

Meeting Minutes
42nd Meeting of the Informal Group on Gaseous Fuelled Vehicles (GFV)
27 October 2015
DG Growth – Brey Building
10:00 – 17:00

I. Welcome and Introduction

1. Mr. Rijnders welcomed the GFV and thanked the participants for attending. He thanked Mr. Seisler for organizational aspects to support the meeting and taking meeting minutes.

II. Adoption of agenda for today (changes/additions)

2. Mr. Castagnini asked to shift agenda items to deal first with the update of dual-fuel regulatory development since some of the AEGPL participants had to leave early.

III. Adoption of minutes of the GFV-41 on 6 June 2015 (Geneva)

3. Regarding the minutes there are no comments or changes requested from GFV-41. Minutes were adopted and will be put into the UNECE website.

IV. Report and information exchange on Heavy Duty Dual-Fuel Task Force (Retrofit)

4. Mr. Rijnders indicated that the goal is to have a full draft of the regulation, as complete as possible, in an Informal Document for GRPE in January 2016. If there are small additions that are not completed by January it would be acceptable, however, the hope/goal is to have an approved document at the June 2016 GRPE.

Update progress: latest draft UNECE Regulation & Open Points

5. Mr. Dekker provided an update on the accomplishments of the HDDF TF. A lot of work still needs to be done: pre-amble; approval documents + plate; (installation) documentation; developing a simplified test procedure; general review of the document and then checked by all the HDDF principals. Creating a simplified test procedure remains the biggest challenge that is yet-to-be-solved.
6. *Definitions:* Now included are definitions for active and passive CAN (Controller Area Network) communication. *Active* CAN communication means communication via a CAN messages (error frames included); *Passive* CAN communication means a communication without actively requesting or sending CAN messages – ‘listen only’. Also included is a definition for the Actual applications
7. *Definition Application Range:* Question is raised about the definition of ‘Application range’ (....means a grouping of engine systems to which the engine retrofit system *can be applied.*) Further consideration will be given to this definition.
8. *Markings of an approved D-F engine retrofit system:* This has been moved to a separate Annex.
9. *Actual Applications:* An engine system belongs to the actual applications when the engine retrofit system manufacturer has notified the type-approval authority that this engine *system* is added to the list of actual applications or when it was already included as an actual application at the time of its type approval. The use of ‘engine’ and ‘engine system’ conforms to R49.
10. “A CAN message can be modified in dual-fuel mode when the original safety functions of the engine are not inhibited”. Question is, how can this be checked by the approval authority; only through actual communications between and with the retrofit system supplier and the OEM? New paragraph added that “Modified CAN messages should be

documented at type approval.” (This is to ensure the functional safety of the vehicle as provided by the OEM.)

11. *Engine retrofit system family*: The characteristics of the system can be described in an annex via a listing of the system components. The engine retrofit supplier is responsible to notify the type-approval authority of any change or update to the list of engine system or retrofit system family members. The ‘listing’ of components was discussed; whether it would be clear how an individual dual-fuel system is adapted only if a list of components is provided. A new proposal for this section is required, for LPG and natural gas. Mr. Dekker suggested that the system suppliers need to provide input and give a sample/recommendation. (Maybe the component list can be divided into those ‘basics’ and ‘additional ones’ that will need to be numbered, indicating changes of the system.)
12. *Conformity of Production*. Only specific systems developed for the specific application range can be approved for CoP testing. Second part of the paragraph reads: ‘Only actual applications may be selected even when this will force the engine retrofit system manufacturer to obtain a representative demonstration engine for the actual application.’ There was a discussion about adding engine application ranges using a simplified test but one needing a CoP test as well. It was suggested that the test requirements also could result from communications through the approval authority and the retrofit supplier (either a test bench or simplified test to achieve CoP). Which test procedure/which sampling plan would be required? New language is suggested: “Upon agreement between the approval authority one of the test procedures describe in ...shall be used.” In case of discrepancies and disagreements the approval authority has the ultimate say. This issue will be revisited.
13. *Annex 1 Appendix 6- Arrangements of the D-F engine retrofit system type approval mark*. Discussion of what symbols represent CNG, LPG and LNG. *=CNG; #=LPG; and %=LNG. Question: Is it important to distinguish between CNG and LNG (and biomethane)? Yes, because specified reference fuels/market fuel type need to be noted (reference fuels are included in R.49). This is a challenging issue requiring more discussion (and more time than is available at this meeting).
14. *Problem with Euro IV*. No requirements for D-F Euro IV are in Annex 11 of R49, as the Scope is limited to Euro V and EEV.
15. *Power requirements*. Proposed text for CAN messages is needed. Text also is required regarding the measurement/CAN communication of ‘torque’ and any changes to torque that might occur after adding the retrofit system. Suggested language: “If CAN messages are modified in D-F mode then the original safety functions of the engine shall not be inhibited.” Still, torque will need to be tested.
16. *Requirements to ensure correct operation of NOx control measures*. The D-F system shall enable the retrofitted engine to remain compliant with NOx control systems. If the MI (malfunction indicator) is activated the system shall automatically switch to diesel mode and stay in that mode until the issue causing inducement is fixed.
17. *Operations Manual*. A large number of changes were provided by AEGPL that cannot be addressed at this meeting. But it is important for the type approval authorities to understand the complete functioning of the system; as well as the process of removing the D-F retrofit system from the original engine.
18. *Description of the fitting devices of the container installation on the vehicle: Approvals and markings*. Initially this part was in a separate section but now has been included in the operational manuals provided by the retrofit installer. New language added: “Description of any modification of the engine system (hardware and/or software) required for the installation of the engine retrofit system.” Language also is edited to improve this section on ‘interfaces’.

