

**Economic and Social Council**Distr.: General
4 November 2014

Original: English

Economic Commission for Europe**Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****Working Party on Pollution and Energy****Seventieth session**

Geneva, 13-16 January 2015

Item 4(a) of the provisional agenda

**Heavy duty vehicles - Regulations Nos. 49
(Emissions of compression ignition and positive
ignition (LPG and CNG) engines) and 132
(Retrofit Emissions Control devices (REC))****Proposal for amendments to Regulation No. 49 (Compression
ignition and positive ignition (LPG and CNG) engines)****Submitted by the expert from the International Organization of Motor
Vehicle Manufacturers***

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA) to adapt some requirements to the current state of technology and to transpose the latest decisions of the European Union (EU) regarding on-board diagnosis (OBD) threshold limits. The modifications to the current text of Regulation No. 49, Revision 6, are marked in bold for new or strikethrough for deletion. It shall be noted that the largest part of this proposal has already been approved by GRPE in June 2014.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, 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.

I. Proposal

Paragraph 4.10.8., amend to read:

"4.10.8. If the manufacturer chooses, until the date specified in paragraph ~~4.3.2.2.~~ **13.2.3.** for new type approvals, he may use alternative provisions for the monitoring of the Diesel Particulate Filter (DPF) as set out in paragraph 2.3.2.2. of Annex 9A."

Paragraphs 13.2.1. to 13.3.3., amend to read:

"13.2.1. Contracting Parties applying this Regulation shall, from the date of entry into force of the 06 series of amendments to this Regulation, grant an ECE approval to an engine system or vehicle only if it complies with:

- (a) The requirements of paragraph 4.1. of this Regulation;
- (b) The performance monitoring requirements of paragraph 2.3.2.2. of Annex 9A **in the case of compression ignition and dual-fuel engines and vehicles;**
- (c) The NO_x OTL monitoring requirements as set out in the row "phase in period" of ~~the Tables 1 and 2~~ of Annex 9A, **in the case of compression ignition and dual-fuel engines and vehicles;**
- (d) **The NO_x monitoring requirements as set out in the row "phase in period" of Table 2 of Annex 9A, in the case of gas fuelled engines and positive ignition engines ;**
- (e) The Reagent quality ~~and consumption~~ "phase-in" requirements as set out in paragraphs 7.1.1.1. ~~and 8.4.1.1.~~ of Annex 11.

13.2.1.1. In accordance with the requirements of paragraph 6.4.4. of Annex 9A manufacturers are exempted from providing a statement of OBD in-use Performance compliance.

13.2.2. **In the case of positive ignition engines and vehicles**, Contracting Parties applying this Regulation shall, from 1 September 2014, grant a type-approval to an engine system or vehicle only if it complies with:

- (a) The requirements of paragraph 4.1. of this Regulation;
- ~~(b) The PM Mass OTL monitoring requirements as set out in the row "phase in period" of Table 1 of Annex 9A;~~
- ~~(c)~~ **(b)** The NO_x OTL monitoring requirements as set out in the row "phase-in period" of Tables ~~1 and 2~~ of Annex 9A;
- (c) **The CO OTL monitoring requirements as set out in the row "phase-in period" of Table 2 of Annex 9A;**
- (d) The Reagent quality ~~and consumption~~ "phase-in" requirements as set out in paragraphs 7.1.1.1. ~~and 8.4.1.1.~~ of Annex 11.

13.2.2.1. In accordance with the requirements of paragraph 6.4.4. of Annex 9A manufacturers are exempted from providing a statement of OBD in-use Performance compliance.

13.2.3. Contracting Parties applying this Regulation shall, from 31 December 2015, grant a type-approval to an engine system or vehicle only if it complies with:

- (a) The requirements of paragraph 4.1. of this Regulation;
 - (b) The PM Mass OTL monitoring requirements as set out in the row "general requirements" of Table 1 of Annex 9A **in the case of compression ignition and dual-fuel engines and vehicles**;
 - (c) The NOx OTL monitoring requirements as set out in the row "general requirements" of Tables ~~1~~ and 2 of Annex 9A **in the case of compression ignition and dual-fuel engines and vehicles**;
 - (d) **The NOx and CO OTL monitoring requirements as set out in the row "general requirements" of Table 2 of Annex 9A in the case of positive ignition engines and vehicles**;
 - ~~(d)~~ (e) The Reagent quality ~~and consumption~~ "general" requirements as set out in paragraphs 7.1.1.1. ~~and 8.4.1.~~ of Annex 11.
 - ~~(e)~~ (f) 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;
 - ~~(f)~~ (g) The requirements of paragraph 6.4.1. of Annex 9A for providing a statement of OBD in-use Performance compliance.
- 13.3. Limit of validity of type approvals
- 13.3.1. As from the 1 January 2014, type approvals granted to this Regulation as amended by the 05 series of amendments shall cease to be valid.
- 13.3.2. As from 1 September 2015, **in the case of positive ignition engines and vehicles**, type approvals granted to this Regulation as amended by the 06 series of amendments, which do not comply with the requirements of paragraph 13.2.2., 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 ~~13.2.2~~ **13.2.3.**, shall cease to be valid."

