

Bimix-fuel vehicles

Proposal of amendments to R. 115 and R 83

Context and targets

Based on the AEGPL document GFV-11-03 and the relevant comments made by the group during the 11th meeting held on 8 Nov 2010, AEGPL was asked to:

1. clarify the definition and the requirements applied to bi-fuel gas vehicles;
2. propose a clear definition and its associated requirements for a new class of gas systems/vehicles for which a more intensive use of petrol is allowed also simultaneously with gas (with a clear distinction between this new class and the bi-fuel gas systems/vehicles);
3. develop a reliable calculation/measurement method to limit the use of petrol for this new class of gas systems/vehicles.

In relation to first point, AEGPL realized that the present definition and requirements contained in R 83 are clear enough. So, an alignment of R 115 to R 83 was considered sufficient.

As regards the second point, a class "bimix-fuel gas vehicle" was defined and relevant additional requirements have been developed.

Concerning the third point, a direct and reliable measurement of LPG consumption based on a static fuel weighing instrument is proposed. In addition, instead of a maximum limit on the use of petrol, a minimum limit on LPG consumption has been set at 80% in energy unit.

R 115

Definitions

Alignment with R 83

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

R 115

Emission tests requirements

New title for par. 6.12.4.1.3.

6.1.2.4.1.3. Exhaust emissions test in petrol mode

New title for par 6.12.4.1.6.

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).

New sub-paras to distinguish requirements for bi-fuel and new category bimix-fuel vehicles

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) **aforsaid 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.

R 115

Emission tests requirements

A new paragraph to be added:

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.

R 115

Emission tests requirements

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 ± 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 ± 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:

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

Where

M_{lpg} : the LPG mass consumed during the cycle

FC_{mean} : the mean fuel consumption calculated in accordance with par. 6.1.2.4.3.2

$dist$: distance travelled during the cycle.

$d = 0.538 \text{ kg/liter}$

R 83

New definition and requirements

A new definition to be added:

2.23.2 “Bimix-fuel gas vehicle” means a vehicle with a gas storage and a separated petrol storage, of a capacity exceeding 15 litres, that can run on petrol (petrol mode) and also on either LPG or CNG (LPG or CNG mode), and in gas mode it is designed to make a limited use of petrol also simultaneously with gas.

A new paragraph to be added:

Annex 12

Granting of an ECE type approval for a vehicle fuelled by LPG or NG/biomethane

3.2.6. Notwithstanding the requirements of paragraphs [6.4.1.3.](#) of Annex 4a and [3.2.5.](#) of this annex, in case of bimix-fuel gas vehicle 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 Appendix 1 of this Annex.

R 83

New requirements

New part to be added after the annex 12:

Appendix 1 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 ± 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 ± 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_{lpg} : the LPG mass consumed during the cycle

FC_{mean} : the mean fuel consumption calculated in accordance with par. 6.1.2.4.3.2

$dist$ = distance travelled during the cycle.

$d=0.538\text{kg/liter}$

Thanks!

R83

Current provisions for bi-buel vehicles

Annex 4a

6.4.1.3. In cases where LPG or NG/biomethane is used as a fuel it is permissible that the engine is started on petrol and switched to LPG or NG/biomethane after a predetermined period of time which cannot be changed by the driver.

Annex 12

3.2.5. During the Type I test the vehicle shall only use petrol for a maximum of 60 seconds when operating in gas mode