19. *Remaining critical issue: Development of a simplified test procedure.* The complexity of this issue might take longer to resolve so maybe a model test procedure should be used initially in the draft regulation. But a 'reservation' (e.g. a 'place holder') should be made in the draft regulation so it can still make forward progress through GRPE in January 2016. But the GFV also can be involved in identifying and developing a 'simplified test' procedure that must be included in the final regulation for consideration in the June 2016 GRPE if the new HDDF regulation is to be adopted. The development and validation that the method works will take time and the question arises whether this can be completed by June.
20. *CO2 specific measurements to simplify the test procedure:* In the variation from 100% diesel to 100% gaseous fuel the CO2 output changes. (<10% LPG; <25% CNG). The amount of O2 used changes only 2% and 3% respectively for LPG/CNG. so it might not be appropriate to be used as the basis for a 'simplified measurement.' Conclusions: CO2-specific emissions are not suited measurements for D-F operation.
21. *Actual measurement available?* O2 data generally is not kept available so it is difficult to determine/correlate with the power output of the engine, which could allow other measurements to be made. Chassis dynamometer measurement is possible but R49 has no chassis dyno provisions. A back-TO-back PEMS test on the road could be possible when we use wet measurements and the O2_used method can be validated. Otherwise, maybe the only way to make a measurement will be on chassis-dyno or engine test bench. The main challenge is to get the proper data, which costs money/sponsorship to obtain. (There also is a need for 'wet' measurement data.) Now OEMs are using EGR engines so the results will be different than older OEM technology. The Euro V engine data would come from 10-15 years ago and is no longer available.
22. The question is raised of the approval authorities (i.e. TUV) whether they have the old data that, for example, was developed in the WHDC process). (TUV will check; also Westport will see what data might be able to be shared.) (Correlations/ratios between O2 used and the brake-specific power of the engine is needed as a starting point.)
23. The question was raised of the D-F vendors whether they have non-proprietary data that can be shared with Mr. Dekker in order to validate his calculations. (Westport and CAP will check to see what data might be available.)
24. Mr. Dekker will begin with an attempt to do a chassis-dyno calculation method in the first instance but also will solicit data from various stakeholders involved in the HDDF TF. This will include: O2 data; request with some explanation; revised sheets (wet/dry data);
25. *Simplified Test options:* Various options for a simplified test were identified: 1) on the road with PEMS SORT test; 2) chassis dyno - different operating points (engine speeds); full load and several part loads data similar to ESC; 3) engine bench test (ESC); all back-to-back (O2_used or g/h emissions). More options will also involve more initial validation work; The O2 approach still needs validation whether suitable for back-to-back testing.
26. *Chassis dyno:* Start drafting discussion; back-to-back; different operating points (engine speeds, full load and several part loads) similar to ESC;
27. *PEMS:* Is a SORT-test suitable for back-to-back testing? Other possibilities for a PEMS back-to-back test?
28. *GRPE procedures:* Various procedural strategies were discussed as to how best to put forward an Informal Document without specifying a simplified test with a 'reservation' in the document for new information (typically done in documents but usually only for less complicated or controversial items/text). It also is possible to table an Informal Document (January 2016) with a back-to-back simplified test; chassis dyno test, engine test, but with a placeholder for the on-road simplified test. But determination of the simplified test procedure should be ready by the first week in March for introduction to

the GRPE in June. There is no conclusion on strategy at this time but it is understood that a formal document would be acceptable only with a simplified test including an on-road test for AEGPL. Mr. Castagnini will check to see if this approach might be acceptable to AEGPL, since there is a risk of not having the Working Document approved if too complicated an emissions test strategy is not introduced early enough.

