



Economic and Social Council

Distr.: General
27 April 2012

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on Pollution and Energy

Sixty-fourth session

Geneva, 5–8 June 2012

Item 3(c) of the provisional agenda

Light vehicles: Regulation No. 83
(emissions of M₁ and N₁ vehicles)

Proposal for an amendment to Regulation No. 83

Submitted by the Chair of the informal group on Gaseous Fuelled Vehicles*

The text reproduced below was prepared by the Chair of the informal group on Gaseous Fuelled Vehicles (GFV) to redefine the class of bi-fuel vehicles to permit the simultaneous use of gas and petrol in gas mode in Regulation No. 83. This document is based on Informal document GRPE-63-05-Rev.1, distributed at the sixty-third session of the Working Party on Pollution and Energy (GRPE) and updated as indicated in ECE/TRANS/WP.29/GRPE/63, paragraph 54. The modifications to the original English text are marked using track changes. The same modifications in the French and Russian versions are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106 and ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Paragraphs 2.22.1., 2.23. and 2.23.1., amend to read:

- "2.22.1. "Mono-fuel gas vehicle" means a vehicle that is designed primarily for permanent running on LPG or NG/biomethane or hydrogen, but may also have a petrol system for emergency purposes or starting only, where the **capacity of the petrol tank does not contain more than exceed 15 litres of petrol.**
- 2.23. "Bi-fuel vehicle" means a vehicle with two separate fuel storage systems that ~~can run part time on two different fuels and is~~ designed to run on only one fuel at a time. **The simultaneous use of both fuels is limited in amount and duration.**
- 2.23.1. "Bi-fuel gas vehicle" means a bi fuel vehicle that can run on petrol (**petrol mode**) and also on either LPG, NG/biomethane or hydrogen (**gas mode**)."

Paragraph 6.4.1.3. of Annex 4a, amend to read:

- "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. **This period of time shall not exceed 60 seconds.**"

Paragraph 3.2.5. of Annex 12, amend to read:

- "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. Without prejudice to paragraph 6.4.1.3. of Annex 4a, during the Type I test, it is permissible to use petrol only or simultaneously with gas when operating in gas mode provided that the energy consumption of gas is higher than 80 per cent of the total amount of energy consumed during the test. This percentage shall be calculated in accordance with the method set out in Appendix 1 (LPG) or Appendix 2 (NG/biomethane) of this Annex. "~~

Annex 12, insert a new Appendix 1, to read:

"Annex 12 - Appendix 1

Bi-fuel gas vehicle - Calculation of LPG energy ratio

1. Measurement of the LPG mass consumed during the Type I test cycle
Measurement of the LPG mass consumed during the Type 1 test cycle shall be done by a fuel weighing system capable of measuring the weight of the LPG storage container during the test in accordance with the following:
an accuracy of ± 2 per cent of the difference between the readings at the beginning and at the end of the test 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.

Other measurement methods are permitted if an equivalent accuracy can be demonstrated.

2. Calculation of the LPG energy ratio

The fuel consumption value shall be calculated from the emissions of hydrocarbons, carbon monoxide, and carbon dioxide determined from the measurement results assuming that only LPG is burned during the test.

The LPG ratio of the energy consumed in the cycle is then determined as follows:

$$G_{LPG} = M_{LPG} * 100 / (FC_{norm} * dist * d)$$

Where:

G_{LPG} : the LPG energy ratio;

M_{LPG} : the LPG mass consumed during the cycle (kg);

FC_{norm} : the fuel consumption calculated in accordance with Paragraph 1.4.3., letter (b), of Annex 6 to Regulation No. 101. If applicable, the correction factor c_f shall be calculated using the H/C ratio of the gaseous fuel;

dist: distance travelled during the cycle (km);

d: density $d = 0.538 \text{ kg/liter}$."

Annex 12, insert a new Appendix 2, to read:

"Annex 12 - Appendix 2

Bi-fuel vehicle - Calculation of NG/biomethane energy ratio

1. Measurement of the CNG mass consumed during the Type I test cycle

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

an accuracy of ± 2 per cent of the difference between the readings at the beginning and at the end of the test 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.

Other measurement methods are permitted if an equivalent accuracy can be demonstrated.

2. Calculation of the CNG energy ratio

The fuel consumption value shall be calculated from the emissions of hydrocarbons, carbon monoxide, and carbon dioxide determined from the measurement results assuming that only CNG is burned during the test.

The CNG ratio of the energy consumed in the cycle is then determined as follows:

$$G_{\text{CNG}} = M_{\text{CNG}} * 100 / (FC_{\text{norm}} * \text{dist} * d)$$

Where:

G_{CNG}: the CNG energy ratio;

M_{CNG}: the CNG mass consumed during the cycle (kg);

FC_{norm}: the fuel consumption calculated in accordance with Paragraph 1.4.3., letter (c), of Annex 6 to Regulation No. 101;

dist: distance travelled during the cycle (km);

d: density $d = 0.654 \text{ kg/m}^3$."

II. Justification

These modifications are needed primarily for the approval of some bi-fuel vehicles equipped with petrol direct injection systems, where, in order to safeguard the petrol injectors, a certain amount of petrol may need to be injected also in gas mode, especially when particular temperature conditions are reached.

In order to avoid over-employment of petrol, provisions are provided to limit its use in amount and duration.

In particular, the limit of 60 seconds presently applied to the entire test cycle has been restricted to the starting-up phase of the engine while, over the cycle, a minimum limit has been fixed to gas energy ratio.

A standard calculation method of the gas energy ratio is provided, based on a direct measurement of the gas consumption and a conservative calculation of the total energy consumed during the cycle.

This is founded on the assumption that only gas is burned during the cycle in line with what is already applicable in accordance with the present regulation (the use of petrol is allowed within the time limit of 60 seconds)

Indeed, such an assumption ensures a conservative condition to the calculation of total energy consumed as well as of pollutant emissions.

Correction factors of pollutant emissions are, in fact, only slightly dependent on fuel type and, the error committed under this hypothesis is conservative – and negligible – with respect to the real case, where a minor use of petrol is done.

For further clarifications see document GFV-16-02.
