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Item 6(c) of the provisional agenda

AMENDMENTS TO UNECE REGULATIONS

Regulation No. 83
(Emissions of M_1 and N_1 categories of vehicles)

Proposal for draft amendments to Regulation No. 83

Submitted by the expert from the International Organization of Motor Vehicle Manufacturers [1]

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA) to amend the requirements in the Regulation to clarify and update the specifications for the Flame Ionisation Detector (FID) hydrocarbon analyser which is used during testing of the vehicle. The modifications to the current text of the Regulation are marked in **bold** and strikethrough characters.

[1] In accordance with the programme of work of the Inland Transport Committee for 2006-2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance performance of vehicles. The present document is submitted in conformity with that mandate.

A. PROPOSAL

Annex 4,

Paragraph 4.3.1.1., amend to read:

"4.3.1.1. Pollutant gases shall be analysed with the following instruments:

Carbon monoxide (CO) and carbon dioxide (CO_2) analysis:
Analysers shall be of the non-dispersive infra-red (NDIR) absorption type.

~~**Hydrocarbons (HC) analysis - spark ignition engines:**~~
~~**The analyser shall be of the flame ionisation (FID) type calibrated with propane gas expressed equivalent to carbon atoms (C_1).**~~

Hydrocarbons (HC) analysis ~~**- compression ignition engines**~~:
The analyser shall be of the flame ionisation type with detector, valves, pipework, etc. **At the manufacturers request, it may be** heated to 463 K (190 °C) ± 10 K (HFID). It shall be calibrated with propane gas expressed equivalent to carbon atoms (C_1).

……"

Paragraph 4.3.2., amend to read:

"4.3.2. Particular requirements for ~~**compression ignition engines**~~ **heated flame ionisation detectors (HFID)**

A heated sample line for a continuous HC-analysis with the **heated** flame ionisation detector (HFID), including recorder (R) shall be used. The average concentration of the measured hydrocarbons shall be determined by integration. Throughout the test, the temperature of the heated sample line shall be controlled at 463 K (190 °C) ±10 K. The heated sampling line shall be fitted with a heated filter (F_H) 99 per cent efficient with particles ≥ 0.3 μm, to extract any solid particles from the continuous flow of gas required for analysis.

The sampling system response time ……"

Paragraph 7.2.8., amend to read:

"7.2.8. The figure adopted for the content of the gases in each of the pollutants measured shall be that read off after stabilisation of the measuring device. Hydrocarbon mass emissions ~~of compression ignition engines~~ **measured using heated FID devices** shall be calculated from the integrated HFID reading, corrected for varying flow if necessary, as shown in Appendix 5 to this annex."

Appendix 5, paragraph 3.1.4., amend to read:

"3.1.4. Additional equipment required when testing ~~compression ignition engined vehicles~~ **with heated FID devices.**

~~To comply with the requirements of~~ **As stated in** paragraphs 4.3.1.1. and 4.3.2. of Annex 4, the additional components within the dotted lines in Figure 5/3 ~~shall~~ **may** be used when testing ~~compression ignition engined~~ vehicles:

Fh is a heated filter,

……"

Appendix 8, paragraph 2., amend to read:

"2. SPECIAL PROVISIONS FOR ~~VEHICLES EQUIPPED WITH COMPRESSION IGNITION ENGINES~~ **USING HFID DEVICES AND FOR MEASUREMENT OF PARTICULATES**

2.1. Determination of HC ~~for compression ignition engines~~ **using HFID**

To calculate HC-mass emission ~~for compression ignition engines~~ **using HFID**, the average HC concentration is calculated ……"

B. JUSTIFICATION

In Regulation No. 83, the Flame Ionisation Detector (FID) is the prescribed technology for the measurement of hydrocarbon emissions.

At the time, when the requirements for FID were established, it was accepted that although heating was not required for the testing of spark ignition engines, it was however needed for compression ignition engines. This was due to the lower volatility of diesel fuel resulting in some of the unburnt hydrocarbons condensing in the sampling tract and not reaching the measurement system. The application of line heating prevented this effect.

Recent testing of Euro 4 standard diesel engined vehicles has however revealed that the heating of the FID analyser no longer had a significant influence on the emissions results (see summary of about 400 comparative tests). Although of course diesel reference fuel has not changed in terms of volatility between Euro 3 and 4, this can be explained through the effects of two different processes:

Firstly, as the more volatile fuel components are the more combustible, the unburnt components will be disproportionately high in low volatile hydrocarbons. A reduction in the emission limits has then brought about higher injection pressures and other technologies to improve combustion which has naturally reversed this balance.

