INFORMAL GROUP ON GASEOUS FUELLED VEHICLES
Within the UN GRPE (WP29)
PROPOSED AMENDMENT

Name of Organisation submitting Amendment/Work Item
Expert from Poland to GRPE

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Regulation name and reference number
Regulation 115

Name of Amendment/Work Item
Proposal for corrections to Draft Amendment to Regulation 115

Specific language for Amendment/Work Item
English

Rationale: (Why is it important/required?)

Several essential, very important amendments were introduced to Regulation 115 in the document transmitted to the Secretariat, in particular:

- clarification of the scope of application,
- deletion of the concept of "non-intrusive" retrofit systems,
- limitation of the operation with petrol to 90 s or 60 s,
- addition of provisions for the setting of the chassis dyno,
- clarification of some provisions.

However, the amendments introduced to Regulation 115 do not seem to be sufficient. There are still some outstanding problems e.g.:

- the definition of the type of systems is not clear, precise and adapted to progress,
- some provisions are not aligned with Regulation 83, 06 series of amendments and Regulation 692/2008
- there are errors, unclear provisions etc. leading to misinterpretation.

This document contains proposals for complementing Draft Amendment to Regulation 115 transmitted to the Secretariat. They are limited to:

- LPG retrofit systems (provisions for CNG systems are more or less "symmetrical"),

- vehicles of M1 and N1 categories in particular.

It is proposed, among other things:

- to modify the definition of the type of retrofit systems,
- to combine all the specifications for LPG systems (emission, carbon dioxide, power and OBD) in one block and those for CNG systems in another block,
- to clearly specify what requirements should be complied with (those in force during the initial type-approval of the vehicle or during the type-approval of the system according to Regulation 115),
- to correct provisions related to the documentation supplied by the manufacturer, in particular Annex 3A.

Some typing errors are also corrected if found.

Analysis/testing or data requirements to support the Amendment/Work item
(could be anticipated or existing supporting documentation)

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E/ECE/324
E/ECE/TRANS/505

Rev.2/Add.114

12 December 2003

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AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS */

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum 114: Regulation No. 115

Date of entry into force: 30 October 2003

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:

I. SPECIFIC LPG (LIQUEFIED PETROLEUM GASES) RETROFIT SYSTEMS TO BE INSTALLED IN MOTOR VEHICLES FOR THE USE OF LPG IN THEIR PROPULSION SYSTEM

II. SPECIFIC CNG (COMPRESSED NATURAL GAS) RETROFIT SYSTEMS TO BE INSTALLED IN MOTOR VEHICLES FOR THE USE OF CNG IN THEIR PROPULSION SYSTEM

UNITED NATIONS

Comment [ES1]: Page 2 is a blank page.

*/ Former title of the Agreement:

Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

Regulation No. 115

Uniform provisions concerning the approval of:

I. Specific LPG (liquefied petroleum gases) retrofit systems to be installed in motor vehicles for the use of LPG in their propulsion system

II. Specific CNG (compressed natural gas) retrofit systems to be installed in motor vehicles for the use of CNG in their propulsion system

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Annex 1A - Addendum - Addendum to the communication concerning a type of LPG retrofit equipment pursuant to Regulation No. 115

Annex 1B - Communication concerning the approval or extension or refusal or withdrawal of approval or production definitely discontinued of a type of CNG retrofit equipment pursuant to Regulation No. 115

Annex 1B - Addendum - Addendum to the communication concerning a type of CNG retrofit equipment pursuant to Regulation No. 115

Annex 2A - Arrangement of the LPG retrofit system type approval mark

Annex 2B - Arrangement of the CNG retrofit system type approval mark

Annex 3A - Complete list of information for the purpose of the LPG retrofit system installed on vehicle type approval

Annex 3B - Complete list of information for the purpose of the CNG retrofit system installed on vehicle type approval

Annex 4 - Description of the leakage test procedures for CNG/LPG systems installed on vehicles

Annex 5 - Prescriptions concerning the fixation of LPG and CNG container(s)

* * *

1. SCOPE

This Regulation applies to:

1.1. Part I : Specific LPG retrofit systems to be installed in motor vehicles for the use of LPG in the propulsion system.

Part II: Specific CNG retrofit systems to be installed in motor vehicles for the use of CNG in the propulsion system.

1.2. This Regulation applies when the retrofit systems manufacturer keep the initial characteristics of the whole system, for the specific vehicle family for which the approval has been granted.

1.3. This Regulation does not apply to the procedures, checks and inspections aimed at verifying the correct installation of the retrofit systems on vehicles, since this matter relies on the competence of the Contracting Party of Country where the vehicle is registered.

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, series of amendments 00 or 01 or 02 or 03 or 04,

(b) vehicles type-approved pursuant to Regulation No. 49, series of amendments 00 or 01 or 02,

(c) vehicles type-approved pursuant to EC Directive 70/220/EEC up to and including the amending Directive 98/77/EC,

(d) vehicles type-approved pursuant to EC Directive 88/77/EEC up to and including the amending Directive 96/1/EC.

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Justification.
Directive 98/77/EC – amendments to Euro 2; introduction of requirements for LPG and CNG, among other things.
Regulation 49.03 – requirements Euro III, Euro IV, Euro V and EEV.

1.5 The requirements for the different categories (M_1, N_1 or others) are defined in paragraphs 2. to 7 [1].

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Once the retrofit system is installed in the vehicle, the modified vehicle shall fulfil all the provisions of the Regulation for which the type approval has been initially granted.

[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.

2. DEFINITIONS

2.1. "Approval of an LPG or CNG retrofit system" means the approval of the type of retrofit system to be installed in motor vehicles for the use of LPG or CNG.

2.1.1. Specific LPG retrofit system of an approved type may consist of several components as classified and approved according to Regulation No. 67[2], Part I and the specific vehicle instruction manuals.

2.1.2. Specific CNG retrofit system of an approved type may consist of several components as classified and approved according to Regulation No. 110[3], Part I and the specific vehicle instruction manuals.

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

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

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

2.1.6. "Original vehicle" means a vehicle before the installation of the retrofit system.

2.2. "Specific LPG or CNG retrofit system of an approved type" means systems, which do not differ in such respect as:

Comment. One of two following formulations is proposed.

First formulation

[2] Regulation No. 67, series of amendments in force during the type-approval of the retrofit system according to this Regulation.

[3] Regulation No. 110, series of amendments in force during the type-approval of the retrofit system according to this Regulation.

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Deleted: 2.2.1. . retrofit system manufacturer (responsible for retrofit approval application);¶
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2.2.2. . pressure regulator/vaporiser type by the same manufacturer;¶

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¶
2.2.4. . sensors and actuators set types;¶
¶
2.2.5. . the fuel container type (i.e. LPG liquid take off / vapour pressure, LPG vapour take off, LPG liquid take off / pressurized by pump, pressurized CNG take off), the safety devices and fuel container accessories, as required by Regulation No. 67, 01 series of amendments, or Regulation No. 110, where applicable (i.e. relief valve, …); ¶
¶
2.2.6. . fuel container fitting devices;¶
¶
2.2.7. . ECU (Electronic Control Unit) type by the same manufacturer;¶
¶
2.2.8. . basic software principles and control strategy; ¶
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2.2.9. . installation manual (see para. 7);¶
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2.2.10. . end-user manual (see para. 7).

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2.2.1. retrofit system manufacturer (responsible for retrofit approval application);

2.2.2. pressure regulator/vaporiser type (the same type-approval number according to Regulation No. 67 [2] or Regulation No. 110 [3]);

2.2.3. gas fuelling (by induction mixer; by injection, vapour or liquid, single- or multi-point injection);

2.2.4. if fuelling by induction mixer – any mixer by the same manufacturer; if fuelling by injection – injector type (the same type-approval number according to Regulation Regulation No. 67 [2] or Regulation No. 110 [3]);

2.2.5. sensors and actuators types;

2.2.6. the fuel container type (i.e. LPG liquid take off / vapour pressure, LPG vapour take off, LPG liquid take off / pressurized by pump, pressurized CNG take off); the fuel container accessories, as required by Regulation No. 67 [2] or Regulation No. 110 [3] where applicable;

2.2.7. ECU (Electronic Control Unit) type (the same type-approval number according to Regulation No. 67 [2] or Regulation No. 110 [3]);

2.2.8. software and control strategy;

Comment. The term "control strategy" is not defined. It is proposed either to define it or to delete para. 2.2.8.

