

MEETING MINUTES
Informal Group on Gaseous Fuelled Vehicles
GFV-29
Shell Headquarters, The Hague, Netherlands
3-4 December 2013

Tuesday, 3rd December 2013

10.00-17.00

Location: Shell Headquarters, Carel van Bylandtlaan (C23)
Building C 16; 2nd Floor, Meeting Room C16/2A34

I. Welcome and Introduction

1. Kaushik Burman (Shell) welcomed the group to Shell Headquarters
2. Mr. Rijnders, the Chairman, welcomed the group to the Hague and the Netherlands. The participants did a round-table self-introduction.

II. Agenda for today (changes/additions)

3. The agenda point IV will be skipped so the order of agenda points are changed. No changes were made to the agenda.

III. Adoption of minutes of the 28th GFV on 12th September 2013 (GFV-28-08)

4. The minutes of the previous meeting were adopted without change.

IV. Agenda point VI: Process of the GFV HDDF Retrofit task-force activity, (André Rijnders). (Document GFV 29-06). Mr. Rijnders provided an update and background to the dual-fuel work of the Heavy Duty Dual-Fuel Task Force (HDDF TF) within the GFV.

5. Mr. Martinez (European Commission) indicated that Regulation 582/2011 (Euro VI) concerning dual-fuel that the 3rd round of Comitology adopted in July 2013 still is in progress. Publication is expected soon, by the end of January 2014.
6. Decision by the 66th GRPE endorsed the GFV proposal to develop a new UN regulation for HDDF retrofit systems. The initial basic principles have been discussed in the first instance and ACEA/OICA have made suggestions about the framework for a new regulation. AEGPL also has begun developing an initial document that can be a starting point as the basis for the new regulation.
7. Timing of the Retrofit Amendments is now targeted to be completed by the June 2015 WP29 meeting based on the following schedule: 1) an informal document is anticipated for the June 2014 GRPE-69 meeting; 2) a formal document is anticipated in January 2015 for the GRPE-70 meeting and for adoption; 3) If this occurs then the amendments could be approved by WP29 in June 2015.
8. Mr. Stoehr (AEGPL) prefers a robust and usable framework and draft based on experience gained in the field. He cautions about rushing the development process to ensure that the amendments that are developed will be functional.
9. Organization of the activities of fundamentals, principles and process. 1) A chair needs to be selected; 2) NGV Global (Jeff Seisler) will provide secretariat services to the group (which has been done previously on an ad-hoc basis, as needed by the previous co-chairmen – Mr. Renaudin and Mr. Dekker). 3) Mr. Renaudin will not chair this new retrofit activity, however, Mr. Dekker (TNO) as a 'neutral' stakeholder could chair the new retrofit work subject to the group's approval.
10. When asked, the group strongly supported Mr. Dekker as the Chairman overseeing the new retrofit work of the HDDF TF.

11. Jaime D'Alamo (NGVAE) (not present at this meeting) informed Mr. Rijnders prior to this meeting that he is leaving the association so, in the first instance, NGVAE will not have a representative to the GFV until a replacement for Mr. D'Alamo is found. This might be provided through an NGVAE member company on an interim basis.
12. Fundamentals and principles of HDDF retrofit have been discussed and agreed: first Euro IV and Euro V will be completed, with Euro VI to be discussed by the European Commission. Only type B dual-fuel engines will be addressed. Mr. Martinez said that a precedent has been set in the Retrofit Emissions Control (REC). Care must be taken to make the regulations robust but not overly restrictive.
13. Mr. Whelan indicated that the US regulations for dual-fuel retrofits were made somewhat less rigorous in deference to motivating the technology to develop and move forward in the marketplace. Clearly, however, there will be different views between the original equipment manufacturers (OEMs) and the retrofit industry.
14. There is a general discussion of the retrofit vs OEM approach to developing the regulation. The retrofit industry does not have the same, large development budget as the OEMs, therefore, it is better and easier to begin with Euro IV and V.
15. The Chairman indicates that it should be possible to develop a robust retrofit regulation for the earlier Euro stages. The final regulation must be accepted in its entirety (under the 1958 agreement). Contracting Parties (CP) might still have or will use conditions for retrofit that are less rigorous than the new activity to develop a UNECE Regulation. This should not create a problem to agree with the new ECE Regulation. But if a CP has already more stringent National Regulations for retrofit than this could create problems because the CP has to accept UNECE certificates without creating additional, more stringent national requirements.
16. Mr. Stoehr indicated that care also must be taken to focus on the emissions results of these heavy-duty dual-fuel retrofits. He will provide some documents from Germany TUV (in English) as a possible guideline. Emission limits: even if the parent engine (the diesel) is not compliant with the emission limits, the parent engine equipped with the dual-fuel retrofit system shall meet the original emission values. As with other working groups the HDDF TF should prepare an 'open issue list' particularly when implementation ultimately will be at the GRPE level.
17. The Chairman proposed an example of an Excel-format 'open issue list' for organizing our pending issues and decisions in the task force, GFV and GRPE. The GFV agrees to use this format.
18. Prelude to the OICA documents: two definitions are proposed for retrofits and conversions:
 - Retrofit: fitting new elements of design to an approved engine system without substantially modifying its emission strategies (e.g. fitting a particulate filter).
 - Conversion: fitting new elements of design to an approved engine system and/or substantially changing its emission or operating strategies (e.g. in view of letting it run with a different fuel)

