out the procedure for measuring carbon monoxide emissions at idling speeds (normal and high) for positive ignition engines installed in

vehicles of category M₁ with a technically permissible maximum laden mass not exceeding 7.5 tonnes, as well as in vehicles of categories M₂ and N₁."

Annex 6, add a new paragraph 1.2., to read:

"1.2. This Annex does not apply to dual-fuel engines and vehicles."

Annex 7, add a new paragraph 3.3.2.4., to read:

"3.3.2.4. The use of market fuels is allowed for conducting the service accumulation schedule. A reference fuel shall be used to carry out the emission test."

Annex 8, add new paragraphs 4.6.6.1. and 4.6.6.2., to read:

"4.6.6.1. As an alternative the electrical power to the PEMS system may be supplied by the internal electrical system of the vehicle as long as the power demand for the test equipment does not increase the output from the engine by more than 1% of its maximum power and measures are taken to prevent excessive discharge of the battery when the engine is not running or idling.

4.6.6.2. In case of a dispute the results of measurements performed with a PEMS system powered by an external power supply shall prevail over the results acquired according to the alternative method under 4.6.6.1."

Annex 8, paragraph 5.1.2., amend to read:

"5.1.2. Torque signal

5.1.2.1. The conformity of the torque signal calculated by the PEMS equipment from the ECU data-stream information required in paragraph 9.4.2.1. of this Regulation shall be verified at full load."

Annex 8, paragraph 5.1.2.1. (former), renumber as 5.1.2.1.1.

Annex 8, add new paragraph 5.1.2.4., to read:

"5.1.2.4. Dual-fuel engines and vehicles shall, in addition, comply with the requirements and exceptions related to the torque correction set out in Annex 15."

Annex 8, Appendix 1, table 1, note 4, amend to read:

"⁴ The recorded value shall be either (a) the net brake engine torque according to paragraph A.1.2.4.4. of this Appendix or (b) the net brake engine torque calculated from the torque values according to paragraph A.1.2.4.4. of this Appendix."

Annex 8, Appendix 1, paragraph A.1.2.4.4. amend to read:

"A.1.2.4.4. Connection with the vehicle ECU

A data logger shall be used to record the engine parameters listed in Table 1. This data logger can make use of the Control Area Network (hereinafter CAN) bus of the vehicle to access the ECU data specified in Table 1 of Appendix 5 of Annex 9B and broadcasted on the CAN according to standard protocols such as SAE J1939, J1708 or ISO 15765-4. It may calculate the net brake engine torque or perform unit conversions."

Annex 8, Appendix 1, paragraph A.1.2.5.3. amend to read:

"A.1.2.5.3. Checking and calibrating the analysers

The zero and span calibration and the linearity checks of the analysers shall be performed using calibration gases meeting the requirements of paragraph 9.3.3. of Annex 4. A linearity check shall have been performed within three months before the actual test."

Annex 8, Appendix 2, paragraph A.2.2.3. amend to read:

"A.2.2.3. Sampling of gaseous emissions

The sampling probes shall meet the requirements defined in paragraphs A.2.1.2. and A.2.1.3. of Appendix 2 to Annex 4. The sampling line shall be heated to 190 °C (+/-10°C)."

Annex 9B, paragraph 4.5., insert an example and amend to read:

"4.5. Requirements for malfunction classification

...

If a malfunction would result in a different classification for different regulated pollutant emissions or for its impact on other monitoring capability, the malfunction shall be assigned to the class that takes precedence in the discriminatory display strategy (for example Class A takes precedence over Class B1).

..."

Annex 9B, paragraph 4.5.1., amend to read:

"4.5.1. Class A malfunction

A malfunction shall be identified as Class A when the relevant OBD threshold limits (OTLs) are assumed to be exceeded.

The emissions may still remain below the OTLs when this class of malfunction occurs."

Annex 9B, paragraph 4.7.1.5.1., amend to read:

"4.7.1.5.1. The manufacturer may request, subject to approval by the Type Approval Authority, the ready status for a monitor to be set to indicate "complete" without the monitor having run and concluded the presence or the absence of the failure relevant to that monitor.

Such a request may only be approved if during a multiple number of operating sequences (minimum 9 operating sequences or 72 operation hours):

- (a) Monitoring is temporarily disabled according to paragraph 5.2. of this Annex due to the continued presence of extreme operating conditions (e.g. cold ambient temperatures, high altitudes); or
- (b) The system that is monitored is not in operation and the DTC associated to that system does not have the confirmed and active or the previously active status at the time when the readiness status becomes incomplete during a repair.

Any such request must specify the conditions for monitoring system disablement and the number of operating sequences that would pass without monitor completion before ready status would be indicated as "complete".

The extreme ambient or altitude conditions considered in the manufacturer's request shall never be less severe than the conditions specified by this annex for temporary disablement of the OBD system."

Annex 9B, paragraph 5.2.2., insert a new item (e) to read:

"5.2.2. Ambient temperature and altitude conditions

Manufacturers may request approval to disable OBD system monitors:

...

- (d) At elevations above 2,500 meters above sea level; or
- (e) Below 400 meters under sea level."

Annex 9B, Appendix 3, Item 1, amend to read:

"Appendix 3 - Item 1

...

Wherever a feedback control loop exists, the OBD system shall monitor the system's ability to maintain feedback control as designed (possible errors are for example: not entering feedback control within a manufacturer specified time interval, or: when feedback control has used up all the adjustment capability allowed by the manufacturer and the system cannot achieve the target) - component monitoring.

..."

Annex 9B, Appendix 3, Item 2, amend to read:

"Appendix 3 - Item 2

...

- (c1) DPF filtering performance: the filtering and regeneration process of the DPF. This requirement would apply to PM emissions only - emission threshold monitoring.

