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PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 115

(Specific LPG and CNG retrofit systems)

Transmitted by the expert from the European LPG Association (AEGPL)

Note: The document reproduced below has been prepared by the expert from AEGPL in order to adapt some of the aspects of the existing text of Regulation No. 115 to make its implementation applicable to the characteristics of the existing vehicles and equipment. It is based on TRANS/WP.29/GRPE/2004/12 and includes the comments expressed by some experts during the forty-eighth GRPE session. The main improvements of this new AEGPL proposal are:
- complete deletion of provisions related to self-testing process;
- clarification of characteristics and requirements regarding "master-slave" and "non-intrusive" concepts;
- improvement of the part dedicated to OBD test and requirements;
- clear definition of respective role and responsibility of system manufacturer and installer.

The modifications to the current text of the Regulation are marked in **bold** characters.

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Paragraphs 1.4. and 1.5., amend to read:

"1.4.   This Regulation applies to retrofit systems intended to be fitted on vehicles of categories M and N, **with the exception of:**
  a) **vehicles type-approved pursuant to Regulation No. 83, approval A and C,**
  b) **vehicles type-approved pursuant to Regulation No. 83, others than M1 and N1 categories,**
  c) **vehicles type-approved pursuant to Regulation No. 83, series of amendments 01 or 02 or 03 or 04 series,**
  d) **vehicles type-approved pursuant to Regulation No. 49, series of amendments 01 or 02 or 03 series.**

The requirements for the different categories (M_1, N_1 or others) are defined in paragraphs 2. to 7. **1/** "

Insert a new footnote 1/, to read:

"**1/   Regarding safety requirements, it is recommended that the minimum requirements of Regulation No. 67, 01 series of amendments and Regulation No. 110 shall apply to all retrofitted vehicles.**"

Paragraph 1.5., should be deleted (including the footnotes 1/ and 2/).

Paragraphs 2.1.1. and 2.1.2., correct the words "installation instructions manual" to read "instruction manuals".

Paragraph 2.1.3., amend to read:

"2.1.3.   "A vehicle is considered mono-fuel", when, **after the retrofit operation**, it is equipped with a petrol tank of capacity ≤ 15 litres, that can only be used to "limp-home"."

Insert new paragraphs 2.1.4., 2.1.5. and 2.1.6., to read:

"**2.1.4.   "A vehicle is considered bi-fuel", when after the retrofit, it is equipped to operate on both petrol and LPG, with a petrol tank capacity exceeding 15 litres.**

2.1.5.   "Non intrusive system" means a retrofit system in which the LPG fuelling system does not change the original air and petrol feed system to the engine.

2.1.6.   "Master-slave system" means a retrofit system in which the LPG ECU is able to translate the petrol ECU control strategy in LPG operation."

Paragraph 2.2.3., amend to read (deletion of the points "…" at the end of the sentence):

"2.2.3.   gas fuelling system type by …… or multi-point injection **system);**"

Paragraph 2.2.4., amend to read:

"2.2.4.   sensors and actuators set types ~~from the same manufacturer~~;"

Paragraph 2.2.5., amend to read:

"2.2.5.   **the fuel container type (i.e. liquid take off/ vapour pressure, vapour take off, liquid take off / pressurized by pump), the** safety device**s** ~~type by the same manufacturer~~ **and fuel container accessories,** as required by Regulation No. 67, 01 series of amendments, or Regulation No. 110, where applicable (i.e. relief valve, …);"

Paragraphs 2.2.6. and 2.2.7., should be deleted.

Paragraphs 2.2.8. and 2.2.9., renumber as paragraphs 2.2.6. and 2.2.7.

At the bottom of the page, in the note, amend the reference to "paragraphs 2.2.5., 2.2.6., 2.2.7. and 2.2.8.," to read "paragraphs 2.2.4., 2.2.5. and 2.2.6.,".

Paragraph 2.2.10., renumber as paragraph 2.2.8. and amend to read:

"2.2.8.   basic software principles and ~~system~~ **control** strategy;"

Paragraph 2.2.11., renumber as paragraph 2.2.9.

Paragraph 2.2.12., renumber as paragraph 2.2.10 and amend to read:

"2.2.10.   end-user manual (see para. 7)."