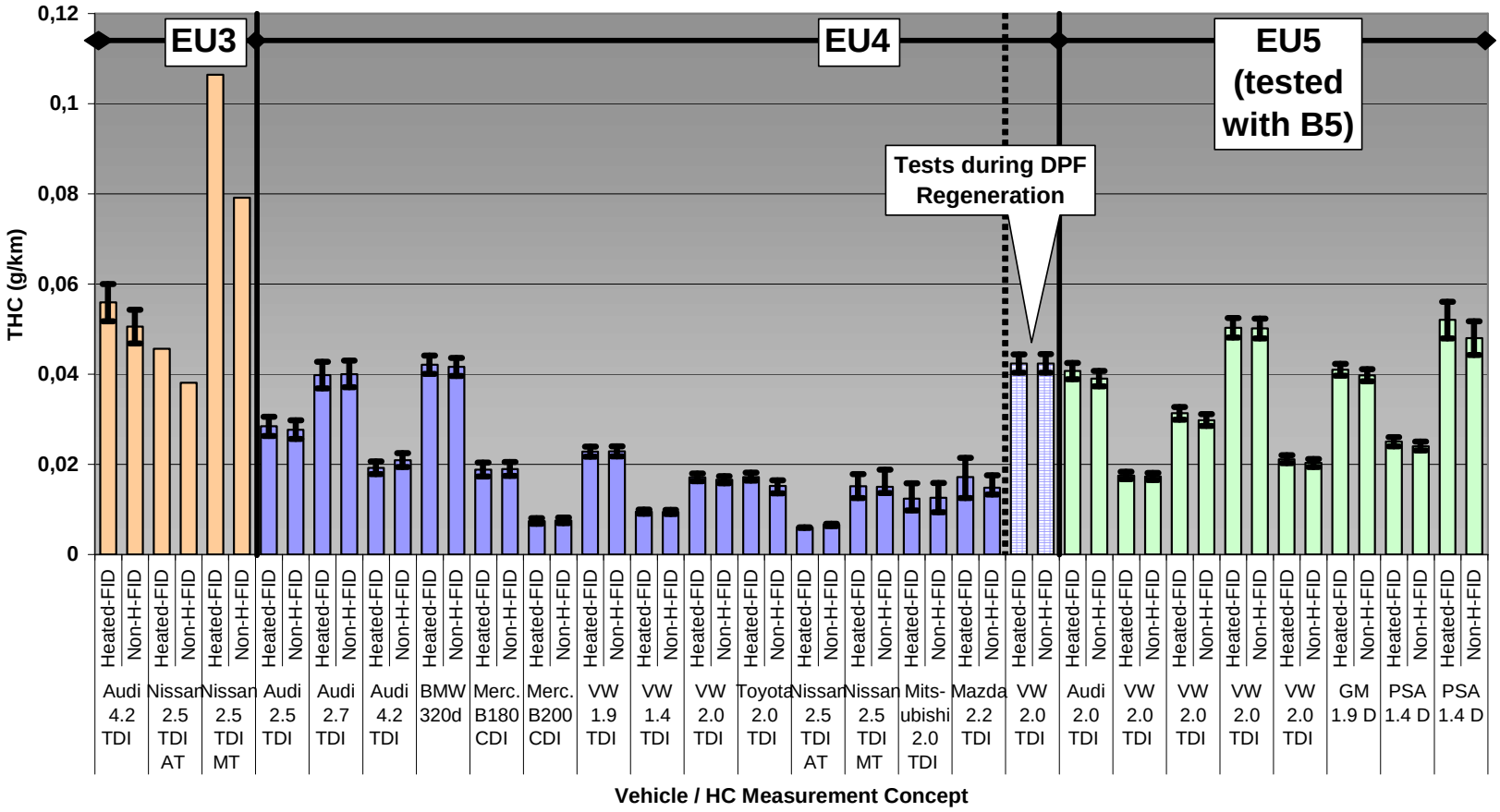
Secondly, it is the longer chain hydrocarbons that are the less volatile, these long chain molecules are however the more reactive. As the reduction in emissions limits has led to higher catalyst precious metal loadings and earlier light-off times, the long chain hydrocarbons in the exhaust stream have been reduced to insignificant levels similar to those from spark ignition engines.

As the reference fuel changes from pure diesel at Euro 4 (B0) to diesel containing 5 per cent FAME or Biodiesel at Euro 5 (B5), a number of vehicles have been tested using B5 fuel. This was also seen to have negligible effect on the emissions results.

Euro 5 will apply particulate mass limits for vehicles equipped with a direct injection spark ignition engine and Euro 6 will add particle number (PN) limits, thus making the common use of test facilities an item of greater interest in the near future. This ability to communize will bring flexibility and, thereby, cost reduction that will benefit both manufacturers and technical services alike, without influence on the test results.

In view of the above, it is logical to amend Regulation No. 83 to permit non-heated or heated FID devices for all testing.

Comparison of THC Measurements with heated (Diesel) and non-heated (Otto) FID
(approx. 400 European emission tests from various manufacturers)



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