..."

Annex 9B, Appendix 3, Item 3, amend to read:

"Appendix 3 - Item 3

...

- (b) Active/intrusive reagent: the proper consumption of the reagent if a reagent other than fuel is used (e.g. urea) - performance monitoring;

..."

Annex 9B, Appendix 5, table 1, amend to read (also adding new lines):

"Table 1

Mandatory requirements

| | <i>Freeze frame</i> | <i>Data stream</i> |
|---|---------------------|--------------------|
| Calculated load (engine torque as a percentage of maximum torque available at the current engine speed) | x | X |
| Engine speed | x | x |
| Engine coolant temperature (or equivalent) | x | X |
| Barometric pressure (directly measured or estimated) | x | x |
| Reference maximum engine torque | | x |
| Net brake engine torque (as a percentage of reference maximum engine torque), or Actual engine torque / indicated torque (as a percentage of reference maximum engine torque, e.g. calculated from | | x |

| | | |
|--|--|---|
| commanded injection fuel quantity) | | |
| Friction torque (as a percentage of reference maximum engine torque) | | X |
| Engine fuel flow | | X |

"

Annex 9B, Appendix 5, table 2, amend to read (deleting one line):

"Table 2

Optional engine speed and load information

| | <i>Freeze frame</i> | <i>Data stream</i> |
|--|---------------------|--------------------|
| Driver's demand engine torque (as a percentage of maximum engine torque) | X | X |
| Actual engine torque (calculated as a percentage of maximum engine torque, e.g. calculated from commanded injection fuel quantity) | X | |
| Reference maximum engine torque as a function of engine speed | | X |
| Time elapsed since engine start | X | X |

"

Annex 9C, paragraph 4.1.1., amend to read:

"4.1.1. Groups of monitors

...

Manufacturers are not required to implement software algorithms in the OBD system to individually track and report in-use performance data of monitors running continuously as defined in paragraph 4.2.3. of Annex 9B."

Annex 10, paragraph 11, amend to read:

"11. Documentation

The Type Approval Authority shall require that the manufacturer provides a documentation package. This should describe any element of design and emission control strategy of the engine system and the means by which it controls its output variables, whether that control is direct or indirect.

The information shall include a full description of the emission control strategy. In addition, this could include information on the operation of all AES and BES, including a description of the parameters that are modified by any AES and the boundary conditions under which the AES operate, and indication of which AES and BES are likely to be active under the conditions of the test procedures in this annex.

This documentation package shall be provided according to the provisions of paragraph 5.1.4.3. of this Regulation."

Annex 11, paragraph 5.3., add footnote 2 to read:

"5.3. Low-level inducement system

The low-level inducement system shall reduce the maximum available engine torque across the engine speed range by 25 per cent between the peak torque speed and the governor breakpoint as described in Appendix 3 to this annex. The maximum available reduced engine torque below the peak torque speed of the engine before imposition of the torque reduction shall not exceed the reduced torque at that speed.

The low-level inducement system shall be activated when the vehicle becomes stationary² for the first time after the conditions specified in paragraphs 6.3., 7.3., 8.5. and 9.4., have occurred.

² A vehicle shall be considered as stationary at the latest 1 minute after the vehicle speed has been reduced to zero km/h. The engagement of any device such as a park-brake, a trailer-brake, or a hand-brake shall not be necessary for being stationary."

Annex 11, paragraph 5.4.4., add a reference to footnote 2 and amend to read:

"5.4.4. A "disable on time limit" system shall limit the vehicle speed to 20 km/h ("creep mode") on the first occasion when the vehicle becomes stationary² after eight hours of engine operation if none of the systems described in paragraphs 5.4.1. to 5.4.3. has been previously been activated."

Annex 11, paragraph 7.1.1.1., amend to read:

"7.1.1.1. During the phase-in period specified in paragraph 4.10.7. of this Regulation and upon request of the manufacturer for the purpose of paragraph 7.1. the reference to the NO_x emission limit specified in paragraph 5.3. to this Regulation shall be replaced by the value of 900 mg/kWh."

Annex 11, Appendix 5, paragraph A.5.3.1., amend to read:

"A.5.3.1. The "NO_x control information" shall contain at least the following information:

...

(g) The DTCs associated with the malfunctions relevant to this annex and when their status is 'potential' or 'confirmed and active'."

Annex 11, Appendix 6, paragraph A.6.1., amend to read:

"A.6.1. The manufacturer shall demonstrate the correct value of the minimum acceptable reagent quality CD_{min} during type approval by performing the hot part of the WHTC cycle, in accordance with the provisions of Annex 4, using a reagent with the concentration CD_{min}."

Annex 15, the title, amend to read:

"Additional technical requirements for diesel-gas dual-fuel engines and vehicles"

Annex 15, paragraph 4.3.1.2., amend to read:

"4.3.1.2. The dual-fuel mode indicator shall be set for at least one minute on dual-fuel mode or diesel mode as soon as the engine operating mode is changed from

diesel to dual-fuel mode or vice-versa. This indication is also required for at least one minute at key-on, or at the request of the manufacturer at engine cranking. The indication shall also be given upon the driver's request."

Annex 15, paragraph 5.4., amend to read:

"5.4. Conformity factors

In principle, the emission limit applicable for applying the conformity factor used when performing a PEMS test, whether a PEMS test at certification or a PEMS test when checking and demonstrating the conformity of in-service engines and vehicles, should be determined on the basis of the actual GER calculated from the fuel consumption measured over the on-road test.

However, in absence of a robust way to measure the gas or the diesel fuel consumption, the manufacturer is allowed to use the GER_{WHTC} determined on the hot part of the WHTC and calculated according to this annex."