Paragraph 2.3., amend to read:

"2.3.   "**System manufacturer**" means an organization which can assume technical responsibility for the manufacturing of LPG and CNG retrofit systems and can demonstrate that it possesses the features required and the necessary means to achieve quality assessment and conformity of production **of the retrofit system**."

Insert a new paragraph 2.4., to read:

"**2.4.   "Installer" means an organisation which can assume technical responsibility for the correct and safe installation of the approved LPG and CNG retrofit system, in conformity with respectively paragraphs 6.1.1.3. and 6.2.1.3. of this Regulation 2/.** "

Insert a new footnote 2/, to read:

"**2/   In the bounds of the legislative power of the Contracting Party, as stated in paragraph 1.3. of this Regulation, in order to ensure a proper qualification of the installer, it is recommended to require valid certificates, issued by the system manufacturer and/or by**

skilled organizations, attesting the personnel's necessary expertise and the workshop's suitability to carry out retrofit system's installation."

Paragraphs 2.4. to 2.4.1.(former), renumber as paragraphs 2.5. to 2.5.1.

Paragraphs 2.4.1.1.(former), renumber as paragraph 2.5.1.1. and amended to read:

"2.5.1.1.   a) It is produced by the same vehicle manufacturer.
             b) It is classified in the same category M_1 or M_2 or M_3 or N_1 or N_2 or N_3. Vehicles of category **M_1 and** N_1 **class I** may belong to the same family ~~of category M_1 (parent vehicle)~~.
             c) It is subject to the same emission limits **or those specified in earlier series of amendments of the applicable Regulation.**
             d) If the gas fuelling system has a central metering for the whole engine: it has **an approved** power output between 0.7 and 1.15 times that of the engine of the parent vehicle. If the gas fuelling system as an individual metering per cylinder: it has **an appoved** power output per cylinder between 0.7 and 1.15 times that of the engine of the parent vehicle.
             e) Fuel feed and combustion process (injection: direct or indirect, single-point or multi-**point).**
             f) It has the same pollution control system:
                - same type of catalyst if fitted (three-way, oxidation, de **NO_x)**
                - air injection (with or without)
                - exhaust gas recirculation (EGR) (with or without)
                If the tested vehicle was not equipped with air-injection or EGR, engines with these devices are allowed."

Paragraph 2.4.1.2. (former), renumber as paragraph 2.5.1.2 and amend to read:

"2.**5**.1.2.   **With regard to the requirement of paragraph 2.5.1.1.(a), the vehicle family can also cover vehicles produced by other vehicle manufacturers if it can be demonstrated to the type approval authority that the same engine type and emission strategy is used.**"

Paragraph 2.4.1.3.(former), renumber as paragraph 2.5.1.3 and amend to read:

"2.**5**.1.3.   With regard to requirement **of paragraph 2.5.1.1.(d):**

             - **in the case of a central metering for the whole vehicle where a demonstration shows two gas fuelled vehicles could be members of the same family with the exception of their approved power output, respectively P1 and P2 (P1 < P2), and both are tested as if they were parent vehicles, the family relation will be considered valid for any vehicle with an approved power output between 0.7*P1 and 1.15*P2;**

             - **in the case of an individual metering per cylinder where a demonstration shows two gas fuelled vehicles could be members of the same family with the**

exception of their approved power output, respectively P1 and P2 (P1 < P2), and both are tested as if they were parent vehicles, the family relation will be considered valid for any vehicle with an approved power output between 0.7∗P1 and 1.15∗P2."

Insert a new paragraph 2.5.1.4., to read:

"2.5.1.4. **With regard to the requirement of paragraph 2.5.1.1.(f) in case of a "master-slave" system, as defined in paragraph 2.1.6., the family relation will be considered valid regardless the presence of the air injection or the EGR."**

Paragraphs 2.5. and 2.6. (former), renumber as paragraphs 2.6. and 2.7.