2.2.9. installation manual (see para. 7);

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

Second formulation

2.2.1. retrofit system manufacturer (responsible for retrofit approval application);

2.2.2. pressure regulator/vaporiser type (only the type(s) with which the parent vehicle(s) is (are) fitted can be used; different versions in respect of the maximum gas delivery are permitted);

2.2.3. gas fuelling (by induction mixer; by injection, vapour or liquid, single- or multi-point injection);

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2.2.4. mixer type or injector type (only the type(s) with which the parent vehicle(s) is (are) fitted can be used);

2.2.5. sensors and actuators types;

2.2.6. the fuel container type (i.e. liquid take off/ vapour pressure, vapour take off, liquid take off / pressurized by pump); the fuel container accessories, as required by Regulation No. 67 [2] or Regulation No. 110 [3], where applicable;

2.2.7. ECU (Electronic Control Unit) type (only the type with which the parent vehicle(s) is(are) fitted can be used; versions for different cylinder number/ configuration are permitted);

2.2.8. software and control strategy;

Comment. The term "control strategy" is not defined. It is proposed either to define it or to delete para. 2.2.8.

2.2.9. installation manual (see para. 7);

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

Note: With respect to paragraphs 2.2.5. and 2.2.6., the manufacturer of the retrofit can insert in his installation manual other components, included in the approval, as interchangeable items (see para. 7).

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.

2.4. "Installer" means an organization 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 [4].

2.5. For the purposes of this Regulation, "the parent vehicle", with regard both to LPG system and to CNG system, means a vehicle that is selected to act as the vehicle, on which the requirements of this Regulation are going to be demonstrated, and to

[4] 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.

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which the members of a family refer.

2.5.1. Vehicles of M1, M2, N1 and N2 categories

This definition applies to vehicles of M_1, M_2, N_1 and N_2 categories referred to in paragraph 6.1.2.

According to this Regulation, "a member of the family" is a vehicle sharing the following essential characteristics with its parent vehicle(s). The family definition is based on the original vehicle characteristics.

2.5.1.1. a) It is produced by the same vehicle manufacturer.

b) It is classified in the same category M_1, M_2, N_1 or N_2. Vehicles of category M_1 and N_1 class I may belong to the same family.

c) It was type-approved according to the same emission limits or those in force earlier [5].

Comment. Euro 3 and Euro 4 are specified in the same series of amendments. Perhaps, the wording " those in force earlier" is not good, but we are not able to propose anything better.

d) If the gas fuelling system has a central metering for the whole engine: it has an approved maximum power output between 0.7 and 1.15 times that of the engine of the parent vehicle. If the gas fuelling system has an individual metering per cylinder: it has an approved maximum 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 parent vehicle was not equipped with air-injection or EGR, vehicles with these devices are allowed.

[5] According to Regulation 83 series of amendments or Directive amending Directive 70/220/EEC or Regulation amending Regulation 692/2008 implementing Regulation 715/2007 under which the initial type-approval of the vehicle with regard to pollutant emission was granted.

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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, ? is used.

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Comment. Retrofit systems manufacturers and technical services for this Regulation do not seem to be capable to determine that the emission strategy is "the same". It is proposed to delete the wording "emission strategy".

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 maximum 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 maximum 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 maximum 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 maximum power output between 0.7∗P1 and 1.15∗P2.

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 2.1.5., the family relation will be considered valid regardless of the presence of the air injection or the EGR.

2.6. For definitions of the components of LPG retrofit systems refer to Regulation No. 67[2].

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2.7. For definitions of the components of CNG retrofit systems refer to Regulation No. 110[3].

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3. APPLICATION FOR APPROVAL

3.1. The application for approval of a specific retrofit system shall be submitted by the manufacturer or by his duly accredited representative.

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3.2. It shall be accompanied by the under-mentioned documents in triplicate and by the following details:

3.2.1. Description of the retrofit system comprising all the relevant details, including the

approval numbers of each component, referred to in item 2 of Annex 3A to this Regulation for LPG system and Annex 3B to this Regulation for CNG system;

3.2.2. Description of the parent vehicle(s) on which the requirements of this Regulation are tested comprising all the relevant details referred to in item 3 of Addendum to Annex 1A and in item 1 of Annex 3A to this Regulation for LPG system or item 3 of Addendum to Annex 1B and in item 1 of Annex 3B to this Regulation for CNG system;

3.2.3. Description of all modifications applied to the original parent vehicle;

3.2.4. 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 "master-slave" system, as defined in paragraph 2.1.5;

3.2.5. Description of vehicle type(s) to which the retrofit system is intended to be fitted, containing all the relevant details referred to in item 3 of Addendum to Annex 1A and in item 1 of Annex 3A to this Regulation for LPG system or item 3 of Addendum to Annex 1B and in item 1 of Annex 3B to this Regulation for CNG system;

3.2.6. Installation manual(s) for the retrofit system installation on the parent vehicle(s);

3.2.7. End-user manual.

3.3. A sample of the specific retrofit system, properly installed in the parent vehicle(s) shall be submitted to the technical service.

4. MARKINGS

4.1. The sample(s) of a specific retrofit system submitted to type-approval shall be accompanied by a plate with the trade name or mark of the retrofit manufacturer and the type, as indicated in Annexes 2A and 2B.

4.2. All retrofit systems, installed in the vehicle belonging to the family, as defined in paragraph 2, shall be identified by a plate, in which the approval number, and the technical specifications, as required in Annexes 2A and 2B shall be placed. This plate has to be permanently fixed to the structure of the vehicle and shall be clearly readable and indelible.

5. APPROVAL

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5.1. If the retrofit system sample submitted for approval meets the requirements of paragraph 6 of this Regulation, the type approval of the retrofit system shall be granted.

5.2. Retrofit systems, which have been already approved as "master-slave" systems on at least one parent vehicle, do not need to comply with paragraph 6.1.2.7.4.1. or (insert a number for CNG) of this Regulation.

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5.3. An approval number shall be assigned to each type of the retrofit system approved. Its first two digits (at present 00 according to the Regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same type approval number to another type of retrofit system.

5.4. Notice of approval or of refusal of a retrofit system type pursuant to this Regulation shall be communicated to the Parties to the Agreement applying this Regulation, by means of a form conforming to the model in Annexes 1A and 1B to this Regulation.

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Justification. Chapter 5 refers to the approval. Chapter 8 refers to the extension. Notice of extension – see paragraph 8.3.

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5.5. An international approval mark shall be affixed in the plate as indicated in Annexes 2A and 2B, to all retrofit systems, conforming to a type approved under this Regulation, in addition to the mark prescribed in paragraph 4.1. This approval mark shall consist of:

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5.5.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted the approval [6].

5.5.2. The number of this Regulation, followed by the letter "R", a dash and the approval

[6] 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Serbia and Montenegro, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 for Azerbaijan, 40 for The former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for South Africa and 48 for New Zealand. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify the Agreement Concerning the Adoption for Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approval Granted on the Basis of these Prescriptions, and the numbers, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

number to the right of the circle defined in paragraph 5.4.1. The approval number consists of the retrofit system type approval number, which appears in the communication form for this type (see paragraph 5.2. and Annexes 1A and 1B) preceded by two figures indicating the latest series of amendments to this Regulation.

5.6. The approval mark shall be clearly readable and be indelible.

5.7. Annexes 2A and 2B to this Regulation give examples of the arrangement of the aforesaid plate with approval mark.

6. SPECIFICATIONS REGARDING THE RETROFIT SYSTEMS

6.1. PART I - LPG retrofit system specifications:

6.1.1. Requirements for the installation of specific retrofit system for the use of LPG in the propulsion system of a vehicle

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

6.1.1.1.1. Components indicated in Regulation No. 67[2] and defined as necessary,

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6.1.1.1.2. Installation manual,

6.1.1.1.3. End-user manual.

6.1.1.1.4. The plate with the approval mark and technical information according to Annex 2A.

Comment. In our view the plate should be part of the retrofit system.

6.1.1.2. The LPG retrofit system may also include components indicated as optional in Regulation No. 67[2].

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6.1.1.3. The LPG retrofit system installed in the vehicle, in a proper way as defined in the above installation manual, shall comply with the installation requirements of Regulation No. 67[2]. Concerning the fixation of the cylindrical fuel container, the requirements of Regulation No. 67[2] shall be deemed to be met if the requirements of Annex 5 to the present Regulation are satisfied.

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6.1.2. Specifications for retrofit systems intended to be fitted to vehicles of M_1, M_2, N_1 and N_2 categories

Deleted: Pollutants emissions and CO_2 emissions (for category M_1 and N_1 vehicles only)

Justification. Regulation 83.06 and Regulation 715/2007 apply not only to vehicles of M1 and N1 categories, but also to vehicles of M2, N2 categories having the reference mass not exceeding

2610 kg.