Insert a new paragraph 13.3.4., to read:

- "13.3.4. Type approvals granted to compression ignition and dual-fuel engines and vehicles which comply with the requirements of this Regulation and however have a Character B after the approval number specified in Annex 3 to this Regulation, shall remain valid until the date considered in paragraph 13.3.3."**

Annex 1, Part 1, in the table, delete paragraph 3.2.12.2.8.6.

Annex 3, Table 1, including reference notes, replace 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>CO OTL⁶</i>	<i>IUPR¹³</i>	<i>Reagent quality</i>	<i>Additional OBD monitors¹²</i>	<i>Implementation dates: new types</i>	<i>Date when type approval cease to be valid</i>
A	Row "phase-in period" of Tables 1 and 2 of Annex 9A	Performance monitoring ³	N/A	Phase-in ⁷	Phase in ⁴	N/A	Date of entry into force of 06 series of R49	31 August 2015 ⁹ 31 December 2016 ¹⁰
B ¹¹	Row "phase-in period" of Tables 1 and 2 of Annex 9A	N/A	Row "phase-in period" of Table 2 of Annex 9A	Phase-in ⁷	Phase in ⁴	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	Row "general requirements" of Table 2 of Annex 9A	General ⁸	General ⁵	Yes	31 December 2015	

Notes:

¹ "NO_x OTL" monitoring requirements as set out in Table 1 of Annex 9A for compression ignition and dual-fuel engines and vehicles and in Table 2 of Annex 9A for positive ignition engines and vehicles.

² "PM OTL" monitoring requirements as set out in Table 1 of Annex 9A for compression ignition and dual-fuel engines and vehicles.

³ "Performance monitoring" requirements as set out in paragraph 2.3.2.2. of Annex 9A.

⁴ Reagent quality "phase-in" requirements as set out in paragraph 7.1.1.1. of Annex 11.

⁵ Reagent quality "general" requirements as set out in paragraph 7.1.1. of Annex 11.

⁶ "CO OTL" monitoring requirements as set out in Table 2 of Annex 9A for positive ignition engines and vehicles.
⁷ excluding the statement required by paragraph 6.4.1. of Annex 9A.

⁸ including the statement required by paragraph 6.4.1. of Annex 9A.

⁹ For positive-ignition engines and vehicles.

¹⁰ For compression-ignition and dual-fuel engines and vehicles.

¹¹ Only applicable to positive-ignition engines and vehicles.

¹² "Additional provisions concerning monitoring requirements" as set out in paragraph 2.3.1.2. of Annex 9A.

¹³ IUPR specifications are set out in Annexes 9A and 9C of this Regulation. PI engines are not subjected to IUPR."

Annex 9A

Paragraph 2.2., amend to read:

"2.2. ~~Reserved.~~ **Requirements regarding operating sequences and driving cycles for hybrid vehicles and vehicles with stop-start systems."**

Insert new paragraphs 2.2.1. to 2.2.2.3., to read:

"2.2.1. **Operating sequence**

2.2.1.1. **For vehicles that employ engine shut-off strategies that are commanded by the engine control system (for example hybrid bus with engine shut-off at idle) and that are followed by an engine cranking, the (engine shut-off – engine cranking) sequence shall be considered as part of the existing operating sequence.**

2.2.1.2. **The manufacturer shall provide the description of such strategies in the documentation considered in paragraphs 3.1.3. (a) and 3.1.3. (b) of this Regulation.**

2.2.1.3. **In the case of a hybrid vehicle, the operating sequence shall start at the time of the engine start or at the time when the vehicle starts moving, whichever occurs first.**

2.2.2. **Driving cycle**

2.2.2.1. **For vehicles that employ engine shut-off strategies that are commanded by the engine control system (for example hybrid bus with engine shut-off at idle) and that are followed by an engine cranking, the (engine shut-off – engine cranking) sequence shall be considered as part of the existing driving cycle.**

2.2.2.2. **The manufacturer shall provide the description of such strategies in the documentation considered in paragraphs 3.1.3. (a) and 3.1.3. (b) of this Regulation.**