Insert new paragraphs 3.2.5. and 3.2.6., to read:

"3.2.5. **If needed for the purpose of paragraph 5.2., notice of approval of the retrofit system for a parent vehicle which is different from those the approval is applied for, certifying that the retrofit system has been approved as a "non intrusive" system, as defined in paragraph 2.1.5.**

3.2.6. **If needed for the purpose of paragraph 5.3., notice of approval of the retrofit system for a parent vehicle which is different from those the approval is applied for, certifying that the retrofit system has been approved as a "master-slave" system, as defined in paragraph 2.1.6."**

Paragraphs 3.3. to 3.5., amend to read:

"3.3. **Part I of the** installation manual for the retrofit system installation on **vehicle(s).**

3.4. End-user ~~service~~ manual.

3.5. A sample of the specific retrofit **system**, properly installed in the parent vehicle(s)."

Insert new paragraphs 5.2. and 5.3., amend to read:

"5.2. **Retrofit systems, which have been already approved as "non intrusive" systems on at least one parent vehicle, do not need to comply with paragraph 6.1.2.2. of this Regulation.**

5.3. **Retrofit systems, which have been already approved as "master-slave" systems on at least one parent vehicle, do not need to comply with paragraph 6.1.4.4.2.1. of this Regulation."**

Paragraphs 5.2. to 5.6. (former), renumber as paragraphs 5.4. to 5.8.

Paragraph 6.1.1.1., amend to read:

"6.1.1.1.   An LPG retrofit system shall **consist** at least **of** the following components:"

Paragraph 6.1.1.1.3., amend to read:

"6.1.1.1.3.   End-user ~~service~~ manual."

Paragraph 6.1.2. and 6.1.2.1., amend to read:

"6.1.2.   **Pollutants** emissions and CO_2 emissions (for category M_1 **and N1** vehicles only)

6.1.2.1.   One LPG retrofit system sample, as described in paragraph 2. of this Regulation, installed into the parent vehicle(s), as described in paragraph 2. of this Regulation, shall be submitted to the test procedures described in Regulations No. 83 4/ and No. 101, or No. 49 5/, where applicable, **in the limits of the requirements of paragraphs 6.1.2.5. and 6.1.2.6.** The vehicles and/or the engines are also submitted to a maximum power comparison test, as described in Regulation No. 85 for engines, or defined in paragraph 6.1.3. below for vehicles."

Insert a new paragraph 6.1.2.2., to read:

"**6.1.2.2.   In order to prove that the retrofit system is "non intrusive", as defined in paragraph 2.1.5., the system manufacturer shall provide data and/or engineering evaluations which adequately demonstrate that the original air and petrol feed system to the engine is not affected by the installation of the retrofit system.**"

Paragraphs 6.1.2.2. and 6.1.2.3. (former), renumber as paragraphs 6.1.2.3. and 6.1.2.4. and amend to read:

"6.1.2.**3**.   Fuel requirements by the engine: the type of fuel normally used by the engine could be:

(a) LPG only
(b) both unleaded petrol or LPG
(c) both diesel fuel or diesel fuel and LPG.

6.1.2.**4**.   "Gaseous pollutants" means:

(i) carbon monoxide

4/   According to Regulation No. 83, the series of amendments in force during the initial type approval of the engine.
5/   According to Regulation No. 49, the series of amendments in force during the initial type approval of the engine.

(ii) hydrocarbons assuming a ratio:
$CH_{1,85}$ for petrol,
$CH_{1,86}$ for diesel fuel,
$CH_{2,52}$ for LPG,
CH (to be defined) for dual fuel;

(iii) oxides of nitrogen, the latter being expressed in nitrogen dioxide (NO_2) equivalent.

(iv) particulates, etc."

Paragraph 6.1.2.4. (former), renumber as paragraphs 6.1.2.5. to 6.1.2.5.3.5. and amend to read:

"6.1.2.**5**. **Exhaust emissions and CO₂ emissions (M₁ and N₁ category of vehicles)**:

6.1.2.5.1. **Specific requirements on the Type I test (verifying the average exhaust emissions after a cold start) as defined in Regulation No. 83, 05 series of amendments (for vehicles having the maximum mass not exceeding 3,500 kg):**

6.1.2.5.1.1. **Three** measurements of tailpipe emissions **shall be performed** after a cold start with each fuel:

(i) reference petrol,
(ii) reference LPG A,
(iii) reference LPG B.

The emissions of CO, HC, NO_x and HC + NO_x are calculated according Regulation No. 83. 4/.

6.1.2.5.1.2. The test vehicle(s) **equipped with the retrofit system, and** with the reference petrol, shall comply with the limit values according to the type approval of the vehicle(s) including the deterioration factors applied during the type approval of the vehicle(s).

This condition is deemed to be met if the emissions values for each pollutant or combination of pollutants obtained in each test with reference petrol are less than the limits.

However, one of the three test values obtained may exceed, by not more than 10 per cent, the limit prescribed, provided that the arithmetical mean of the three values is below this limit.

