

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

**Name of Organisation submitting Amendment/Work Item**

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**Regulation name and reference number**

Proposed amendment to supplement 4 to Regulation 115 (ECE/TRANS/WP.29/2009/117).

**Name of Amendment/Work Item**

Proposal for an amendment to Regulation 115 introducing a new class of bi-fuel vehicle/gas system and clarifying the requirements between all the classes.

**Specific language for Amendment/Work Item**

English

**Rationale: (Why is it important/required?)**

Specific provisions are necessary for gas systems intended to be fitted on direct injection petrol vehicles in order to safeguard the petrol injectors (a certain amount of petrol need to be injected also in gas mode, especially when particular temperature conditions are reached).

The proposed amendment introduces a new definition for these systems and sets the associated requirements (notably in Annex 6 where a methodology to measure the amount of LPG consumed plus a limit are introduced).

**Please submit new work items to:**

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**Changes to supplement 4 to Regulation 115 are made on bold characters and/or via strikethroughs :**

Clarification of the definitions via:

“

2. Definitions

...

2.1.3. "A vehicle is considered mono-fuel", when, after the retrofit operation, **it is designed primarily for permanent running on LPG or CNG, but may also have a petrol system for emergency purposes or starting only, where the petrol tank does not contain more than 15 litres of petrol** ~~it is equipped with a petrol tank of capacity  $\leq$  15 litres, that can only be used to "limp home"~~.

Remark:

1. If the petrol system may be used for emergency purposes and starting, I can not see any difference between mono-fuel vehicles and bi-fuel vehicles in terms of operation.. Both can run on petrol and LPG/CNG. Both can run on only one fuel at a time. The only difference is that mono-fuel vehicles are tested on LPG/CNG only, but bi-fuel ones on petrol and LPG/CNG. In my view the petrol system should be used for emergency purposes only.

2. In my view, the wording "the petrol tank does not contain more than 15 litres of petrol" may be interpreted to mean that the capacity of petrol tank may be higher than 15 litres, but the actual amount of fuel in it is not more than 15 litres. The current definition, it means "it is equipped with a petrol tank of capacity  $\leq$  15 litres", seems to be better. In 2.1.4 the word "capacity" is used.

3. I realized that the alignment with Regulation 692/2008 is what matters.

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.~~

1. **it is equipped with a gas storage and a separated petrol storage, with a capacity exceeding 15 litres; and**
2. **it can run on petrol (petrol mode) and also on either LPG or CNG (LPG or CNG mode); and**
3. **is designed to run on only one fuel at a time.**

Remark:

1. If my remarks to 2.1.3 are accepted, it is proposed to amend the point 1 to read:

~~"it is equipped with a gas storage and a separated petrol storage, with a capacity exceeding 15 litres; and"~~

2. It is proposed to amend the point 2 to read:

~~"it can run on petrol (petrol mode) and also on either LPG or CNG (LPG or CNG mode); in LPG or CNG mode the vehicle can run on petrol for a limited period of time"; and"~~

3. It is proposed to amend the point 3 to read:

~~"is designed to run on only one fuel at a time; the simultaneous operation on both the fuels is allowed during the fuel switch over for a short period of time."~~

2.1.5. **"A vehicle is considered bimix-fuel"** when, after the retrofit operation:

1. **it is equipped with a gas storage and a separated petrol storage, with a capacity exceeding 15 litres; and**

2. it can run on petrol (petrol mode) and also on either LPG or CNG (LPG or CNG mode); and
3. In gas mode it is designed to make a limited use of petrol also simultaneously with gas.

**Remark:**

1. If my remarks to 2.1.3 are accepted, it is proposed to amend the point 1 to read:  
“it is equipped with a gas storage and a separated petrol storage, ~~with a capacity exceeding 15 litres; and~~”

2.1.56. “*Master-slave system*” means a retrofit system in which the LPG Electronic Control Unit (ECU) or CNG ECU is able to translate the petrol ECU control strategy in LPG or CNG operation.

2.1.67. “*Original vehicle*” means a vehicle before the installation of the retrofit system.

