

**INFORMAL GROUP ON GASEOUS FUEL VEHICLES**  
**Within the UN GRPE (WP29)**  
**NEW WORK ITEM**  
**March 2009**

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

**Person submitting Item**  
André Rijnders

**Address/phone/email coordinates**  
RDW  
Vehicle Standards Development Dept.  
Po Box 777  
2700 AT Zoetermeer  
The Netherlands  
Tel +31.79.3458196  
mail arijnders@rdw.nl

**Regulation name and reference number**  
UN ECE Regulation 115

**Name of Amendment/Work Item**  
Proposed Amendment to the Total Hydrocarbon Emissions Limit Value for Natural Gas Vehicles

**Specific language for Amendment/Work Item**  
**Amendment:**

6.1.2.3. 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**)
- (c) both diesel fuel or diesel fuel and LPG (**dual fuel**)  
**(provisions for dual fuel to be defined)**

6.1.2.5.1.1. Three measurements of tailpipe emissions shall be performed after a cold start with each fuel:

- (i) reference petrol,
- (ii) reference LPG A,
- (iii) reference LPG B.

The emissions of CO, HC, **and** NO<sub>x</sub> ~~and HC + NO<sub>x</sub>~~ are calculated according to Regulation No. 83. 4/

6.1.2.5.1.3. The requirements regarding emissions of the vehicle(s) equipped with the retrofit system, and with the two reference gases, shall be deemed to be fulfilled if the results meet the following conditions for each regulated pollutant (~~CO, HC + NO<sub>x</sub>~~) or (CO, HC, NO<sub>x</sub>) according to the requirements the petrol parent vehicle had to comply with at the date of its approval:

- (1)  $(MA + MB)/2 < 0.85S + 0.4G$
- (2)  $MA \text{ and } MB < G$

where:

- MA: mean value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) ~~4/ or the sum of two pollutants (HC + NO<sub>x</sub>)~~ obtained from the three Type I tests with the retrofit system and with LPG A,
- MB: mean value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) ~~4/ of the sum of two pollutants (HC + NO<sub>x</sub>)~~ obtained from the three Type I tests with the retrofit system and with LPG B,
- S: mean value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) ~~4/ or the sum of two pollutants (HC + NO<sub>x</sub>)~~ obtained from the three Type I tests with the reference petrol,
- G: limit value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) ~~4/ or the sum of two pollutants (HC + NO<sub>x</sub>)~~ according to the type approval of the vehicle(s) divided by the deterioration factors.

6.1.2.5.1.4.2. The number of emission tests to be performed on one LPG reference fuel can be reduced in the conditions hereinafter defined:

- only one test is performed if the result obtained for each pollutant ~~or for the combined emission of two pollutants~~ subject to limitation is less than or equal to 0.7 the emission limit (i.e.  $M1 \leq 0.70 G$ );
- only two tests are performed if, for each pollutant ~~or for the combined emission of two pollutants~~ subject to limitation the following requirements are met:

$$M1 \leq 0.85 G \text{ and } M1 + M2 \leq 1.70 G \text{ and } M2 \leq G$$

where:

- M1: value of the emission of one pollutant obtained from the first test of the Type I performed;
- M2: 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<sub>x</sub>) or the sum of two pollutants ~~(HC + NO<sub>x</sub>)~~ according to the type approval of the vehicle(s) divided by the deterioration factors.