Where the prescribed limits are exceeded for more than one pollutant or combination of pollutants, it is immaterial whether this occurs in the same test or different tests.

6.1.2.5.1.3. The requirements regarding emissions of the vehicle(s) equipped with the retrofit system, and with the two reference gases, shall be deemed to be fulfilled if the results

meet **the following conditions for each regulated pollutant (CO, HC + NO$_x$) or (CO, HC, NO$_x$) according to the requirements the petrol parent vehicle had to comply with at the date of its approval**:

(1) $(MA + MB)/2 < 0.85S + 0.4G$

(2) MA and MB < G

where:

MA: mean value of the emissions of one pollutant (CO/HC/NO$_x$) 4/ or the sum of two pollutants (HC + NO$_x$) obtained from the three Type I tests with the retrofit system and with LPG A,

MB: mean value of the emissions of one pollutant (CO/HC/NO$_x$) 4/ of the sum of two pollutants (HC + NO$_x$) obtained from the three Type I tests with the retrofit system and with LPG B,

S: mean value of the emissions of one pollutant (CO/HC/NO$_x$) 4/ or the sum of two pollutants (HC + NO$_x$) obtained from the three Type I tests with the reference petrol,

G: limit value of the emissions of one pollutant (CO/HC/NO$_x$) 4/ or the sum of two pollutants (HC + NO$_x$) according to the type approval of the vehicle(s) divided by the detoriation factors.

6.1.2.5.1.4. **Notwithstanding the provisions of paragraphs 6.1.2.5.1.1. to 6.1.2.5.1.3., for non intrusive retrofit system as defined in paragraph 2.1.5., the Type I test shall be carried out only with LPG.**

6.1.2.5.1.4.1. **Subject to the requirements of paragraph 6.1.2.5.1.4.2. the tests shall be repeated three times.**

The test vehicle(s) with each reference LPG shall comply with the limits values according to the type approval of the vehicle(s) including the deterioration factors applied during the type approval of the vehicle(s).

6.1.2.5.1.4.2. **The number of emission tests to be performed on one LPG reference fuel can be reduced in the conditions hereinafter defined:**

- **only one test is performed if the result obtained for each pollutant or for the combined emission of two pollutants subject to limitation is less than or equal to 0.7 the emission limit (i.e. M1 ≤ 0.70 G);**

- **only two tests are performed if, for each pollutant or for the combined emission of two pollutants subject to limitation the following requirements are met:**

M1 ≤ O.85 G and M1 + M2 ≤ 1.70 G and M2 ≤ G

where:

M1: value of the emission of one pollutant obtained from the first test of the Type I performed;

M2: value of the emission of one pollutant obtained from the second test of the Type I performed;

G: limit value of the emissions of one pollutant (CO/HC/NO$_x$) or the sum of two pollutants (HC + NO$_x$) according to the type approval of the vehicle(s) divided by the deterioration factors.

6.1.2.5.1.5. Notwithstanding the provisions of paragraph 6.1.2.5.1.1., at the request of the system manufacturer, the Type I test on the LPG mode can be performed on only one LPG reference fuel, the choice of which is left at the discretion of the technical service responsible for the test.

6.1.2.5.1.5.1. The requirements regarding emissions of the vehicle equipped with the retrofit system as described in paragraph 6.1.2.5.1.3. will be deemed to be met if:

(a) $M < G$

(b) $M < 0.85\ S + 0.4\ G$

where M is the mean value of the emissions of one pollutant (CO/HC/NOx) or the sum of two pollutants (HC + NOx) obtained from the three Type I tests with the LPG reference fuel chosen for the tests.

6.1.2.5.1.5.2. In the case of non intrusive retrofit system, the requirements of paragraph 6.1.2.5.1.4. shall be calculated with the value of the emission of one pollutant (CO/HC/NOx) or the sum of two pollutants (HC + NOx) obtained from the Type I test with the LPG reference fuel chosen for the tests.

6.1.2.5.2. Specific requirements on the Type II test (carbon monoxide emission test at idling speed) for vehicles having a maximum mass exceeding 3,500 kg:

6.1.2.5.2.1. One LPG retrofit system sample, as described in paragraph 2. of this Regulation, installed into the parent vehicle, as described in paragraph 2. of this Regulation, shall be submitted to the Type II test procedures described in Regulation No. 83.