In light of these definitions, OICA assumes that the retrofitting of any dual-fuel system (on either a running vehicle or a running engine) has to be considered as a "conversion" and, therefore, the converter becomes the new engine manufacturer and takes the full responsibility for the engine in-service conformity, while the original engine manufacturer shall not be considered responsible in any manner of the non-compliance of a converted engine system
19. Discussion: it is noted that not all the dual-fuel systems can be considered "conversions", as defined by OICA. Furthermore it was recognized that the term 'conversions' is a new working and definition that could effect more kinds of

modifications, like chip tuning. It is a fundamental discussion that will affect other regulations.

20. The GFV participants agreed to keep the historical wording “retrofit” system for our assembly of gas components fitted in after-market equipment in order to avoid any confusion. A sub-classification among HDDF retrofit systems can be taken into account in order to distinguish those systems which “substantially” modify emission and operating strategies from those that do not. In this case, a clarification about “substantially” is also needed. Ideas like intrusive and non-intrusive systems also need clarification.
21. AEGPL asked for further clarifications about which “responsibilities” the retrofit system manufacturers should take in the case its system was considered to be “substantially” modified (original) emission or operating strategies. In other words, excluding commercial responsibilities that are out of R. 49 scope, as well as conformity of the engine production (being the engine is “used” and not produced by the retrofit system manufacturer) which responsibilities related to provisions in R. 49 should be regulated? AEGPL asked to clarify the in-use conformity responsibilities.
22. AECC commented (GFV 29-05rev1): regarding the OICA definitions of “conversions” and “retrofits”, AECC highlighted that installation of an SCR system (to meet Retrofit Class III of the recently-agreed retrofit Reg.) or a combined DPF & de-NOx system (to meet Retrofit Class IV) would fall in the definition of “conversions” with all the legal consequences, i.e. responsibilities related to R 49 and to the Retrofit of Emissions Control (REC) (as proposed by OICA).
23. The Chairman concluded that this is a fundamental discussion and should be discussed again; also with OICA and AECC present.

V. Agenda Point VII. Dutch HDDF Test Program (Henk Dekker, TNO) (See document GFV 29-07)

24. This was a two year program, between 2011-2013
25. Three types of testing regimes were used: an engine test stand; simulation of ESC/ETC on a vehicle/powertrain test stand; and .road data with PEMS. Only tested type 2 B engines
26. Fuel: Test fuel or market fuel, both of which are allowed. LNG is particularly difficult to determine fuel quality.
27. Emission sampling complicated by fluctuating fuel composition
28. Test bench results: ten engine types were tested on 100% diesel, LPG, CNG and LNG (ETC cycle).
29. Results: NOx emissions on diesel often too high; CNG HC emissions above the limit (including methane); LPG HC emissions within limits. Difference between measured and claimed diesel substitution (DEC).
30. Findings and Issues: With D-F technology it is possible to meet Euro V emission levels in the type approval cycles; GHG benefit is negligible for both NG as well as LPG; so far no failures found while using dual-fuel; used vehicles sometimes have higher emissions. The R67 and R110. tank mounting requirements for HD use needs attention.

Mr. Rijnders indicated that the Dutch program is a voluntary program and retrofit system manufactures can get, after showing their performance, a license to retrofit some engine/vehicle types. The retrofitted vehicles will get an individual approval. Because it is voluntary there is no enforcement concerning periodic technical inspection yet.

VI. Agenda point V Fundamentals & principles of HDDF-retrofit work (OICA presentation) (Documents GFV 29-03 and GFV 29-04)

Discussion focused on fundamentals and principals of HDDF retrofit, grappling with what engines or combination engine/vehicles should be the focus of the retrofit regulation and avoid creating loophole situations to make it easier to certify some engines versus others.