2.2.2.3. **In the case of a hybrid vehicle, the driving cycle shall start at the time of the engine start or at the time when the vehicle starts moving, whichever occurs first."**

Paragraph 2.3.2.2., amend to read:

"2.3.2.2. In the case of a wall flow diesel particulate filter (DPF), **until the date specified in paragraph 13.2.3. of this Regulation for new type approvals and paragraph 13.3.3. for new registrations**, the manufacturer may choose to apply the performance monitoring requirements set out in Appendix 8 to Annex 9B instead of the requirements of paragraph 2.3.2.1., if he can demonstrate with technical documentation that in case of deterioration there is a positive correlation between the loss of filtration efficiency and the loss of pressure drop ("delta pressure") across the DPF under the operating conditions of the engine specified in the test described in Appendix 8 to Annex 9B."

Paragraph 2.4.1., including footnote, amend to read:

"2.4.1. ~~Reserved~~[†] **If requested by the manufacturer, for vehicles of categories M₂ and N₁, for vehicles of categories M₁ and N₂ with a technically permissible maximum laden mass not exceeding 7.5 tonnes, and for vehicles of category M₃ Class I, Class II and Class A and B¹ with a permissible mass not exceeding 7.5 tonnes, compliance with the**

requirements of Annex 11 to the 07 series of amendments to Regulation No. 83 shall be considered equivalent to the compliance with this Annex, according to the following equivalences:

¹ This paragraph has been reserved for future alternative approvals (e.g. transposition of Euro VI into Regulation No. 83). As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2. - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

Insert new paragraphs 2.4.1.1. to 2.4.1.3.2.2., to read:

- 2.4.1.1.** The OBD standard "Interim OBD threshold limits" in Table A11/3 of Annex 11 to the 07 series of amendments to Regulation No. 83 shall be considered as equivalent to the character A of the Table 1 of Annex 3 to this Regulation.
- 2.4.1.2.** The OBD standard "Preliminary OBD threshold limits" in Table A11/2 of Annex 11 to the 07 series of amendments to Regulation No. 83 shall be considered as equivalent to the character B of the Table 1 of Annex 3 to this Regulation.
- 2.4.1.3.** The OBD standard "Final OBD threshold limits" in Table A11/1 of Annex 11 to the 07 series of amendments to Regulation No. 83 shall be considered as equivalent to the character C of the Table 1 of Annex 3 to this Regulation.
- 2.4.1.3.1.** If such alternative approval is used, the information related to OBD systems in paragraph 3.2.12.2.7. of Part 2 of Annex 1 is replaced by the information of paragraph 3.2.12.2.7. of Annex 1 to the 07 series of amendments to Regulation No. 83.
- 2.4.1.3.2.** The equivalences set out in paragraph 2.4.1. shall apply in the following manner:
 - 2.4.1.3.2.1.** The OTL's and dates referred to in Table 1 of Annex 3 to this Regulation and relevant to the assigned character for which the type-approval is sought shall apply;
 - 2.4.1.3.2.2.** The requirements on NOx control measures described in paragraphs 2.1.2.2.1. to 2.1.2.2.4. of Annex 11 shall apply."

Table 2, amend to read:

"Table 2

OTLs (all positive ignition engines fitted to vehicles belonging to category M₃, to N₂ vehicles having a maximum permissible mass exceeding 7.5 tonnes, and to N₃ vehicles)

	Limit in mg/kWh	
	NO _x	CO ^t
Phase-in period	1 500	7 500 ^t
General requirements	1 200	7 500

¹ The OTL for CO shall be set at a later stage. Mandatory as from the dates specified in paragraphs 13.2.2. and 13.3.2. of this Regulation, as appropriate."

Annex 9B

Paragraph 3.5., amend to read:

- "3.5. *"Continuous-MI"* means the malfunction indicator showing a steady indication ~~at all times while the key is in the on (run) position with the engine running~~ **from the time the key is moved to on (run) position and the engine is started (ignition on – engine on) or the vehicle starts moving, whichever occurs first, and extinguishing when the key is moved to off."**

Paragraph 3.22., amend to read:

- "3.22. *"Short-MI"* means the malfunction indicator showing a **15 seconds** steady indication from the time the key is moved to on (run) position and the engine is started (ignition on - engine on) **or the vehicle starts moving**, and extinguishing **either** after **these** 15 seconds or **when** the key is moved to off, whichever occurs first."