6.1.2.5.2.2. Notwithstanding the provisions of Annex 5 of Regulation No. 83, 05 series of amendments, the Type II test shall be performed at the request of the system manufacturer with only one LPG reference fuel chosen at the discretion of the type-approval technical service responsible for the test.

6.1.2.5.3. Calculation of the CO$_2$ emissions and fuel consumption (for M1 and N1 category of vehicles)

6.1.2.5.3.1. The emissions of CO$_2$ are calculated according to Regulation No. 101 for each parent vehicle, if applicable.

The mean of CO_2 emissions shall be calculated as follows:

$$CO_{2LPG} = 1/n \sum_{i=1}^{n} (CO_{2Ai} + CO_{2Bi})/2$$

$$CO_{2petrol} = 1/n \sum_{i=1}^{n} CO_{2petrol.i}$$

where:

i:	number of parent vehicles (i = 1 to n)
CO_{2Ai}:	mean value of the emissions of CO_2 obtained from the three Type I tests with the retrofit system and with LPG A for vehicle No. i,
CO_{2Bi}:	mean value of the emissions of CO_2 obtained from the three Type I tests with the retrofit system and with LPG B for vehicle No. i;
$CO_{2petrol.i}$:	mean value of the emissions of CO_2 obtained from the three Type I tests with reference petrol for vehicle No. i.

6.1.2.5.3.2. **The mean fuel consumption shall be calculated in the same way as for the mean of CO_2 emissions, as defined in paragraph 6.1.2.5.3.1.**

6.1.2.5.3.3. The ratios of CO_2 emissions and fuel consumption shall be calculated as follows:

$$K_{CO2} = CO_{2LPG} / CO_{2petrol}$$

$$K_{Cons} = Cons_{LPG} / Cons_{petrol}$$

for each vehicle of the family, the official values of CO_2 emissions and fuel consumption are multiplied by the above ratios.

6.1.2.5.3.4. **Notwithstanding the provisions of paragraph 6.1.2.5.3.1. above, when the vehicle(s) equipped with the retrofit system is (are) tested with only one of the two reference gases, according to the provisions of paragraph 6.1.2.5.1.5., the mean of CO_2 emissions shall be calculated as follows:**

$$CO_{2LPG} = 1/n \, \Sigma^n \, CO_{2LPGi}$$

where:

i:	**number of parent vehicles (i = 1 to n)**
CO_{2LPGi}:	**mean value of the emissions of CO_2 obtained from the Type I test(s) with the retrofit system and with LPG for vehicle No. i.**

6.1.2.5.3.5. **Notwithstanding the provisions of paragraph 6.1.2.5.3.1., for non intrusive system, as defined in paragraph 2.1.5. of this Regulation, the value of the petrol CO_2 emission may be the official CO_2 emission value of the vehicle(s) No. i."**

Paragraph 6.1.2.5. (former), renumber as paragraph 6.1.2.6.

Paragraph 6.1.3.1., amend to read:

"6.1.3.1.   One LPG retrofit system sample as described in paragraph 2 of this Regulation, installed in the parent vehicle(s) or on the parent engine(s) shall be submitted to the test procedures of paragraph 6.1.3.2. or 6.1.3.3. **The measured power with LPG shall be lower than that measured with petrol + 5 per cent**."

Paragraph 6.1.3.2., amend to read:

"6.1.3.2.   Chassis dynamometer method:

The maximum power at the wheels is measured on a chassis dynamometer on each parent vehicle with the following fuels:

i)   reference petrol,
ii) reference LPG A or B,

The mean of power measurements shall be calculated as follows:
…."

Insert a new paragraph 6.1.3.4., to read:

"**6.1.3.4.   Notwithstanding the provisions of paragraph 6.1.3.1., with regard to the way to calculate the mean of maximum power on petrol in paragraphs 6.1.3.2. and 6.1.3.3., for non intrusive system, as defined in paragraph 2.1.5. of this Regulation, the value of maximum power on petrol of the vehicle(s) No. i may be the official value**."

Insert new paragraphs 6.1.4. to 6.1.4.4.2.4., to read:

"**6.1.4.   <u>OBD requirements and tests for vehicles retrofitted with LPG retrofit system</u>**.