31. Discussion returns to retrofits versus conversion. OICA proposed three sets of requirements:
 - 1) requirements for certifying a conversion system;
 - 2) requirements for certifying a converted vehicle;
 - 3) requirements for installing a certified engine on a converted vehicle;
32. Mr. Piccolo raised the issue of whether the HDDF retrofit engine should be considered as a new type of engine. He showed language from Directives 2007/46, 2005/55, (type approval as a separate technical unit as defined in Article 2 of Directive 70/156/EEC) and Regulation 595/2009, which grants EC type approval or national approval in respect to new types of vehicles or engines. In light of the current definitions, this legislation seems to be applicable only to new engine types for new vehicles, while dual-fuel retrofit engines, even if considered as new types, would be fitted on “running” vehicles. Therefore, from the legal point of view, this instance could be covered by the new (retrofit) regulation.
33. The other participants were doubtful about this interpretation and suggested to further investigate this. One remark was that European Directive 2007/46 it not applicable here because this is not a whole vehicle type approval issue. The other is that the engine (replacement engines) with R49 approvals can be used for “running” vehicles. It is noted that the possibility to certify a retrofitted dual-fuel engine in conformity with the new (retrofit) regulation would create possible confusion in the market, opening a loophole in the OEM legislation.
34. Combinations of systems were discussed, including repowering engines for an older vehicle; purchasing components separately as a chassis and fitting an engine to it; and how certification (or not, in terms of a modification) would work in various cases.
35. Mr. Dekker suggested to focus on the simple things first, on what should be harmonized, and then worry about the combinations later.
36. Mr. Whelan (Clean Air Power) brought up the U.S. categorization of OUL engines — out of useful life – whereby an older engine is retrofitted on a vehicle beyond a particular age. This a small number of applications in the U.S., however, it might be popular in countries outside the US and Europe. Mr. Whittaker (Hardstaff) warned not to focus just on these types of situations because it could possibly drive the OEMs out of developing dual-fuel engines. It also was recognized that the OUL is ‘temporary’ and that a UNECE regulation is a longer-life framework.
37. The Chairman concluded that we start in the task force with the ‘low hanging fruit’ and first focus on the harmonized method for the classification, evaluation and approval of dual-fuel retrofit systems. Retrofitted engines will be further discussed in the GFV in parallel with the activity in the Task Force and should not stop the initial work in the Task Force.
38. The GFV agreed with this approach and confirmed this decision.
39. CLEPA was not present at this meeting of the GFV, however, their comments on (GFV 29-08) ‘Fundamental Issues’ are shown to the participants. The issues they raise have been fundamentally discussed already, relative to certification of NEW vehicles types or components and modification of the vehicle could invalidate Type Approval and Certification.

40. The CLEPA written comments indicate that a 'converter of a vehicle or engine already in use shall become the OEM-like person or body and shall bear all the liabilities the situation implies.'
41. Discussion in the GFV previously indicates this is not the case and that the converter of an engine is not the OEM-like body. The second element in the CLEPA comment that amendments of Euro IV and V Type Approval Certificates shall be possible is no longer applicable based on the earlier discussion. Access to information remains a competitive issue.

Wednesday, 4th December 2013

09.30-16.00

**Location: Shell Headquarters, Carel van Bylandtlaan (C23)
Building C16, 3rd Floor meeting room C16/3F16**

- VII. **Agenda point IX: Update on other UN regulatory activities related to safety: UN WP15 (Carriage of Dangerous Goods) and ADR regulatory issues regarding CNG and LNG safety on ADR-regulated trucks.** (Mr. Seisler) (Presentation by LNG TF to WP15, October 2013 and update on latest draft amendments) (*Documents for this discussion are available at WP15 UNECE website: <http://www.unece.org/trans/main/dqdb/wp15/wp15inf95.html> . Informal documents Inf.23 (NGV Global) and Inf.25 (KIWA). The issues are presented in the Dutch delegation documents Inf.6 and Inf.10.*)
 42. Mr. Seisler presented the problems associated with language in the ADR that says if the fuel leaks from the tank (on the vehicle) it should go to the ground, which is not necessarily the case with gaseous fuels (although LNG and LPG initially are heavier than air until they vaporize). He presents the results to date of the LNG TF discussions and the proposed language for an amendment.
Comments to the presentation:
 43. If the text includes the phrase 'above the auto ignition temperature of the fuel' LNG dilution should be mentioned.
 44. The language might include the flammability range of diesel and LNG, particularly if it is raised in the amendment.
 45. Focusing on the word 'leakage' only without looking at the practical results that might not result in a fire.
 46. Where are the 'hot parts' of the truck? Turbo charger; exhaust pipe; other engine components. But the chance of leakage near hot parts of the engine and the dispersion of LNG at that point suggests that the LNG is likely out of the flammability range. But there also could be a spark from an electrical component (i.e. in a garage).
 47. A more scientific approach could/might be taken to study where the fuel goes and if it can come into contact with hot parts of the engine or hot parts of the load.
 48. Mr. Piccolo knows someone who has some ADR expertise who might be able to assist with the amendment.
- VIII. **Update on other UN regulatory activities related to safety** (Mr. Seisler) Brief report on LNG-TF: WP29 approval of R.110; new amendments being considered for April GRSG (*Documents ECE-TRANS-WP29-2013-101e and WP.29-161-05e[corrigendum] on the WP29 website*)
Preventing LNG fuel downstream of the vaporizer.
 49. Mr. Dekker: There are temperature sensors that can be used to detect temperatures lower than design temperatures of the components downstream of the vaporizer. This was raised by Andrew Whitehouse (CAP) during the last LNG Task Force