6.1.2.6. Exhaust emissions (M<sub>2</sub>, M<sub>3</sub>, N<sub>2</sub> and N<sub>3</sub> categories of vehicles)

**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.**

→ ***Futher text deleted.***

6.1.3.3. Engine dynamometer method:

The maximum power at the crankshaft is measured on an engine dynamometer according to Regulation No. 85 for each parent vehicle(s) with the following fuels:

- (i) commercial petrol ~~or diesel fuel~~,
- (ii) commercial LPG,

6.2.2.3. Fuel requirements by the engine, the type of fuels normally used by the engine:

- (a) CNG only (**monofuel**)
- (b) both unleaded petrol or CNG (**bi-fuel**)
- (c) both diesel fuel or diesel fuel and CNG (**dual fuel**)  
**(provisions for dual fuel to be defined)**

6.2.2.5.1.1. Three measurements of tailpipe emissions shall be performed after a cold start with each fuel:

- (i) reference petrol,
- (ii) reference G20 fuel,
- (iii) reference G25 fuel.

The emissions of CO, HC, ~~and NO<sub>x</sub> and HC + NO<sub>x</sub>~~ are calculated according Regulation No. 83. 4/

6.2.2.5.1.3. The requirements regarding emissions of the vehicle(s) equipped with the retrofit system, and with the two reference gases, shall be deemed to be fulfilled if the results meet the following conditions for each regulated pollutant ~~(CO, HC + NO<sub>x</sub>) or~~ (CO, HC, NO<sub>x</sub>) according to the requirements the petrol parent vehicle had to comply with at the date of its approval:

- (1)  $(MA + MB)/2 < 0.85S + 0.4G$
- (2)  $MA \text{ and } MB < G$

where:

MA: mean value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) 4/ ~~or the sum of two pollutants (HC + NO<sub>x</sub>)~~ obtained from the three Type I tests with the retrofit system and with G<sub>20</sub>,

MB: mean value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) 4/ ~~of the sum of two pollutants (HC + NO<sub>x</sub>)~~ obtained from the three Type I tests with the retrofit system and with G<sub>25</sub>,

S: mean value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) 4/ ~~or the sum of two pollutants (HC + NO<sub>x</sub>)~~ obtained from the three Type I tests with the reference petrol,

G: limit value of the emissions of one pollutant (CO/HC/NO<sub>x</sub>) 4/ ~~or the sum of two pollutants (HC + NO<sub>x</sub>)~~ according to the type approval of the vehicle(s) divided by the deterioration factors.

**Option a)**

For vehicles with an initial type approval according to Row B (2005) of the table in paragraph 5.3.1.4. of Regulation No. 83 to the 05 series of amendments the HC emissions shall be measured as NMHC and CH<sub>4</sub>. The mean value of HC shall be corrected in two pollutants HC<sub>a</sub> and HC<sub>b</sub> as follows:

(a)  $HC_a = 1.5 \text{ NMHC}$

(b)  $HC_b = [0.5] \text{ CH}_4$

The measured value of HC<sub>a</sub> and HC<sub>b</sub> shall be used separately in the calculation for determination of compliance of the emission of HC.

For vehicles with an initial type approval according to tabel 1 [or 2] in paragraph 5.3.1.4. of Regulation No. 83 to the 06 series of amendments the THC emissions shall be read as CH<sub>4</sub> and the measured CH<sub>4</sub> emission in the tests shall be multiplied by the factor [0.5] . The result of the emissions shall be less the the limit value shown in the tabel.

**Or**

**Option b)**

For vehicles with an initial type approval according to Row B (2005) of the table in paragraph 5.3.1.4. of Regulation No. 83 to the 05 series of amendments the HC emissions shall be **read** as NMHC.

For vehicles with an initial type approval according to tabel 1 [or 2] in paragraph 5.3.1.4. of Regulation No. 83 to the 06 series the limits of THC emissions is not applicable when the engine is running on Natural Gas.