6.1.4.1.   For the purposes of this paragraph, the following definitions apply:

6.1.4.1.1.   "original emission-related component" means any component in the air inlet, exhaust or evaporative system which supplies an input to or receives an output from the petrol controller.

6.1.4.1.2.   "LPG emission-related component" means any component in the air inlet exhaust or evaporative system which supplies an input to or receives an output from the LPG controller.

6.1.4.2.   In the case that there is a need, to fit properly the LPG retrofit system in the vehicle, it is allowed to simulate the right operation of the original emission-

related components which are not in use on LPG mode.

6.1.4.3.   **The LPG retrofit system, as described in paragraph 2. of this Regulation, installed into the parent vehicle(s), shall comply with the requirements and tests of Annex 11 of Regulation No. 83, 05 series of amendments on both petrol and LPG modes.**

6.1.4.4.   **Specific OBD requirements and tests for "master-slave" retrofit system:**

6.1.4.4.1   **Notwithstanding the requirements of the paragraph 6.1.4.3., a "Master-slave" retrofit system shall fulfil the following requirements:**

    a)   **The petrol ECU shall remain activated for engine management in both petrol and LPG modes**

    b)   **during petrol operations the petrol OBD system shall remain the only on-board diagnostic system of the vehicle**

    c)   **during LPG operations the petrol OBD system shall continue to monitor original emission related components with the exception of those which are not in use**

    d)   **during LPG operations the LPG ECU shall only monitor for the LPG emission-related components as well as their electrical connections;**

6.1.4.4.2.   **Notwithstanding the requirements of paragraph 6.1.4.3., the LPG retrofit system shall be submitted to the following tests, which, in the case of Type I tests, shall be performed according to Annex 11, Appendix 1, of Regulation No. 83, 05 series of amendments.**

6.1.4.4.2.1.   **The following tests shall be carried out on one parent vehicle, equipped with the LPG retrofit system:**

    -   **the LPG ECU shall follow the petrol ECU on fuel strategies (e.g. injection). This can be demonstrated by a monitoring (diagnostic) program, while modifying the signal of one of the petrol system's sensors with an impact on the injection time;**

    -   **during a Type I test on petrol the original MI shall activate due to the electrical disconnection of any original emission-related component;**

    -   **during a Type I test on LPG the original MI shall activate due to the electrical disconnection of any original emission-related component, which is in use during LPG operations.**

6.1.4.4.2.2.   **The following tests shall be carried out on the parent vehicle(s), equipped with the LPG retrofit system, only on LPG operating mode:**

a) **during a Type I test, electrical disconnection of one LPG emission-related component;**

b) **during a Type I, test replacement of one LPG emission-related component with a deteriorated and defective one or electronic simulation of such a failure.**

The original MI or automatic switch from LPG mode to petrol mode shall activate before the end of the tests under any of the conditions above.

6.1.4.4.2.3. **Fault codes due to malfunctions of the LPG emission-related components and their electrical connections shall be stored in the LPG ECU.**

6.1.4.4.2.4. **The system manufacturer shall provide specific instructions as to read out the LPG fault codes referred to in paragraph 6.1.4.4.2.3.**"

Paragraph 7.1., amend to read:

"7.1. **Installation** manual for the retrofit installation on the vehicle"

Paragraphs 7.1.3.3. to 7.1.3.5., amend to read:

"7.1.3.3. The installation manual is part of the retrofit system and shall therefore be **provided for each** conversion kit.

7.1.3.4. The installation **manual must** be written in the language of the country to which the conversion retrofit will be delivered**, or at least in English**.

7.1.3.5. The installation manual can be divided in two parts:

Part I: (i) Part containing the description of the sample of retrofit installed on the parent vehicle**(s)**, and submitted to the tests and inspections of the Authority that grants the type approval.

(ii) Part containing the list of components indicated by the retrofit manufacturer as alternatives.

Part II: (i) Part containing **specific** installation instructions, for **vehicles belonging to the family of the parent vehicle(s)**."

Paragraphs 7.1.3.6. and 7.1.3.7., amend to read:

"7.1.3.6. Part I of the **installation** manual has to be submitted to the authority that grants the type approval.

7.1.3.7. Part II of the **installation** manual has to be filed by the retrofit system manufacturer

for a time to be determined in accordance with the authority that grants the type approval."