Paragraph 4.6.4., amend to read:

- "4.6.4. MI activation at key-on/engine-off

The MI activation at key-on/engine-off shall consist of two sequences separated by a 5 seconds MI off:

- (a) The first sequence is designed to provide an indication of the MI functionality and the readiness of the monitored components;
- (b) The second sequence is designed to provide an indication of the presence of a malfunction.

The first sequence starts from the first time the system is at key-on position and stops either at its normal completion or when the key is set to the key-off position, whichever occurs first.

The second sequence is repeated until **either the engine is started¹ (engine-on), the vehicle starts moving**, or the key is set to the key-off position, **whichever occurs first.**

~~At the request of the manufacturer, this activation may only occur once during an operating sequence (for example in case of start stop systems).~~

¹ An engine may be considered started during the cranking phase."

Paragraphs 4.6.5.1.1. and 4.6.5.1.2., amend to read:

- "4.6.5.1.1. Continuous-MI counter

The OBD system shall contain a continuous-MI counter to record the number of hours during which the **internal combustion** engine has been operated while a continuous-MI is activated. ... "

- "4.6.5.1.2. Cumulative continuous-MI counter

The OBD system shall contain a cumulative continuous-MI counter to record the cumulative number of hours during which the **internal combustion** engine has been operated over its life while a continuous-MI is activated. ... "

Paragraph 4.6.5.2.1., amend to read:

"4.6.5.2.1. Single B1-counter

The OBD system shall contain a B1 counter to record the number of hours during which the **internal combustion** engine has operated while a Class B1 malfunction is present. ..."

Annex 9C

Paragraph 5.5., amend to read:

"5.5. Requirements for incrementing the ignition cycle counter

The ignition cycle counter shall be incremented once and only once per ~~engine start~~ **driving cycle.**"

Annex 11

Paragraph 2.1.1., including footnote, amend to read:

"2.1.1. ~~Reserved~~¹. **If requested by the manufacturer, for vehicles of categories M₂ and N₁, for vehicles of categories M₁ and N₂ with a technically permissible maximum laden mass not exceeding 7.5 tonnes, and for vehicles of category M₃ Class I, Class II and Class A and Class B¹ with a permissible mass not exceeding 7.5 tonnes, compliance with the requirements of Annex 6 to the 07 series of amendments to Regulation No. 83 shall be considered equivalent to the compliance with this annex.**

¹ This paragraph has been reserved for future alternative approvals (e.g. transposition of Euro VI into Regulation No. 83). As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2. - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html"

Insert new paragraphs 2.1.2. to 2.1.2.2.5., to read:

"2.1.2. **If the alternative approval is used:**

2.1.2.1. **The information related to the correct operation of NOx control measures in paragraphs 3.2.12.2.8.1. to 3.2.12.2.8.5. of Part 2 of Annex 1 to this Regulation is replaced by the information of paragraph 3.2.12.2.8. of Annex 1 to the 07 series of amendments to Regulation No. 83.**

2.1.2.2. **The following exceptions shall apply regarding the application of the requirements set out in Appendix 6 to the 07 series of amendments to Regulation No. 83 and those of this Annex:**

2.1.2.2.1. **The provisions on reagent quality monitoring set out in paragraphs 7.1. to 7.1.2. of this Annex shall apply, instead of paragraphs 4.1. and 4.2. of Appendix 6 to the 07 series of amendments to Regulation No. 83.**

2.1.2.2.2. **The provisions on dosing activity monitoring set out in paragraph 8.4. of this Annex shall apply, instead of paragraph 5. of Appendix 6 to the 07 series of amendments to Regulation No. 83.**

2.1.2.2.3. **The driver warning system referred to in paragraph 4., 7. and 8. of this Annex shall be understood as the driver warning system in paragraph 3. of Appendix 6 to the 07 series of amendments to Regulation No. 83.**

2.1.2.2.4. **Paragraph 6 of Appendix 6 to the 07 series of amendments to Regulation No. 83 shall not apply.**

2.1.2.2.5. The provisions set out in paragraph 5.2. of this Annex shall apply in the case of vehicles for use by the rescue services or to vehicles designed and constructed for use by the armed services, civil defence, fire services and forces responsible for maintaining public order."

Paragraphs 7.1.1. to 7.1.1.2., amend to read:

"7.1.1. The manufacturer shall specify ~~a minimum acceptable reagent concentration CD_{min} , which a value CD_{min} , which is greater than the highest reagent concentration~~ **that** results in tailpipe emissions ~~not~~ exceeding the limit values specified in paragraph 5.3. of this Regulation.

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 7.1.1. 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.

7.1.1.2. The ~~correct~~ value of CD_{min} shall be demonstrated during type approval by the procedure defined in Appendix 6 to this annex and recorded in the extended documentation package as specified in paragraph 5.1.4. to this Regulation."

