United Nations ECE/TRANS/WP.29/GRSG/2013/29

Economic and Social Council

Distr.: General
24 July 2013

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on General Safety Provisions

105th session
Geneva, 8–11 October 2013
Items 8 of the provisional agenda
Regulation No. 67 (LPG vehicles)

Proposal for amendments to Regulation No. 67 (LPG vehicles)

Submitted by the expert from the European Liquefied Petroleum Gas Association*

The text reproduced below was prepared by the expert from the European Liquefied Petroleum Gas Association (AEGPL) to introduce new provisions into Regulation No. 67 for preventing a flow of liquefied petroleum gas (LPG) into the petrol or diesel tank, and vice versa. This may create safety problems, in the case of bi-fuel or dual-fuel vehicles for which such an event can occur. The modifications to the existing text of the Regulation are marked in bold 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

Part II, insert new paragraphs 17.1.7.6. to 17.1.7.9., to read:

"**17.1.7.6.** **Means shall be provided to prevent any flow of gaseous fuel into the petrol or diesel tank under all operating temperature, pressure conditions as well as in case of a fault. These measures shall be demonstrated during the type approval.**

17.1.7.7. **Means shall be provided to prevent flows of petrol or diesel into the LPG fuel tank which could lead to:**

(a) **An overfilling of the LPG tank (i.e. above 80 per cent of its capacity);**

(b) **And/or a content of petrol or diesel higher than 12 per cent of the LPG tank capacity.**

17.1.7.8. **The provisions of paragraph 17.1.7.7. shall be considered under all operating temperature and pressure conditions as well as in case of a fault, e.g. by use of redundant components, activation of limp home mode or of a malfunction indication to the driver. These measures shall be demonstrated during the type approval.**

17.1.7.9. **If flows of petrol or diesel into LPG tank are likely to occur under the provisions of paragraph 17.1.7.7., non-metallic LPG components, [including flexible hoses and their elements,] and non-metallic parts of LPG components which may come into contact with petrol or diesel shall meet the requirements set out, respectively, in paragraphs 1. or 2. of Annex 18 to this Regulation.**"

Insert a new Annex 18, to read:

"Annex 18

Provisions regarding compatibility of non-metallic components and parts with petrol or diesel

1. **Petrol compatibility tests for non-metallic components and parts**

1.1. **Non-metallic components or parts which may come into contact with petrol [under the provisions of paragraph 17.1.7.7.] shall not show excessive volume change or loss of weight.**

Resistance to petrol according to ISO 1817 with the following conditions:

(a) **Medium: petrol (E5) complying with Annex 10 to Regulation No. 83;**

(b) **Temperature: 23 °C (tolerance acc. to ISO 1817);**

(c) **Immersion period: 72 hours.**

1.2. **Requirements:**

Maximum change in volume 20 per cent

After storage in air with a temperature of 40 ºC for a period of 48 hours, the mass compared to the original value may not decrease more than 5 per cent.

2. Diesel compatibility tests for non-metallic components and parts

2.1. Non-metallic components or parts which may come into contact with diesel [under the provisions of paragraph 17.1.7.7.] shall not show excessive volume change or loss of weight.

Resistance to diesel according to ISO 1817 with the following conditions:

(a) Medium: diesel (B5) complying with Annex 10 to Regulation No. 83;

(b) Temperature: 23 °C (tolerance acc. to ISO 1817);

(c) Immersion period: 72 hours.

2.2. Requirements:

Maximum change in volume 20 per cent.

After storage in air with a temperature of 40 ºC for a period of 48 hours, the mass compared to the original value may not decrease more than 5 per cent."

II. Justification

1. New paragraph 17.1.7.6. aims at preventing any flow of LPG into the petrol or diesel tank as the introduction of such a much more volatile fuel could lead to an increase of the internal pressure in the tank above its design pressure. This is a general requirement (para. 17.1.) and, therefore, applicable to the entire gas system and, hence, in all operating conditions, including – but not exclusively – the "fuel selection system" and the related switch over phases (ECE/TRANS/WP.29/GRSG/2013/11).

2. New paragraphs 17.1.7.7. to 17.1.7.9. and new Annex 18 aim, overall, at improving the safety aspects of gas systems which, by their architectural nature, allow limited flows of petrol or diesel into the LPG tank. This is, for instance, the case of current LPG direct injection systems, in all the versions available today on the market, regardless of the manufacturer: in the rare cases in which the system acts, automatically or upon user's request, a switch over between operational modes (for example, when the LPG tank is nearing empty) a small flow of petrol is flushed into the LPG tank.

3. The unconditioned prohibition of such reverse flows would determine the unjustifiable ban from the market of such innovative systems to the avoid detriment of the environment.

4. As these new gas systems significantly reduce the emission of pollutants and greenhouse gases with respect to analogous petrol technologies.

5. In particular, paragraph 17.1.7.7. observes that:

(a) The presence of petrol or diesel in the LPG tank does not create pressure-related risks as both liquid fuels have a lower volatility, indeed their mixing with the gaseous fuel can only reduce the internal pressure at the same temperatures;

(b) The provision of subparagraph (a) aims at preventing the risk that even a minimum amount of petrol or diesel could cause an overfilling of the LPG tank (above 80 per cent of its capacity); the reading of the actual liquid level inside the LPG tank allows to inhibit, if necessary, all the events which can lead to further reverse flows of petrol or diesel (for instance, the switch over operation in the case of LPG direct injection systems);

(c) The provision of subparagraph (b) ensures that the content of petrol or diesel in the LPG tank does not exceed the emission-related limits (applicable in gas mode). The

percentage permitted under the recent updates of the Regulation No. 83 is 20 per cent in energy unit. For simplicity, the prescription has been expressed in percentage by volume and a single value has been chosen corresponding to the lowest one, given the slight differences between the two numbers. Below is a conversion table from energy unit to volume.

6. New paragraph 17.1.7.8. requires that the provisions above are respected in all temperature and pressure conditions also by use of redundant solutions. In the case of LPG direct injection systems, the equipment (being able to monitor the volume of LPG loaded at each refuelling operation, the petrol flow at each switch over phase and the fuel consumption between these events) will inhibit any further flow if the maximum permissible limit (12 per cent) is exceeded.

7. By virtue of new paragraph 17.1.7.9. and new Annex 18 therein referred to, each non-metallic component or component part, which may come into contact with petrol or diesel, will have to be chemically compatible with these fuels.

8. Annex 18 requires a compatibility test with standard petrol or diesel in accordance with the same stringency conditions and acceptability criteria provided in the case of the compatibility test with LPG.

Fuel	*CV [MJ/kg]*	*Density [kg/l]*	*CV [MJ/kg]*	*Max. energy ratio [%]*	*Volume ratio of 80 % capacity [%]*	*Volume ratio of total capacity [%]*
Petrol	43.6	0.75	33	20	16	13
LPG	46.1	0.75	25	20	84	67

Fuel	*CV [MJ/kg]*	*Density [kg/l]*	*CV [MJ/kg]*	*Max. energy ratio [%]*	*Volume ratio of 80 % capacity [%]*	*Volume ratio of total capacity [%]*
Diesel	44.4	0.835	37	20	15	12
LPG	46.1	0.75	25	20	85	68