6.1.2.1. This paragraph applies to retrofit systems intended to be fitted to vehicles of M_1, M_2, N_1 and N_2 categories fuelled with petrol which:
(i) have a maximum mass not exceeding 3500 kg and were type-approved according to Regulation 83 or Directive 70/220/EC [5],
(ii) were type-approved according to Regulation 715/2007 [5].

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 paragraphs from 6.1.2.4 to 6.1.2.7.

.6.1.2.2. Fuel requirements by the engine: the type of fuel normally used by the engine could be:

(a) LPG only (mono-fuel),
(b) both unleaded petrol or LPG (bi-fuel).

6.1.2.3. "Pollutants" means the pollutants according to prescriptions in force during the initial type-approval of the vehicle [5]

6.1.2.4. Exhaust emissions over the type I test [5]

6.1.2.4.1. Tests shall be performed according to the test procedures used for the initial type-approval of the vehicle [6] with the exceptions described in paragraph 6.1.2.4.2 on each parent vehicle with each fuel:
(i) reference petrol,
(ii) reference LPG A,
(iii) reference LPG B.

6.1.2.4.2. Setting of the dynamometer

With the agreement of the authority that grants the type approval, one of the following methods may be used:

6.1.2.4.2.1. Using of coast-down factors/coefficients of the original vehicle:

In case coast-down coefficients of the original vehicle used during the type-approval are used, the following conditions shall apply:

Deleted: in Regulations No. 83 and No. 101, or No. 49, where applicable, in the limits of the requirements of paragraphs 6.1.2.4. and 6.1.2.5. 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.¶

Deleted: (c) . both diesel fuel or diesel fuel and LPG (dual fuel)¶ (provisions for dual fuel to be defined).¶

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Deleted: and CO_2 emissions (M_1 and N_1 category of vehicles):

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– the parent vehicle reference mass shall be measured with the retrofit system installed on the vehicle including the LPG container fully filled up (80% of capacity) or shall be calculated as the sum of the original vehicle reference mass and the mass of the retrofit system with the LPG container fully filled up (80% of capacity);
– the inertia mass of the parent vehicle shall be determined according to the reference mass of the retrofitted vehicle;
– the rolling resistance of the parent vehicle shall correspond to the original vehicle value proportionally adjusted to the parent vehicle mass measured or calculated as above:

$$f0' = f0 + (abs(f0))*(p/m)$$

where

f'0= rolling resistance of the parent vehicle
f0= rolling resistance of the original vehicle
m=reference mass of the original vehicle;
p= retrofit system mass;

– the other coefficients of the resistance of the parent vehicle shall be equal to that of the original vehicle.

6.1.2.4.2.2. Using of the table values:

– the parent vehicle reference mass shall be measured with the retrofit system installed on the vehicle including the LPG tank fully filled up (80% of capacity) or shall be calculated as the sum of the original vehicle reference mass and the mass of the retrofit system with the LPG tank fully filled up (80% of capacity);
– the inertia mass of the parent vehicle shall be determined according to the reference mass of the retrofitted vehicle;
– the coefficient a shall be the one corresponding to the reference mass of the retrofitted vehicle;
– the coefficient b shall be the one corresponding to the reference mass of the original vehicle.

6.1.2.4.3. Subject to the requirements of paragraph 6.1.2.4.6, the tests shall be repeated three times with the reference petrol. The values obtained in each test shall be multiplied by the deterioration factors and by the factors of K_i for periodically regenerating systems, where appropriate, according to the initial type-approval of the vehicle [5]. The calculated results shall be less than the limits in force during the initial type-approval of the vehicle [5].

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Deleted: The parent vehicle(s), equipped with the retrofit system, shall comply with the limit values according to the type approval of the original vehicle(s) including the deterioration factors applied during the type approval of the original vehicle(s).

Mono-fuel vehicles may be tested with the reference petrol before the retrofit if tests after the installation of the retrofit system are not possible or may result in false results. The total vehicle mileage between the tests before and after the retrofit shall not exceed [200] km.

Justification.
The wording proposed in the second sentence of the first indent is similar to that used in Regulation 83 or Directive 70/220/EEC and is more precise.
This Regulation is applicable also to mono-fuel vehicles. It is necessary to specify how to test such vehicles with petrol.

6.1.2.4.4. Subject to the requirements of paragraph 6.1.2.4.8. the tests shall be repeated three times with each reference LPG. The values obtained in each test shall be multiplied by the deterioration factors and by the factors of K_i for periodically regenerating systems, where appropriate, according to the initial type-approval of the vehicle [5]. The calculated results shall be less than the limits in force during the initial type-approval of the vehicle [5].
If the parent vehicle(s) was (were) type-approved according to Regulation No. 83, 05 series of amendments, or to Directives 98/69/EC, 1999/102/EC, 2001/1/EC, 2001/100/EC, 2002/80/EC, 2003/76/EC during the type I test the vehicle shall use petrol for a maximum of 90 seconds. In the other cases, this period shall not exceed 60 seconds.

Justification.
In our view it is necessary to list all the Directives.
The term "gas mode" is not defined which may lead to misinterpretation and/or manipulation. The wording "during the type I test" is regarded as sufficient.

6.1.2.4.5. Notwithstanding the requirements of paragraphs 6.1.2.4.3. and 6.1.2.4.4., for each pollutant one of the three test results may be equal to or exceed, by not more than 10 per cent, the limit prescribed, provided the arithmetical mean of the three results is below the prescribed limit. Where the test results are equal to or exceed the prescribed limits for more than one pollutant, it is immaterial whether this occurs in the same test or in different tests.

6.1.2.4.6. The number of emission tests prescribed in paragraphs 6.1.2.4.3. and 6.1.2.4.4. can be reduced in the conditions hereinafter defined:

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

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Deleted: 6.1.2.4.4. . Notwithstanding the requirements of paragraph 6.1.2.4.3., for each pollutant or combination of pollutants, one of the three test results may exceed, by not more than 10 per cent, the limit prescribed, provided the arithmetical mean of the three results is below the prescribed limit. Where the prescribed limits are exceeded for more than one pollutant, it is immaterial whether this occurs in the same test or in different tests.¶
¶
6.1.2.4.5. . The number of emission tests prescribed in paragraph 6.1.2.4.3. can be reduced in the conditions ... [3]
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- only two tests are performed if, for each pollutant subject to limitation the following requirements are met:

$M1 \leq O.85\ G$ and $M1 + M2 \leq 1.70\ G$ and $M2 \leq G$

where:

M1: result of the emission of one pollutant obtained from the first test of the type I performed;

M2: result 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 according to the initial type approval of the vehicle [5]).

Annex

Justification.

1. Regulation 115 is supposed to be applicable to Euro 3 and later vehicles. The CO limit value at idle for vehicles having a maximum mass exceeding 3500 kg is 3.5% vol. Such vehicles can hardly be regarded as Euro 3.

2. The deleted paragraphs apply only to vehicles of M1 category having the maximum mass more than 3500 kg. The number of such vehicles is negligible.

6.1.2.5. CO_2 emissions and fuel consumption

6.1.2.5.1. Tests shall be performed together with those specified in paragraph 6.1.2.4. according to the test procedures [in force during the initial type-approval of the vehicle] or [in force during the type-approval of the system] [7] on each parent vehicle with the following fuels, if applicable:

(i) reference petrol,

(ii) reference LPG A ,

(iii) reference LPG B.

The dynamometer setting shall be that specified in paragraph 6.1.2.4.2.

Comment. As the objective is to determine the coefficient K_{CO2}, there are two options with

[7] According to Regulation No. 101 series of amendments or Directive amending Directive 80/1268/EEC or Regulation amending Regulation 692/2008 implementing Regulation 715/2007 under which the initial type-approval of the vehicle with regard to CO_2 emissions and fuel consumption was granted.
or
According to Regulation No. 101 in force during the type-approval of the retrofit system according to this Regulation.

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¶
6.1.2.4.2.1. . 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.¶
¶
6.1.2.4.2.2. . Notwithstanding the provisions of

Deleted: 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.

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regard to the test procedures:

- procedures in force during the initial type-approval of the vehicle,
- procedures in force during the type-approval of the system.

Differences – different properties of reference fuels, small differences in the test cycle.

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 type I tests performed 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 type I tests performed 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 type I tests performed with reference petrol for vehicle No. i.