6.2.2.5.1.4.2. The number of emission tests to be performed on one CNG reference fuel can be reduced in the conditions hereinafter defined:

- only one test is performed if the result obtained for each pollutant ~~or for the combined emission of two pollutants~~ subject to limitation is less than or equal to 0.7 the emission limit (i.e.  $M1 \leq 0.70 \text{ G}$ );
- only two tests are performed if, for each pollutant ~~or for the combined emission of two pollutants~~ subject to limitation the following requirements are met:

$$M1 \leq 0.85 \text{ G and } M1 + M2 \leq 1.70 \text{ G and } M2 \leq \text{G}$$

where:

M1: value of the emission of one pollutant obtained from the first test of the Type I performed;

M2: 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<sub>x</sub>) ~~or the sum of two pollutants (HC + NO<sub>x</sub>)~~ according to the type approval of the vehicle(s) divided by the deterioration factors.

**Option a)**

For vehicles with an initial type approval according to Row B (2005) of the table in paragraph 5.3.1.4. of Regulation No. 83 to the 05 series of amendments the HC emissions shall be measured as NMHC and CH<sub>4</sub>. The mean value of HC shall be corrected in two pollutants HC<sub>a</sub> and HC<sub>b</sub> as follows:

(c) HC<sub>a</sub> = 1.5 NMHC

(d) HC<sub>b</sub> = [0.5] CH<sub>4</sub>

The measured value of HC<sub>a</sub> and HC<sub>b</sub> shall be used separately in the calculation for determination of compliance of the emission of HC.

**For vehicles with an initial type approval according to tabel 1 [or 2] in paragraph 5.3.1.4. of Regulation No. 83 to the 06 series of amendments the THC emissions shall be read as CH<sub>4</sub> and the measured CH<sub>4</sub> emission in the tests shall be multiplied by the factor [0.5] . The result of the emissions shall be less the the limit value shown in the tabel.**

**Or**

**Option b)**

For vehicles with an initial type approval according to Row B (2005) of the table in paragraph 5.3.1.4. of Regulation No. 83 to the 05 series of amendments the HC emissions shall be **read** as NMHC.

**For vehicles with an initial type approval according to tabel 1 [or 2] in paragraph 5.3.1.4. of Regulation No. 83 to the 06 series the limits of THC emissions is not applicable when the engine is running on Natural Gas.**

6.2.2.6. Exhaust emissions (M<sub>2</sub>, M<sub>3</sub>, N<sub>2</sub> and N<sub>3</sub> categories of vehicles)

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

*Futher text deleted.*

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

- The HC +NO<sub>x</sub> emission level can be deleted since the R.115 is only applicable for R83 05 series of amendments. In this 05 series the limit values for the combination of HC and NO<sub>x</sub> does not exist anymore.

- The NMHC could be 50 % more stringent than the THC value because the limit is achievable but still represents a significant reduction over gasoline vehicles. The CH<sub>4</sub> emission limit is 50 % less stringent than the THC value because the HC value in R83 was originally defined for petrol. The highly stable CH<sub>4</sub> molecule is difficult to convert, especial for retrofit systems on a vehicle with a catalyst designed for petrol. CH<sub>4</sub> has very low reactivity and is not toxic or carcinogenic and not considered as an ozone precursor. A higher limit value for CH<sub>4</sub> is justified.
- European, U.S. and California precedents exist for an NMHC standard. An NMHC standard has been recognized in Europe for heavy duty vehicles in 1999 in an amendment (1999/96/EC) to 88/77/EEC; in the U.S. Clean Air Act Amendments of 1990; and in California (identifying separately non-methane organic gases).
- Clarification: In this Regulation no requirement for dual fuel systems are defined. It is not possible to deliver an approval for dual fuel retrofit systems at the moment.

**Andre Rijnders, Chairman (RDW, Netherlands) [arijnders@rdw.nl](mailto:arijnders@rdw.nl)**

**Co-secretariat(s)**

**Jeffrey Seisler (IANGV/Clean Fuels Consulting) [jseisler@cleanfuelsconsulting.org](mailto:jseisler@cleanfuelsconsulting.org)**

**Arnaud Duvielbuerbigny (AEGPL) [arnaud.duvielbuerbigny@aeqpl.be](mailto:arnaud.duvielbuerbigny@aeqpl.be)**