29. *Calculation procedure.* In answer to a question from ISO the dual-fuel CO₂ calculation was explained. CO₂ from dual-fuel engines can only be measured accurately with a CVS system. It is allowed to calculate the CO₂ output from the fuel consumption. But when measuring the exhaust of a diesel engine might also find a small amount of CO₂ due to the use of AdBlue. Hence this is also included in the calculation.

V. Document from GRPE Secretariat for consideration

Consideration of Informal document GRPE-71-07, (71st GRPE, 8-12 June 2015) Issues identified by the (GRPE) Secretariat in Revision 7 of UN Regulation No. 49 (Emissions of compression ignition and positive ignition (LPG and CNG) engines)

30. Some issues were raised with this document, which is a Revision 7 without considering the rev6 (Euro VI) corrections to Annex 4B and other locations. The GFV reaction is: 1) not to deal with this document until there are clarifications from the Secretariat as to a lot of other mistakes that have been transposed into Revision 7; or 2) to deal just with the questions raised in GRPE-71-07 and deal later with all the other mistakes that are identified.
31. Paragraph 2.1.41. (*definition of LNG₂₀*): The definition does not specify whether the limit set on ethane content (1.5 per cent) is by volume, mass or mole. Mr. Dekker indicates that the proper reference is 'by volume in the liquid phase'. Same issue in paragraph 4.6.3.1.7. The other option that can be used is mole%, but then the number should be changed into 1.0 mole per cent. (Same as GR-20, reference fuel).
32. Mr. Rijnders suggested that GFV react by email to the GRPE Secretariat as to further instructions about how GFV should respond to GRPE-71-07. Mr. Dekker will prepare an email to the GRPE Secretariat.

VI. Report on other gaseous fuels activities/issues at UNECE/EU

Mr. Seisler provided a brief description of the GRSG and ADR issues affecting gaseous fuels.

33. GRSG meeting 28 September – 2nd October 2015
An amendment proposed by Japan was adopted that: 1) removes provisions for allowing welded steel CNG cylinders, which are now prohibited; and 2) limits steel for cylinders to 1,200Mpa and requires additional sulfide stress testing of high strength steel above 950Mpa. This now is in more conformity with the ISO cylinder standard and will allow Japan to move forward in adopting R110 in its national regulation.
34. ADR (Dangerous Goods), upcoming on 11 November 2015. LNG as a fuel for ADR-certified vehicles was approved in November 2014 but there continue to be certain questions from Germany and Sweden about safety and, most recently, about the amount of fuel that can be stored on the vehicle (equivalent to diesel) as well as other relatively minor but, nonetheless important issues. The NGV Global/AEGPL amendments to allow CNG and LPG will be considered on 11th November (on-going since the amendment was introduced in May 2015). Issues include: maximum limits of fuel on board the vehicle (equivalent to diesel; by energy or volume); effect of LNG leaking on the load of the vehicle (not a 'real' issue despite great concerns); directional venting of pressure relief devices for CNG, etc. The issues/questions are being addressed by NGV Global/AEGPL in a new Informal Document being prepared for the ADR meeting.

VII. Other

35. Question was raised about the status of the so-called Potpourri Amendments: 1) Ammonia slip has been set at 80mg/kWh. OICA will consider the issue if this is applicable for gas engines/vehicles. 2) the 'methane issue' (creating an allowance for methane and non-methane hydrocarbons in light duty emissions limits) is on-going and it is hoped that a solution is developed in good time.

VIII. Any Other Business

36. No other business or issues are tabled.

IX. Planning next Meetings of GFV & HDDF TF

37. GFV-43: Wednesday, 13 January 2016, 09.30-12.30 at the United Nations in advance of GRPE.
38. HDDF TF schedule: Every Tuesday on-going from 14.00-16.00 CET. Mr. Seisler will prepare a reminder each week in advance for the HDDF TF.

X. Closing

39. Meeting closed at 17.45.

Participants

Andre Rijnders, Chairman (RDW)
Henk Dekker (on behalf of RDW)
Jeff Seisler, Co-Secretariat, (NGV Global/Clean Fuels Consulting)
Salvatore Piccolo, Co-Secretariat (AEGPL)
Alberto Castagnini, (AEB)
Jasper van Sambeek, Prins Autogassystemen
Cecile Favre (AECC)
David Castro-Moreira (MAN Truck & Bus)
Leif-Erik Schulte (TUEV-Nord)
George Nikolaou (AEGPL)
John Crawford (Westport) via telecon
Andrew Whitehouse (CAP) via telecon