6.1.2.5.2. The mean fuel consumption shall be calculated in the same way as for the mean of CO_2 emissions, as defined in paragraph 6.1.2.5.1.

6.1.2.5.3. 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 are multiplied by the above ratios.

6.1.2.6. Power requirements

The parent vehicle(s) or its (their) engine(s) are submitted to the tests as follows:

6.1.2.6.1. Tests shall be performed according to the test procedures of paragraph 6.1.2.6.2. or

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¶
This paragraph is reserved for the specific requirements for emissions of diesel engines approved according to Regulation No. 49 and equipped with a retrofit LPG system (dual fuel) if required.¶

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6.1.2.6.3. The measured power with LPG shall be lower than that measured with petrol + 5 per cent.

6.1.2.6.2. Chassis dynamometer method:

The maximum power at the roller(s) is measured on a chassis dynamometer on each parent vehicle with the following fuels:

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

The reference fuels shall be those used during the type-approval of the retrofit system [8].

Comment. It is easier to perform measurements at the roller than at the wheels.

6.1.2.6.3. Engine dynamometer method:

The maximum power at the crankshaft is measured on an engine dynamometer according to Regulation No. 85 [9] for the engine of each parent vehicle with the following fuels:

(i) commercial petrol,
(ii) commercial LPG.

6.1.2.6.4. Mono-fuel vehicles or their engines may be tested with the reference petrol before the retrofit if tests after the installation of the retrofit system are not possible or may result in false results. The total vehicle mileage between the tests before and after the retrofit shall not exceed [200] km.

Justification.
This Regulation is applicable also to mono-fuel vehicles. It is necessary to specify how to test such vehicles with petrol.

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

[8] According to Regulation No. 83, the series of amendments in force during the type-approval of the retrofit system according to this Regulation.
[9] According to Regulation No. 85, the series of amendments in force during the type approval of the retrofit system according to this Regulation.

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

$$Power_{LPG} = 1/n \sum_{i=1}^{n} Power_{LPG.i}$$

where:

i - number of parent vehicles (i = 1 to n),
$Power_{petrol}$ - mean value of maximum power measured with petrol,
$Power_{LPG}$ - mean value of maximum power measured with LPG,

The ratio of engine power shall be calculated as follows:

$K_{power} = Power_{LPG} / Power_{petrol}$

For each vehicle of the family, the official values of engine power are multiplied by the above ratio.

6.1.2.7. OBD requirements and tests.

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

6.1.2.7.1.1. "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.

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

6.1.2.7.2. 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.

6.1.2.7.3. The LPG retrofit system, as described in paragraph 2. of this Regulation, installed into the parent vehicle, shall comply with the requirements and tests in force with regard to OBD during the initial type-approval of the vehicle[5] Annexon both petrol and LPG modes. Tests may be performed on one parent vehicle only and in the case of LPG with one of reference LPG A or B.

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

6.1.2.7.4.1 Notwithstanding the requirements of the paragraph 6.1.2.7.3., a "master-slave" retrofit system shall only 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;

6.1.2.7.4.2. Notwithstanding the requirements of paragraph 6.1.2.7.3., the LPG retrofit system shall only be submitted to the following tests, which, in the case of type I tests, shall be performed according to procedures in force during the initial type-approval of the vehicle [5]. Annex

6.1.2.7.4.2.1. 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.

6.1.2.7.4.2.2. 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;

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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.

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

6.1.2.7.4.2.4. The system manufacturer shall provide specific instructions as to read out the LPG fault codes referred to in paragraph 6.1.2.7.4.

6.1.2.8. Emissions data required for roadworthiness testing

Emissions data required for roadworthiness testing shall be determined according to the procedures used for the initial type-approval of the vehicle [5] on each parent vehicle with the following fuels:
(i) reference petrol,
(ii) reference LPG A or B.
The obtained concentrations of carbon monoxide shall be equal to or lower than those determined during the initial type-approval of the vehicle [5].

6.1.3. Specifications for retrofit systems intended to be fitted to vehicles of M_2, M_3, N_2 and N_3 categories

This paragraph is reserved for the specific requirements for emissions of engines approved according to Regulation No. 49 or equivalent Directives and equipped with a retrofit LPG system, if required.

6.2. PART II - CNG retrofit system specifications:

.....

7. INSTRUCTION MANUALS

7.1. Installation manual for the retrofit installation on the vehicle

7.1.1. Scope

The scope of this paragraph is to list the minimum requirements which shall be

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contained in the installation manual.

7.1.2. List of reference standards:

7.1.3. General requirements

7.1.3.1. The installation manual has the purpose to guide the installer through the correct procedures which shall be observed while assembling the LPG/CNG systems.

7.1.3.2. The installation manual shall be prepared by the retrofit system manufacturer.

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 retrofit system

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

Part II: (i) Part containing installation instructions for the specific vehicle.

7.1.3.6. Installation manual of the parent vehicle(s) has to be submitted to the authority that grants the type approval.

7.1.3.7. Installation manual of the vehicles belonging to the family 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.

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.

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7.1.4.2 Proper assembly check

7.1.4.2.1. The installation manual shall contain the detailed procedures and actions which must be taken by the installer to check whether the system has been assembled in order to safely perform and to abide by the installation instructions.

7.1.4.3. Start-up procedures

7.1.4.3.1. The installation manual shall contain the start-up operations which must be performed by the installer.

7.1.4.4. Service instructions

7.1.4.4.1. The installation manual shall contain the maintenance schedule in which all the ordinary service (type) which the single components as well as the system must undergo through their working life (time in km covered by the vehicle) will be specified.

7.1.4.4.2. The installation manual must specify the expertise necessary for the installation/service of the system.

7.1.4.5. System malfunction

7.1.4.5.1. The installation manual shall contain the actions which must be taken in case the system malfunctions.

7.1.4.6. Diagnosis

7.1.4.6.1. If a diagnosis system is included in the conversion kit, the installation manual shall contain a detailed description of such a system together with the corrective actions which may be taken in case of malfunctioning.

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.

Comment. The term "fitting device" is not defined in Regulation 67

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, all the settings and adjustments included..

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.

7.2. End-User Manual

7.2.1. Scope

To specify the minimum requirements of the end-user manual for LPG/CNG

systems maintenance.

7.2.2. General requirements

7.2.2.1. The user manual has the purpose to inform the end-user about the characteristics and safety features of the installed LPG/CNG systems.

7.2.2.2. The user manual shall be prepared by the manufacturer of the retrofit system.

7.2.2.3. The manufacturer of the system shall include all the necessary information that is needed for correct use and safe operation of the LPG/CNG systems.

7.2.2.4. The user manual shall be considered as an integral part of the system and therefore be delivered with the LPG/CNG systems.

7.2.2.5. The user manual shall be written in the language of the country to which the system is delivered.

7.2.2.6. The user manual shall indicate reference to the product type and version and production year for which it is applicable.

7.2.2.7. Information shall be given for relevant extreme ambient conditions.

7.2.3. Contents of the end-user manual

7.2.3.1. Technical specifications

The user manual shall contain at least the following information:

(a) Operating characteristics
(b) Performance under normal operating conditions
(c) Extreme ambient conditions.

7.2.3.2. Safety instructions

The user manual shall give warning for dangers to health and safety categorised in the following way:

(a) SUGGESTIONS for optimal use of the system
(b) ATTENTION for possible problems due to misuse
(c) WARNING for damage to persons or goods when procedures are not followed.

If and when safety symbols are used, they shall be in accordance with the international system, SI and their purpose must be clearly specified in the user manual.

The user manual shall indicate proper actions to be taken in case the vehicle is repainted and put in a hot drying cabin.

7.2.3.3. LPG/CNG systems description

All the components of the LPG/CNG systems shall be clearly described for their purpose, use and function.

7.2.3.4. First use and adjustment of the LPG/CNG systems

The user manual shall contain all the necessary information to the end user about initial running in and or adjustment of the system when needed.

7.2.3.5. Operating of the LPG/CNG systems

7.2.3.5.1. Filling of the LPG/CNG systems

The user manual shall indicate the sequence of operations needed to fill up the LPG/CNG containers. Particular attention must be paid to the maximum filling level of the 80 per cent in case of LPG.

7.2.3.5.2. Switch-over procedure

The user manual shall clearly describe the method of switching over from one to the other alternative fuel by giving the sequence of operations.

7.2.3.5.3. Opening/closing of manual valves

When fitted, the user manual shall indicate the proper procedure to operate the manual valves.

7.2.3.5.4. Level indicator

The user manual shall state the location of the level indicator, for example at the dashboard or at the container. Its read-out has to be clearly explained to the user, giving particular attention to the 80 per cent filling level in case of LPG.