teleconference also as one of the possible safety 'systems' that could be provided under the proposed amendment.

50. Mr. Piccolo noted that there is a concern temperatures downstream on non-LNG components. Mr. Whelan indicated that there are safety features to identify low temperatures that might affect, for example, a CNG solenoid valve. Also, too much cold fuel will shut down the engine.

Minimum height of LNG tank mounted on the truck

51. Mr. Dekker said that 200 mm should be the minimum height above the ground, taking into consideration things like traffic calming measures (also called 'speed bumps'/'sleeping policemen'). What happens if the truck wheels are on either side of the speed bump and it comes in contact with a low-hung fuel tank?
52. Mr. Rijnders asked if the original Scania tank language said 'shall' or 'or (in front of the container and/or tank shall not touch the ground if any tire or tires are deflated)'. The Dutch had prescribed 200mm and if it is lower there should be protection on the tank. Mr. Seisler indicated that the LNG TF had such a discussion and the solutions were too cumbersome.
53. Mr. Dekker asked if the 200mm shall be 'from the lowest part of the tank.' Mr. Seisler indicated that this comment would be raised in the next discussion of the LNG TF, scheduled for 16th December 2013.

IX. Agenda point VIII: Draft proposals for HDDF Retrofit amendments (AEGPL) (Document GFV 29-02) (Alberto Castagnini)

54. As was discussed in the first part of the meeting on the previous day, the modular structure of the draft has been suggested, providing three different type of approvals: 1) approval of a HDDF retrofit system; 2) approval of a HDDF retrofitted engine; and 3) approval of a HDDF retrofit vehicle regarding the installation of a retrofit HDDF engine. The main text includes scope, general provisions and general definitions. All specific topics regarding the three different (above mentioned) approvals have been moved to the appropriate Annexes in the first draft text produced by AEGPL.
55. The group expressed concerns about possible loopholes with respect to R49 when approving a HDDF retrofitted engine and HDDF retrofit vehicle with a retrofitted HDDF engine. Since the most important part is related to HDDF retrofit systems, the group decided to delete Annex 2 and Annex 3 from AEGPL proposal and to develop Annex 1. Future meetings will focus on and complete the discussion on HDDF retrofit systems. The group agrees to take the AEGPL text as starting point for further development.
56. The Annex 1 (HDDF Retrofit systems) of AEGPL proposal was presented. Mr. Castagnini explained the difference between updated text and previous versions.
57. Specific retrofit systems definitions (definitions applicable only to HDDF retrofit systems) were moved from the main text to Annex 1, in order to avoid confusion with other type approvals. The requirements to allow parent engines not meeting the baseline emissions would be enforced. OBD data should be monitored and no detected malfunction shall be active. The group recognized the difficulties of finding an existing engine that meets the emission limits, especially if the engine was certified to a previous emission level than the current Euro level. But the importance of having the engine fulfill the baseline emission limit is clearly recognized. The group agrees to find a solution to this challenging problem.
58. A general discussion took place about the ability to find a diesel engine in compliance with the emissions limits and the impacts of performing a conversion to dual-fuel, as well as how to include this in regulatory language (if possible). System suppliers spend a great deal of money and energy trying to find compliant engines that can be converted if they are going to improve the emissions over diesel. There