Paragraphs 8.3.2., amend to read:

"8.3.2. In order to monitor reagent consumption, at least one of the following parameters within the vehicle or engine shall be monitored:

- (a) The level of reagent in the on-vehicle storage tank;
- (b) The flow of reagent or quantity of reagent injected at a position as close as technically possible to the point of injection into an exhaust after-treatment system;
- (c) **The NO_x level in the exhaust stream."**

Paragraph 8.4.1., amend to read:

"8.4.1. The driver warning system described in paragraph 4. shall be activated if a deviation of more than ~~20~~ **fifty** per cent between the average reagent consumption and the average demanded reagent consumption by the engine system over a period to be defined by the manufacturer, which shall not be longer than the maximum period defined in paragraph 8.3.1., is detected. When the warning system includes a message display system, it shall display a message indicating the reason for the warning (for example: "urea dosing malfunction", "AdBlue dosing malfunction", or "reagent dosing malfunction")."

Paragraph 8.4.1.1. shall be deleted.

Appendix 2, paragraph A.2.4.1.1., amend to read:

"A.2.4.1.1. To comply with the requirements of this annex, the system shall contain ~~at least 5~~ **separate** counters to record the number of hours during which the engine has been operated while the system has detected any of the following:
...."

Annex 15

Paragraph 4.2.2., amend to read:

"4.2.2. The operability restriction applicable to dual-fuel vehicles when they operate in service mode is the one activated by the "*severe inducement system*"

specified in Annex 11 or, in the special case described in paragraph 4.2.2.3., the power limitation described in that section."

Insert new paragraphs 4.2.2.2. to 4.2.2.3.3., to read:

"4.2.2.2. De-activation of the operability restriction

In case of an empty gas tank, the operability restriction in dual-fuel mode due to a lack of gaseous fuel, shall be de-activated as soon as the gas tank is refilled above the critical level.

4.2.2.3. Repair and maintenance of LNG Type A dual-fuel engines and vehicles.

In the case of LNG Type A dual-fuel engines and vehicles, the manufacturer may, instead of limiting the vehicle speed at 20 km/h, opt for limiting the power of the engine to 20 per cent of the declared maximum power in dual-fuel mode, and this at any engine speed, when the service mode is activated during a repair or maintenance operation.

4.2.2.3.1. The power limitation scheme may only be activated if the system concludes to an empty gas tank not later than 5 minutes after engine cranking, the engine being at idle.

4.2.2.3.2. The power limitation scheme shall not be activated when the system concludes that the gas tank is empty from a previous driving cycle and the gas tank has not been refilled.

4.2.2.3.3. The manufacturer shall demonstrate at type-approval that the power limitation scheme can only be activated during a repair or maintenance operation."

II. Justification

1. The proposed amendments aim at transposing into Regulation No. 49 (Revision 6) the provisions regarding OBD threshold limits (OTLs) that are specified in Regulation (EU) 133/2014 and not yet included in Regulation No. 49 and the decision of the European Commission on the date of introduction of the Particulate Matter (PM) OTLs.

2. The proposed amendments aim at introducing into Annexes 9A and 9B of Regulation No. 49 (Revision 6) the OBD provisions necessary for the type-approval of stop-start and hybrid vehicles.

3. The proposed amendments aim at adapting to the current state of technology the requirements regarding NO_x control. In particular, it proposed to amend the requirements related to the monitoring of the reagent consumed from the reagent tank

4. During some repair operations of LNG vehicles, it is necessary to drain out all the gas contained in the tank system. Due to the very poor density of LNG filling stations in some areas, the current requirements forces a Type A dual-fuel vehicle that has no diesel mode to be driven at 20 km/h during hours and accordingly generate traffic issues. The proposal is to introduce in that specific case an alternative requirement that would limit the available power so that the vehicle could not operate commercially, while it would be able to drive at an acceptable speed.

5. The amendments related to the above mentioned points 1, 2, and 4 have already been agreed by GRPE in June 2014.

6. In that session, a complete deletion of the urea consumption monitoring was agreed based on the fact of the general existence of close-loop systems in Heavy-Duty engines and

vehicles. In the meantime, it appeared that some Light Commercial vehicles were not equipped with such system, thereby creating a possible loop-hole in the Regulation. On the basis of the currently available sensor technology and of the effective inducement observed in the field by enforcing the stage A measures on reagent consumption, the present document proposes to keep at stage C the fifty per cent threshold value required for stage A and to permit the monitoring of the reagent consumption by sensing the NO_x level in the exhaust.