7.2.3.5.5. Maintenance

If maintenance is required, the user manual shall state the frequency and type of

maintenance to be carried out.

7.2.3.5.6. Defects and repair

The user manual shall indicate which actions have to be taken in the case of a defect of the system.

When the system is equipped with a diagnosis system the user manual shall describe this system and indicate proper actions to be taken.

7.2.3.5.7. Scrapping of the product

The user manual shall give proper indication about precautions to be taken when the system has to be removed from the vehicle.

8. MODIFICATION AND EXTENSION OF APPROVAL OF A RETROFIT SYSTEM TYPE

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 the authority, which granted the retrofit system type approval. The authority may then either:

8.1.1. Consider that the modifications made are unlikely to have an appreciably adverse effect and that in any case the retrofit system still complies with the requirements, or

8.1.2. Require a further test report from the technical service responsible for conducting the tests.

8.2. In both cases described in paragraphs 8.1.1. and 8.1.2. above, the authority shall be presented in the updated installation manual.

8.4. Confirmation or refusal of approval, specifying the alteration, shall be communicated by the procedure specified in paragraph 5.4. above to the Parties to the 1958 Agreement applying this Regulation.

8.5. The competent authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying to this Regulation by means of a communication form

Deleted: *8.3 . With regard to the Type 1 tests, as described in paragraphs 6.1.2.4.1 and 6.2.2.4.1, the type-approval shall be extended to retrofit systems that implies parent vehicle's (s) different reference mass requiring the use of the next two higher equivalent inertia categories or any lower equivalent inertia category* ¶
¶

conforming to the model in Annexes 1A and/or 1B to this Regulation.

9. CONFORMITY OF PRODUCTION

9.1. The conformity of production procedures shall comply with those set out in the Agreement, appendix 2 (E/ECE/324 - E/ECE/TRANS/505/Rev.2).

9.2. The retrofit systems approved under this Regulation shall be so manufactured as to conform to the type approved. They shall meet the requirements set forth in paragraph 6 and, where applicable, fulfil the requirements of the tests specified in this Regulation.

9.3. The type approval authority may carry out any checks or tests prescribed in this Regulation.

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10. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

10.1. The approval granted in respect of a type of retrofit system pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 9 above are not complied with.

10.2. If a Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the models in Annexes 1A and/or 1B to this Regulation.

11. PRODUCTION DEFINITELY DISCONTINUED

11.1. If the holder of the approval completely ceases to manufacture a type of retrofit system approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annexes 1A and/or 1B to this Regulation.

12. TRANSITIONAL PROVISIONS

Comment. Some transitional provisions seem to be required. It is desirable to specify, in particular:
(i) until when type-approvals granted under the version of Regulation 115 currently in force remain valid,

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(ii) whether type-approvals granted under the version of Regulation 115 currently in force may be extended and under what conditions,
(iii) whether a new type-approval or extension of the existing type-approval is required if a retrofit system for which the type-approval was granted under the version of Regulation 115 currently in force (it means intended to be fitted to Euro 3 and/or Euro 4 vehicles) will be fitted to Euro 5 vehicles.

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12. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF ADMINISTRATIVE DEPARTMENTS

12.1. The Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the technical services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

_____

Annex 1A

COMMUNICATION

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

issued by: Name of administration:
.....
.....
.....

concerning: 2/ APPROVAL GRANTED
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a type of LPG retrofit equipment pursuant to Regulation No. 115

Approval No.: ..... Extension No.: .....

1. LPG retrofit equipment considered:

Container

Accessories fitted to the container 2/

80 per cent stop valve

Level indicator

Pressure relief valve (discharge valve)

Pressure relief device (fuse)

Remote controlled service valve with excess flow valve

With/without LPG fuel pump 2/

Multivalve, including the following accessories: .....

Ventilation housing

Power supply bushing (pump/actuators) 2/

Fuel pump 2/

Vaporiser/pressure regulator 2/

Shut-off valve 2/

Non-return valve 2/

Gas tube pressure relief valve 2/

Service coupling 2/

Flexible hose 2/

Remote filling point 2/

Gas injection device or injector 2/

Gas dosage unit 2/

Gas mixing piece 2/

Electronic control unit 2/

Pressure/temperature sensor 2/

LPG filter unit 2/

2. Trade name or mark .....

Comment. Different wording is used throughout the text:

- trade name or mark in Annex 1A.,
- trade mark in Annex 2,
- trade name or mark holder in Annex 3A
- make in Annex 3A.

What is the difference ?

It is desirable to use a uniform terminology.

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3. Manufacturer's name and address .....

4. Name and address of manufacturer's representative, if applicable .....
.....

5. Submitted for approval on .....

6. Technical service responsible for conducting approval tests .....
.....

7. Date of report issued by that service .....

8. No. of report issued by that service .....

9. Approval granted/refused/extended/withdrawn 2/ .....

10. Reason(s) of extension (if applicable) .....

11. Vehicle types in which the retrofit system can be installed (M_1 and N_1 categories), or vehicle types in which the retrofit system can be installed (other categories of vehicles) and, if applicable, CO_2 and power ratios (see Addendum to this Annex)

Justification. Item 11.1 seems to be redundant. Emission requirements are specified in Addendum, item 1 and 3. Emission requirements may be different for individual vehicle types.

11.1 OBD requirements:

Has the retrofit system demonstrated to be "master-slave": yes/no 2/

12. Place .....

13. Date .....

14. Signature .....

15. The documents filed with the application or extension of approval can be obtained upon request.

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Deleted: Regulation No. 83, ... series of amendments 3/ ¶ Regulation No. 49, ... series of amendments 3/

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1/ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).

2/ Strike out what does not apply.

3/ Amendment in force at the time of the initial type approval of the vehicle or engine.

Annex 1A – Addendum
Proposal only for M1 and N1 categories

ADDENDUM TO THE COMMUNICATION CONCERNING A TYPE OF LPG RETROFIT SYSTEM PURSUANT TO REGULATION No. 115

Deleted: EQUIPMENT

(Approval No. ..... Extension No. .....)

1. Vehicles on which the retrofit system has been tested:

Deleted: equipment

Vehicle No.	1	2	n
Manufacturer:			
Make:			
Type:			
Category, class:			
Emission limits*:			
Power:			
Number of cylinders:			
Fuel feed and combustion process:**			
Pollution control system type***:			
CO concentration****:			

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*According to the type-approval of the original vehicle/engine.
** Injection: direct or indirect, single point- or multi-point.
*** Specify the type of catalyst (three-way, oxidation, deNO$_X$), air injection (with/without), EGR (with/without).
**** Specify CO concentrations determined during the initial type-approval of the vehicle [5] .

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2. Test results:

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Ratio CO_{2LPG} /$CO_{2\ petrol}$: 2/ .....

Ratio $Power_{LPG}$ /$Power_{\ petrol\ (or\ diesel)}$: .....

3. Vehicles type(s) for which the retrofit system type is qualified:

Deleted: equipment

Fuel		Petrol (or diesel) 1/					LPG					
Vehicle manufacturer, make, type	Engine type	Power 4/ (kW)	CO 3/ (g/km)	HC 3/ (g/km)	NOx 3/ (g/km)	CO_2 2/ (g/km)	Power 4/ (kW)	CO 3/ (g/km)	HC 3/ (g/km)	NOx 3/ (g/km)	CO_2 2/ (g/km)	

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1/ Strike out what does not apply.

2/ Applicable to vehicles of category M1 and N1 only. The type-approval value of the original vehicle multiplied by K_{CO2} shall be specified for each vehicle type.

3/ Applicable only to parent vehicle(s). The mean test results shall be specified.

4/ Type-approval values of the original vehicle multiplied by K_{power} shall be specified for each vehicle type.

Deleted: 2/ . Applicable to vehicles of category M_1 and N_1 only.¶
3/ . Applicable only to parent vehicle(s)¶

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4. Components of the retrofit system*

Component	Manufacturer	Type	Number of the type-approval according to Regulation 67 [2]

* Specify for each component, alternative components included, if applicable.

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Annex 1B

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

issued by: Name of administration:
.....
.....
.....

E 1/ ...

concerning: 2/ APPROVAL GRANTED
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a type of CNG retrofit equipment pursuant to Regulation No. 115

Approval No..... Extension No.....