- are a variety of solutions possible but in this forum there was general brainstorming solutions proposed. For example, Mr. Bleuler (German Federal Ministry of Transport) proposed to allow wider engine family definitions in order to reduce the difficulties of finding parent engines that are in compliance with baseline emission limits.
- 59.** AEGPL: If it is agreed that the original emission limits must be maintained (or improved) in the dual-fuel mode even when the parent engine is not compliant in the diesel mode, AEGPL asked to evaluate the possibility, in these cases, to allow for some tolerance of the limits in line with those accepted during COP or ISC (to be investigated). In addition, a creating less stringent engine family definition would ease the practical problems faced by retrofit system manufacturers when searching for compliant diesel engines.
 - 60.** Annex 1: OBD requirements have been defined. Since there is no communication between the ECU and dual-fuel ECE, a switch back to diesel mode is prescribed in case of any detected malfunction.
 - 61.** Annex 1: Extension of the application range requires a simplified test sequence that can be performed either on a representative engine equipped with the HDDF retrofit system or on a vehicle equipped with the representative engine and the HDDF retrofit system (to be defined).
 - 62.** Annex 1: Installation manual shall consist of two parts: 1) describing the HDDF retrofit system and a list of components; and 2) installation instructions for the specific vehicle. This installation of the manual for the parent vehicle must be supplied to the regulatory authority
 - 63.** Annex 1: End user manual informs the end-user about the characteristics and safety features of the installed HDDF retrofit system.
 - 64.** Other Annexes will be defined over time after the completion of Annex 1.
 - 65.** Written remarks received from AECC, John May. Annex 1, 3.1 were discussed (AECC was not able to be present at the meeting). "If the parent engine is not equipped with one or more devices listed above, engines with these devices are allowed." In this case they should not be allowed to be part of the same engine family." Mr. Dekker indicates that, in the light of their experience, sometimes a retrofitted engine in dual-fuel mode performs worse in the presence of EGR than in absence, for instance. More discussion on the family definition is required.
 - 66.** Furthermore AECC mentioned in their written comments that they agree with the possibility to consider CH₄ as a GHG contributor.
 - 67.** Annex 1: 6.3.2 Limit values and relevant pollutants for ESC and ETC cycles: that this needs to be clearer that this applies to the emissions both before and after retrofitting; that the manufacturer cannot be allowed to choose whether or not to include deterioration; and durability of the retrofitted system should have to be demonstrated, rather than simply taking assigned deterioration factors (DFs). There was a broad and general discussion of this issue.
 - 68.** AEGPL explained its proposal: The application of DF's and the testing with deteriorated components (aged after a durability test as in REC) have to be an alternative in order to avoid a double durability burden. This is based on the consideration that R. 49 DF's (05 and 06 series of amendments) in the dual-fuel mode have been confirmed to be identical to those applied in diesel mode. In other words, the language for the OEMs allows them to choose to include deterioration factors, so why not the retrofitters as well?
 - 69.** Discussion: if the concern regards the guarantee that the retrofit system is generically durable, the respect of endurance testing and requirements set out in R 67/01 and R 110 could be already satisfactory. As for environmental aspects, that observation offers also an alternative solution to the application of DF's: engine

emission tests could be carried out fitting gas components aged in accordance with R67/01 or R 110 endurance tests. But this requires further discussion. There are concerns about the complication and the cost of the testing protocols that would be imposed on retrofit suppliers.

70. Mr. Rijnders indicated that the AECC remarks are valid and further discussion will be required.

X. Agenda point XII: Planning upcoming Meetings of GFV & Task Forces

71. Next meeting will be in Geneva on Tuesday 7th January 2014 (starting at 14.30)
Agenda items to include: 1) Mr. Rijnders presentation from yesterday; 2) HDDF TF open issues list plus discussion; 3) the final amendments on the LNG safety issues and ADR;

72. Following the Geneva meeting the GFV has another meeting scheduled in Brussels on Wednesday, 29th January 2014 at DG Enterprise (Brey 5A). This will be used as a kick-off for the HDDF TF-Retrofit task, which Mr. Dekker will chair.

XI. Closing

73. Mr. Rijnders thanks the participants for attending and for their contributions, as well as thanks to Shell for providing its conference facilities.

Attendees

André Rijnders, Chairman (RDW-NL)

Jeff Seisler, Co-secretariat (NGV Global/Clean Fuels Consulting)

Salvatore Piccolo, Co-secretariat (AEGPL)

Henk Dekker (TNO)

Bernardo Martinez (European Commission DG Enterprise)

Alex Stoehr (AEGPL)

Steve Whelan (Clean Air Power)

Joseph Gillingwater (Hardstaff)

Neil Martin Whittaker (Hardstaff)

Alberto Castagnini (AEB Technologies)

Walter Bleuler (Federal Ministry of Transport, Germany)