Clarification of the requirements for each running mode:

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

- (a) LPG only (**LPG mode**) in case of (mono-fuel)<sup>4</sup>
- (b) ~~Both~~ **either** unleaded petrol (**petrol mode**) or LPG (**LPG mode**) in case of (bi-fuel) **and bimix-fuel**<sup>6</sup>
- (c) Both diesel fuel or diesel fuel and LPG (dual fuel)

(Provisions for dual fuel have still to be defined).

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Introduction of a new footnote 6 accordingly :

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**<sup>6</sup> In accordance with the paragraphs 6.1.2.4.1.6.1 and 6.1.2.4.1.6.2., in LPG mode it is permissible to use petrol up to the limits defined therein.**

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6.1.2.4.1.3. **Exhaust emissions test in petrol mode**

Subject to the requirements of paragraph 6.1.2.4.1.5., the tests shall be repeated three times using reference petrol. 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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6.1.2.4.1.6. **Exhaust emissions test in LPG mode**

Subject to the requirements of paragraph 6.1.2.4.1.8., the tests shall be repeated three times with each reference LPG.

The parent vehicle, 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).

6.1.2.4.1.6.1 **Additional requirements for mono-fuel and bi-fuel vehicles**

**It is permissible that the engine is started on petrol and switched to LPG after a predetermined period of time which cannot be changed by the driver**

If the parent vehicle complies with Regulation No. 83, 05 series of amendments, or with Directive 98/69/EC, or with Regulation No. 49, 04 series of amendments, or with Directive 1999/96/EC, the ~~vehicle shall not use petrol for more than a maximum of~~ **aforesaid period of time shall not exceed 90 seconds** during each test.

For vehicles complying with later series of amendments to Regulations Nos. 83 and 49, or later amending Directives or European Regulations, this period shall not exceed 60 seconds.

6.1.2.4.1.6.2 **Additional requirements for bimix-fuel vehicles**

**It is permissible to use petrol during the entire test cycle and also simultaneously with LPG provided that the consumption of LPG in energy unit is equal or higher than 80% of the total energy consumed during the test. This percentage shall be calculated in accordance with the methodology provided in Annex 6.**

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Addition of a new paragraph 1.a in Annex 1A “Communication” (renumbering to be done in due time):

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1. LPG retrofit equipment considered:

...

**1.a. Retrofit system for mono-fuel or bi-fuel vehicles/ bimix-fuel vehicles**<sup>2</sup>

2. Trade name or mark

“

Addition of a new paragraph 2.1.a in Annex 3A “Complete list of information for the purpose of the LPG retrofit system installed on vehicle type approval” (renumbering to be done in due time):

“

2. Description of the LPG retrofit system

2.1. Trade name or mark holder

**2.1.a Retrofit system for mono-fuel or bi-fuel vehicles/bimix-fuel vehicles**<sup>1</sup>

2.2. Identification type

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Addition of a new Annex 6 “Bi-mix vehicle Type 1 test - Calculation of LPG energy consumption”:

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**Annex 6**

**Bi-mix vehicle Type 1 test - Calculation of LPG energy consumption**

**1. Measurement of the LPG mass consumed during the cycle**

Measurement of the LPG mass consumed during the cycle shall be done by a fuel weighing system capable to measure the LPG storage container at the beginning and at the end of the test in accordance with the following:

(a) an accuracy of  $\pm 2$  per cent of the difference between the two readings at the beginning and the end of the test or better;

(b) a precision of  $\pm 1$  per cent of full scale or better.

Precautions shall be taken to avoid measurement errors.

Such precautions shall at least include the careful installation of the device according to the instrument manufacturers' recommendations and to good engineering practice

**2. Calculation of energy percentage of LPG use on total energy consumed**

The following condition shall be fulfilled:

$$M_{lpg} * 100 / (FC_{mean} * dist * d) \geq 80\%$$

Where

**M<sub>lpg</sub>**: the LPG mass consumed during the cycle

**FC<sub>mean</sub>**: the mean fuel consumption calculated in accordance with par. 6.1.2.4.3.2

**dist**= distance travelled during the cycle.

**d**=0.538kg/liter

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