1. CNG equipment comprising:

Container

Accessories fitted to the container 2/

Level or pressure indicator

Pressure relief valve (discharge valve)

Remote-controlled automatic valve with excess flow valve

Pressure relief device (fuse)

Gas-tight housing

Pressure regulator 2/

Automatic valve 2/

Check valve 2/

Flexible fuel line or hose 2/

Filling unit 2/

Gas/air mixer (injector)

Flow gas adjuster

Gas/air mixer (carburettor)

Electronic control unit 2/

Pressure/temperature sensor 2/

CNG filter 2/

2. Trade name or mark .....

3. Manufacturer's name and address .....

4. Name and address of manufacturer's representative, if applicable .....

.....

5. Submitted for approval on .....

6. Technical service responsible for conducting approval tests .....

.....

7. Date of report issued by that service .....

8. No. of report issued by that service .....

9. Approval granted/refused/extended/withdrawn 2/ .....

10. Reason(s) of extension (if applicable) .....

11. Vehicle types in which the retrofit system can be installed (M_1 and N_1 categories), or vehicle types in which the retrofit system can be installed (other categories of vehicles) and, if applicable, CO_2 and power ratios (see Addendum to this Annex) .....

.....

11.1. Emission requirements:

Regulation No. 83, ... series of amendments 3/,

Regulation No. 49, ... series of amendments 3/

11.2 OBD requirements:

Has the retrofit system demonstrated to be "master slave": yes/no 2/

12. Place: .....

13. Date: .....

14. Signature: .....

15. The documents filed with the application or extension of approval can be obtained upon

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request.

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1/ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).

2/ Strike out what does not apply.

3/ Amendment in force at the time of the initial type approval of the vehicle or engine.

Annex 1B - Addendum

ADDENDUM TO THE COMMUNICATION CONCERNING A TYPE OF CNG RETROFIT EQUIPMENT PURSUANT TO REGULATION No. 115

(Approval No. ..... Extension No. .....)

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:			

2. Test results:

Ratio CO_{2CNG} /$CO_{2\ petrol}$: 2/ .....

Ratio $Power_{CNG}$ /$Power_{\ petrol\ (or\ diesel)}$: .....

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

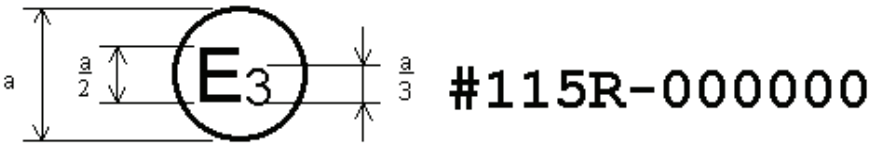
Fuel		Petrol (or diesel) 1/					CNG				
Vehicle type	Engine type	Power (kW)	CO 3/ (g/km)	HC 3/ (g/km)	NOx 3/ g/km)	CO_2 2/ (g/km)	Power (kW)	CO 3/ (g/km)	HC 3/ (g/km)	NOx 3/ (g/km)	CO_2 2/ (g/km)

1/ Strike out what does not apply.
2/ Applicable to vehicles of category M_1 and N_1 only.
3/ Applicable only to parent vehicle(s)

_____

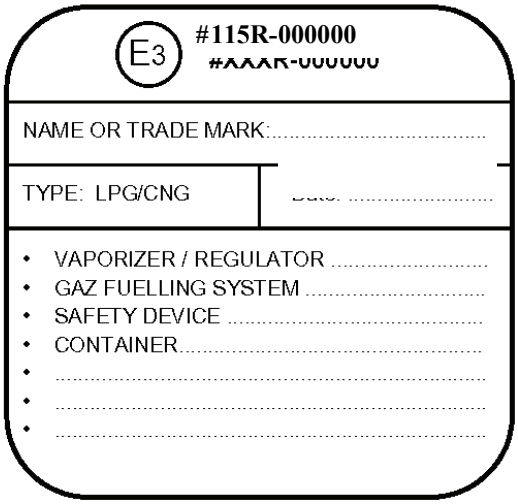
Annex 2A

ARRANGEMENT OF THE LPG RETROFIT SYSTEM TYPE APPROVAL MARK



a = 8 mm min.

The above approval mark affixed to the plate of LPG retrofit system, shows that it has been approved in Italy (E 3), pursuant to Regulation No. 115 under approval number 000000. The symbol "#" indicates the LPG retrofit system, the first two digits of the approval number indicate that approval was granted in accordance to the requirement of Regulation No. 115 in its original form.



Comment.
It is proposed to introduce the following changes:
1. "Manufacturer" instead of "name"
2. to delete the name of components
3. to add the footnote:

*Specify all the components of the retrofit system and their type-approval numbers according to Regulation 67 [2]

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** Specify the date of installation of the retrofit system

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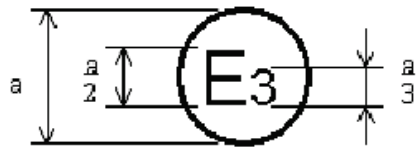
The above plate, with approval mark and some technical information on the retrofit system, has to be fixed permanently on the body of the vehicle.

Annex 2B

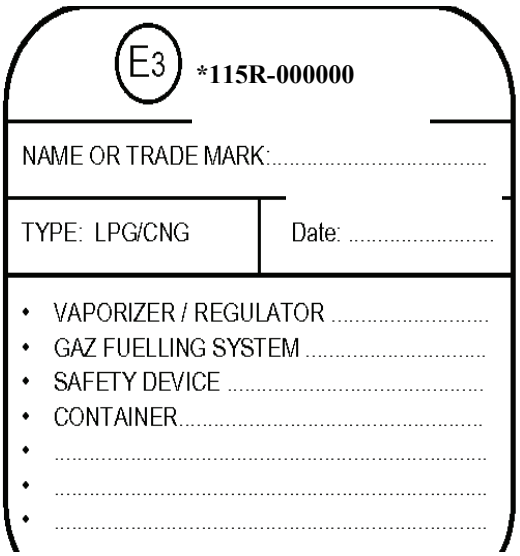
ARRANGEMENT OF THE CNG RETROFIT SYSTEM TYPE APPROVAL MARK



***115R-000000**

a = 8 mm min

The above approval mark affixed to the plate of CNG retrofit system, shows that it has been approved in Italy (E 3), pursuant to Regulation No. 115, under approval number 000000. The symbol "✲" indicates the CNG retrofit system, the first two digits of the approval number indicate that approval was granted in accordance to the requirement of Regulation No. 115 in its original form.



The above plate, with approval mark and some technical information on the retrofit system, has to be fixed permanently on the body of the vehicle.

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Annex 3A

COMPLETE LIST OF INFORMATION FOR THE PURPOSE OF THE LPG RETROFIT SYSTEM INSTALLED ON VEHICLE TYPE APPROVAL

Comment.
Proposal only for vehicles referred to in paragraphs 6.1.2. for LPG and (insert the number of paragraph for CNG) for CNG.
Justification.
The system manufacturer should supply al the data proving that a vehicle is a member of the family.

1. Description of the parent vehicle(s) and all the vehicles to which the system is intended to be fitted (original vehicle characteristics except if specified otherwise)

1.1. Name of the manufacturer .....

1.2. Category, class and identification type .....

1.3. Chassis identification number .....

1.4. Type-approval number .....

Comment. It is understood that the number of the "holistic" type-approval should be specified. In the ECE system, there is no "holistic" type-approval. What number should be specified:

- for M1 – the number of EU "holistic" type-approval, Russian, Ukrainian certification etc?
- for N1 - the number of German, French, Polish etc. national type-approval?

1.5. Vehicle masses

1.5.1. Mass of the original vehicle in running order .....

1.5.2. Mass of the retrofitted vehicle in running order (only for parent vehicle(s)).....

1.5.3. Maximum mass of the vehicle.....

1.6. Emission requirements (according to the type-approval of the original vehicle)

Regulation 83, ...series of amendments; level A (2000), B (2005), Euro 5, Euro 6;
Directive 70/220/EEC as amended by Directive .....; level A (2000), B (2005);
Regulation 715/2007: Euro 5, Euro 6.

1.7. Internal combustion engine identification type .....

1.7.1. Working principle and thermodynamic cycle (positive ignition/ compression

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ignition, four-stroke/two-stroke).....

1.7.2. Naturally aspirated or pressure charged .....

1.7.3. Fuel feed and combustion process (injection: single-point or multipoint; direct or indirect).....

1.7.4. Engine maximum power.....

1.7.5. Number of cylinders.....

1.7.6. Catalyst type (three way, oxidation, deNO$_x$) .....

1.7.7. Air injection (with or without).....

1.7.8. Exhaust gas recirculation (with or without).....

2. Description of the LPG retrofit system[2)]

[2)] Description also of all alternative components, if applicable. Specify the type approval number for each component.