Paragraphs 7.1.4. to 7.1.4.2., amend to read:

"7.1.4.   Contents **of Part I, section (i)** of installation manual

7.1.4.1.   Retrofit system description

7.1.4.1.1.   **Operational principles of the retrofit system**

7.1.4.1.2.   **Operational principles of each component of the retrofit system**"

Paragraphs 7.1.4.1.3. to 7.1.4.2.4., should be deleted.

Paragraphs 7.1.5. to 7.1.9.1. (former), renumber as paragraphs 7.1.4.2. to 7.1.4.6.1.

Insert new paragraphs 7.1.5. and 7.1.5.2.3., to read:

"**7.1.5.   Contents of Part II of installation manual**

7.1.5.1.   Retrofit system identification

7.1.5.1.1.   Retrofit system approval number
7.1.5.1.2.   Vehicle manufacturer
7.1.5.1.3.   Vehicle category
7.1.5.1.4.   Vehicle type
7.1.5.1.5.   Engine type
7.1.5.1.6.   Engine displacement
7.1.5.1.7.   Transmission type
7.1.5.1.8.   Vehicle model
7.1.5.1.9.   Type of conversion retrofit (LPG or CNG)
7.1.5.1.10.   Assembly instruction number
7.1.5.1.11.   General scheme of the retrofit system containing the following information of each component:
        (a) identification number
        (b) manufacturer's code
        (c) type approval, if it exists
        (d) for the containers: capacity/manufacturer/type/date of expiry or replacement date, if it exists
7.1.5.1.12.   Description (including drawings, if applicable) of the fitting devices of the container installation on the vehicle.

7.1.5.2.   Installation instructions

7.1.5.2.1. **Assembly instructions of all components together with diagrams or photographs showing clearly the layout of the single components within the engine compartment.**

7.1.5.2.2. **Diagram or photograph showing the exact position where the installer shall place the retrofit system type approval plate (contained in the conversion kit).**

7.1.5.2.3. **Clear wiring diagram of the electrical system containing the mechanical components to which the wires shall be connected."**

Paragraph 7.2., amend to read:

"7.2. **End-user manual**"

Paragraphs 7.2.4.5. to 7.2.4.7. (former), renumber as paragraphs 7.2.2.5. to 7.2.2.7.

Paragraph 7.2.5. (former), renumber as paragraph 7.2.3. and amend to read:

"7.2.3. Contents of the **end-user manual**"

Paragraphs 7.2.5.1.to 7.2.5.5.7. (former), renumber as paragraphs 7.2.3.1. to 7.2.3.5.7.

Paragraph 8.1., amend to read:

"8.1. Every modification of the installation of the specific equipment for the use of **LPG or CNG** in the propulsion system of the vehicle shall be notified to …."

Annex 1A, (COMMUNICATION)

Item 11.1., amend to read:

"11.1. Emission requirements:
Has the retrofit system demonstrated to be "non intrusive": yes/no 2/
Regulation No. 83, ... series of amendments 3/
Regulation No. 49, ... series of amendments 3/"

Insert a new item 11.2., to read:

"**11.2. OBD requirements:**
Has the retrofit system demonstrated to be "master-slave": yes/no 2/ "

Annex 1A, Addendum,

Item 1., amend to read:

"1. Vehicles on which the retrofit equipment has been tested:

Vehicle No.	1	2	n
Make:			
Type:			
Category:			
Emission limits:			
Power:			
Pollution control system type:			

"

Item 3., amend to read:

"3. Vehicle type(s) for which the retrofit equipment type is qualified:

Fuel		Petrol (or diesel) 1/					LPG				
Vehicle type	Engine type	Power (kW)	**CO (g/km)**	**HC (g/km)**	**NOx g/km)**	CO_2 2/ (g/km)	Power (kW)	**CO (g/km)**	**HC (g/km)**	**NOx (g/km)**	CO_2 2/ (g/km)

1/ strike out what does not apply.
2/ Applicable to category M_1 vehicle only."

Annex 2A, the example of the plate, delete "Date: ……....." from the figure.

Annex 3A,

Insert new items 2.4. and 2.5., to read:

"**2.4.** **"Non intrusive" system: yes/no 1/**
2.5. **"Master-slave" system: yes/no 1/**"

Items 2.4. to 2.20.1. (former), renumber as items 2.6. to 2.22.1.

Annex 4, paragraphs 3.1. and 4.1., amend the references "7.1.5." and "7.1.6." to read "7.1.4.2." and "7.1.4.3.".

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