2.1. Manufacturer, trade name or mark holder .....

2.2. Identification type .....

2.3. Drawing / flow-charts of the installation in the vehicle .....

2.4. "Master-slave" system: yes/no 1/ .....

2.5. Vaporiser/pressure regulator(s)

2.5.1. Manufacture, make(s).....

2.5.2. Type(s) .....

2.5.3. Type-approval number .....

2.5.4. Identification .....

2.5.5. Drawings .....

2.5.6. Number of main adjustment points .....

2.5.7. Description of principle of adjustment through main adjustment points .....

2.5.8. Number of idle adjustment points .....

2.5.9. Description of principle of adjustment through idle adjustment points .....

2.5.10. Other adjustment possibilities: if so and which (description and drawings) .....

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2.5.11. Operating pressure(s): 2/ .....kPa

2.6. Mixing piece: yes/no 1/

2.6.1. Number (of what – type-approval?) .....

2.6.2. Manufacture, make(s)) ..... Deleted: Make(s

2.6.3. Type(s).....

2.6.4. Drawings .....

2.6.5. Place of installation (include drawing(s)) .....

2.6.6. Adjustment possibilities .....

2.6.7. Operating pressure(s): 2/ .....kPa

2.7. Gas dosage unit: yes/no 1/

2.7.1. Number (of what) .....

2.7.2. Manufacture, make(s) ..... Deleted: Make(s)

2.7.3. Type(s) .....

2.7.4. Drawings .....

2.7.5. Place of installation (include drawing(s)).....

2.7.6. Adjustment possibilities .....

2.7.7. Operating pressure(s): 2/.....kPa

2.8. Gas injection device(s) or injector(s): yes/no 1/

2.8.1. Manufacture, make(s)) ..... Deleted: Make(s

2.8.2. Type(s) .....

2.8.3. Identification .....

2.8.4. Operating pressure(s): 2/.....kPa

2.8.5. Drawings of installation .....

2.9. Electronic control unit

2.9.1. Manufacture, make(s) ..... Deleted: Make(s)

2.9.2. Type(s) .....

2.9.3. Place of installation .....

2.9.4. Adjustment possibilities .....

2.10. LPG container

2.10.1. Manufacture, make(s) .....

2.10.2. Type(s) (include drawings) .....

2.10.3. Number of containers .....

2.10.4. Capacity .....litres

2.10.5. LPG fuel pump in container: yes/no 1/ .....

2.10.6. number .....

2.10.7. Drawings of the installation of the container .....

2.11. LPG container accessories

2.11.1. 80 per cent stop valve:

2.11.1.1. Manufacture, make(s) .....

2.11.1.2. Type(s).....

2.11.1.3. Operating principle: float/other 1/ (include description or drawings)

2.11.2. Level indicator:

2.11.2.1. Manufacture, make(s) .....

2.11.2.2. Type(s) .....

2.11.2.3. Operating principle: float/other 1/ (include description or drawings)

2.11.3. Pressure relief valve (discharge valve):

2.11.3.1. Manufacture, make(s) .....

2.11.3.2. Type(s) .....

2.11.4. Pressure relief device (fuse):

2.11.4.1. Manufacture, make(s) Manufacture, make(s) .....

2.11.4.2. Type(s) .....

2.11.5. Remote-controlled service valve with excess flow valve:

2.11.5.1. Manufacture, make(s) .....

2.11.5.2. Type(s) .....

2.11.6. Multi-valve: yes/no 1/

2.11.6.1. Manufacture, make(s) .....

2.11.6.2. Type(s) .....

2.11.6.3. Multi-valve description (include drawings) .....

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2.11.7. Ventilation housing: .....

2.11.7.1. Make(s) .....

2.11.7.2. Manufacture, make(s) ..... Deleted: Type(s)

2.11.8. Power supply bushing (fuel pump/actuators):

2.11.8.1. Manufacture, make(s) ..... Deleted: Make(s)

2.11.8.2. Type(s) .....

2.11.8.3. Drawings .....

2.12. Fuel pump (LPG): yes/no 1/

2.12.1. Manufacture, make(s) ..... Deleted: Make(s)

2.12.2. Type(s) .....

2.12.3. Pump mounted in LPG container: yes/no 1/

2.12.4. Operating pressure(s): 2/.....kPa

2.13. Shut-off valve/ non-return valve/gas tube pressure relief valve: ..... yes/no 1/

2.13.1. Manufacture, make(s) ..... Deleted: Make(s)

2.13.2. Type(s) .....

2.13.3. Description and drawings .....

2.13.4. Operating pressure(s): 2/.....kPa

2.14. Filling point: 1/

2.14.1. Manufacture, make(s) ..... Deleted: Make(s)

2.14.2. Type(s) .....

2.14.3. Description and drawings

2.15. Flexible fuel hose(s)/pipes:

2.15.1. Manufacture, make(s) ..... Deleted: Make(s)

2.15.2. Type(s) .....

2.15.3. Description .....

2.15.4. Operating pressure(s): 2/.....kPa

2.16. Pressure and temperature sensor(s): 1/

2.16.1. Manufacture, make(s) ..... Deleted: Make(s)

2.16.2. Type(s) .....

2.16.3. Description .....

2.16.4. Operating pressure(s): 2/.....kPa

2.17. LPG filter unit(s): 1/

2.17.1. Manufacture, make(s) .....

2.17.2. Type(s) .....

2.17.3. Description .....

2.17.4. Operating pressure(s): 2/.....kPa

2.18. Service coupling(s) (mono-fuel vehicle without limp-home system): 1/

2.18.1. Manufacture, make(s) .....

2.18.2. Type(s) .....

2.18.3. Description and drawings installation

2.19. Connection to LPG system for heating system (allowed for M_2 and M_3 categories of vehicles): yes/no 1/

2.19.1 Manufacture, make(s) .....

2.19.2. Type(s) .....

2.19.3. Description and drawings of installation .....

2.19. Further documentation

2.19.1. Description of the LPG equipment and the physical safeguarding of the catalyst at switch-over from petrol to LPG or back.

2.20.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc.)

2.20.3. Drawing of the symbol

2.20.4. Setting and adjustment data

2.21. Cooling system: (liquid/air) 1/

2.21.1. System description/drawings with regard to the LPG equipment

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1/ Strike out what does not apply.
2/ Specify the tolerance.

Annex 3B

COMPLETE LIST OF INFORMATION FOR THE PURPOSE OF THE CNG RETROFIT SYSTEM INSTALLED ON VEHICLE TYPE APPROVAL

1. Description of the parent vehicle

1.1. Name and address of the manufacturer .....

1.2. Category and identification type .....

1.3. Chassis identification number .....

1.4. Certification number .....

1.5. Internal combustion engine identification type .....

1.5.1. Working principle and thermodynamic cycle .....

1.5.2. Naturally aspirated or pressure charged .....

1.5.3. Displacement .....

1.5.4. Catalyst system type .....

1.5.5. Ignition system type .....

2. Description of the CNG retrofit system

2.1. Trade name or mark holder.....

2.2. Identification type .....

2.3. Drawing / flow-charts of the installation in the vehicle .....

2.4. "Master slave" system: yes/no 1/.....

2.6. Pressure regulator(s)

2.6.1. Make(s) .....

2.6.2. Type(s).....

2.6.3. Certification number .....

2.6.4. Identification .....

2.6.5. Drawings .....

2.6.6. Number of main adjustment points .....

2.6.7. Description of principle of adjustment through main adjustment points .....

2.6.8. Number of idle adjustment points .....

2.6.9. Description of principle of adjustment through idle adjustment points .....

2.6.10. Other adjustment possibilities: if so which (description and drawings) .....

2.6.11. Operating pressure(s): 2/ ..... kPa

2.7. Gas / air mixer (carburettor): yes/no 1/

2.7.1. Number .....

2.7.2. Make(s) .....

2.7.3. Type(s) .....

2.7.4. Drawings .....

2.7.5. Place of installation (include drawing(s)).....

2.7.6. Adjustment possibilities .....

2.7.7. Operating pressure(s): 2/ ..... kPa

2.8. Flow gas adjuster: yes/no 1/

2.8.1. Number .....

2.8.2. Make(s) .....

2.8.3. Type(s) .....

2.8.4. Drawings .....

2.8.5. Place of installation (include drawing(s)) .....

2.8.6. Adjustment possibilities .....

2.8.7. Operating pressure(s): 2/ ..... kPa

2.9. Gas /air mixer (injector): yes/no 1/

2.9.1. Make(s).....

2.9.2. Type(s).....

2.9.3. Identification .....

2.9.4. Operating pressure(s): 2/ ..... kPa

2.9.5. Drawings of installation.....

2.10. Electronic control unit

2.10.1. Make(s).....

2.10.2. Type(s).....

2.10.3. Place of installation .....

2.10.4. Adjustment possibilities .....

2.11. CNG container

2.11.1. Make(s).....

2.11.2. Type(s) (include drawings).....

2.11.3. Number of containers .....

2.11.4. Total capacity ..... litres

2.11.5. Certification number .....

2.11.6. Drawings of the installation of the container .....

2.12. CNG container accessories

2.12.1. Level or pressure indicator:

2.12.1.1 Make(s) .....

2.12.1.2. Type(s) .....

2.12.2. Pressure relief valve (discharge valve):

2.12.2.1. Make(s) .....

2.12.2.2. Type(s) .....

2.12.3 Pressure relief device (fuse):

2.12.3.1. Make(s) .....

2.12.3.2 Type(s) .....

2.12.4. Remote controlled automatic valve with excess flow valve:

2.12.4.1. Make(s) .....

2.12.4.2. Type(s) .....

2.12.5. Gas-tight housing:

2.12.5.1. Make(s) .....

2.12.5.2. Type(s) .....

2.13. Automatic valve/check valve: yes/no 1/

2.13.1. Make(s) .....

2.13.2. Type(s) .....

2.13.3. Description and drawings .....

2.13.4. Operating pressure(s): 2/ ..... kPa

2.14. Filling unit: 1/

2.14.1. Make(s) .....

2.14.2. Type(s) .....

2.14.3. Description and drawings .....

2.15. Flexible fuel lines or hose(s):

2.15.1 Make(s) .....

2.15.2. Type(s).....

2.15.3. Description.....

2.15.4. Operating pressure(s): 2/ ..... kPa

2.16. Pressure and temperature sensor(s): 1/

2.16.1. Make(s).....

2.16.2. Type(s).....

2.16.3. Description.....

2.16.4. Operating pressure(s): 2/ ..... kPa

2.17. CNG filter: 1/

2.17.1. Make(s).....

2.17.2. Type(s).....

2.17.3. Description.....

2.17.4. Operating pressure(s): 2/ ..... kPa

2.18. Service coupling(s) (mono-fuel vehicle without limp-home system): 1/

2.18.1. Make(s).....

2.18.2. Type(s).....

2.18.3. Description and drawings installation .....

2.19. Connection to CNG system for heating system (allowed for M_2 and M_3 category of vehicles only): yes/no 1/

2.19.1. Make(s).....

2.19.2. Type(s).....

2.19.3. Description and drawings installation .....

2.20. Further documentation

2.20.1. Description of the CNG equipment and the physical safeguarding of the catalyst at switch-over from petrol to CNG or back.

2.20.2. System lay-out (electrical connections, vacuum connections compensation hoses, etc.)

2.20.3. Drawing of the symbol

2.20.4. Adjustment data

2.21. Cooling system: (liquid/air) 1/

2.21.1 System description/drawings with regard to the CNG equipment.....
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1/ Strike out what does not apply.

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Annex 4

DESCRIPTION OF THE LEAKAGE TEST PROCEDURES FOR CNG/LPG SYSTEMS INSTALLED ON VEHICLES

1. Scope

To describe the procedures to be undertaken by the installer to verify the gas tightness of the system.

2. The installation of the system shall be done in accordance with the installation manual provided by the retrofit system manufacturer, Part I and II.

3. Leakage test procedure for LPG systems

3.1. When the installation has been completed, the installer shall follow the proper assembly check, paragraph 7.1.4.2. and the start-up procedures described in paragraph 7.1.4.3. After that the system has been filled-up with LPG; it is necessary to check with a gas detector or a leakage fluid detector all the fittings and connections of the system. The solenoid valves must be in open position in order to subject all the components of the system to the service pressure. No evidence of leakage is permitted.

4. Leakage test procedures for CNG systems

4.1. When the installation has been completed, the installer shall follow the proper assembly check, paragraph 7.1.4.2 and the start-up procedures described in paragraph 7.1.4.3 After that the system has been filled-up with CNG, at the service pressure; it is necessary to check with a gas detector or a leakage fluid detector all the fittings and connections of the system. The solenoid valves must be in open position in order to subject all the components of the system to the service pressure. No evidence of leakage is permitted.

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Annex 5

PRESCRIPTIONS CONCERNING THE FIXATION OF LPG AND CNG CONTAINER(S)

1. The requirements of Regulation No. 67, 01 series of amendments, concerning the fixation of LPG container(s) or those of Regulation No. 110 concerning the fixation of CNG container(s) shall be deemed to be met if the container is secured to the motor vehicle by at least:

1.1. two straps per container,

1.2. four bolts, and

1.3. appropriate washers or plates if the body panels at that location are single thickness;

Assuming that the material grade is Fe 370, the fixing bolts shall be of class 8.8, and have the dimensions specified in Table 1 below:

Table 1

Container content [litres]	Minimum dimensions of the washers or plates [mm]	Minimum dimensions of the container straps [mm]	Minimum diameter of bolts [mm]
up to 85	round: 30 x 1.5 round: 25 x 2.5	20 x 3 30 x 1.5	8
85 - 100	round: 30 x 1.5 round: 25 x 2.5	30 x 3 20 x 3 */	10 8 */
100 - 150	round: 50 x 2 round: 30 x 3	50 x 6 50 x 3 **/	12 10 **/
more than 150	shall meet the provisions of Regulation No. 67, 01 series of amendments, for LPG containers, or Regulation No. 110 for CNG containers		

*/ In this case the container shall be secured by at least three container straps.
**/ In this case the container shall be secured by at least four container straps.

2. If the container is installed behind a seat, a total clearance of at least 100 mm, in the longitudinal direction of the vehicle, shall be provided. This clearance may be divided between the container and the rear panel of the vehicle and between the seat and the container.

3. If the container straps also carry the mass of the fuel container, at least three container straps shall be provided.

4. The container straps shall ensure that the fuel container will not slide, rotate or be dislodged.

5. A protective material such as felt, leather or plastic shall be interposed between the fuel container and the container straps.

6. Container frame

6.1. If the container is secured to the motor vehicle by a container frame and container straps, the container shall be secured to the container frame by at least two container straps.

6.2. If the container straps also carry the mass of the fuel container, at least three container straps shall be provided.

6.3. The container straps shall ensure that the fuel container will not slide, rotate or be dislodged.

6.4. A protective material such as felt, leather or plastic shall be interposed between the fuel container and the container straps.

6.5. If the cylindrical container is installed longitudinally to the vehicle, a transverse connection shall be present at the front of the container frame which is:

6.5.1. at least of the same thickness as the container frame;

6.5.2. at least 30 mm high and its top is at least 30 mm above the bottom of the container;

6.5.3. as close as possible, or even within, the domed end of the container.

By "installed longitudinally" it is meant that the axis of the cylindrical fuel container makes an angle of no more than 30 degrees with the longitudinal centre plane of the vehicle.

6.6. The container straps, washers, or plates and bolts used shall meet the provisions of paragraph 1 above.

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6.1.2.4.4. Notwithstanding the requirements of paragraph 6.1.2.4.3., for each pollutant or combination of pollutants, one of the three test results may exceed, by not more than 10 per cent, the limit prescribed, provided the arithmetical mean of the three results is below the prescribed limit. Where the prescribed limits are exceeded for more than one pollutant, it is immaterial whether this occurs in the same test or in different tests.

6.1.2.4.5. The number of emission tests prescribed in paragraph 6.1.2.4.3. can be reduced in the conditions hereinafter defined:

- only one test is performed if the result obtained for each pollutant subject to limitation is less than or equal to 0.7 the emission limit (i.e. $V1 \leq 0.70\ G$);

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- only two tests are performed if, for each pollutant subject to limitation the following requirements are met:

$$V1 \leq O.85\ G \text{ and } V1 + V2 \leq 1.70\ G \text{ and } V2 \leq G$$

where:

V1: value of the emission of one pollutant obtained from the first test of the Type I performed;

V 2: 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 ($CO/HC/NO_x$) according to the type approval of the vehicle(s) divided by the deterioration factors.

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The parent vehicle(s), equipped with the retrofit system, shall comply with the limit values according to the type approval of the original vehicle(s) including the deterioration factors applied during the type approval of the original vehicle(s).

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or with Regulation No. 49, 04 series of amendments, or with Directive

1999/96/EC,

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