

Informal document **GRPE-64-xx2**  
 (64nd GRPE, 4 – 8 June 2012,  
 agenda items 4(c) and 9)

**Proposal correcting working document  
 ECE/TRANS/WP.29/GRPE/2012/13/Rev.1**

**in view of type-approving Heavy-Duty dual-fuel vehicles**

**Submitted by the chair of the informal GFV group**

**I. Corrigenda Proposal**

Appendix 4, the new table at the end, is reformatted and its title corrected, to read:

**Approval for dual-fuel engines fuelled with natural gas/biomethane or LPG**

<i>Dual-fuel type<sup>1</sup></i>	<i>Diesel mode</i>	<i>Dual-fuel mode</i>			
		<i>CNG</i>	<i>LNG</i>	<i>LNG20</i>	<i>LPG</i>
1A		Universal or restricted (2 tests)	Universal (2 tests)	Fuel specific (1 test)	Universal or restricted (2 tests)
1B	Universal (1 test)	Universal or restricted (2 tests)	Universal (2 tests)	Fuel specific (1 test)	Universal or restricted (2 tests)
2A		Universal or restricted (2 tests)	Universal (2 tests)	Fuel specific (1 test)	Universal or restricted (2 tests)
2B	Universal (1 test)	Universal or restricted (2 tests)	Universal (2 tests)	Fuel specific (1 test)	Universal or restricted (2 tests)
3B	Universal (1 test)	Universal or restricted (2 tests)	Universal (2 tests)	Fuel specific (1 test)	Universal or restricted (2 tests)

<sup>1</sup> According to the definitions of Annex 15.

Annex1, part 1, table, is corrected to read:

**"Essential characteristics of the (parent) engine and the engine types within an engine family**

		Parent Engine or Engine Type	Engine Family Members				
			A	B	C	D	E
...	...						
3.2.1.1.	Working principle: positive ignition/compression ignition/ <b>dual-fuel</b> <sup>(1)</sup> Cycle four stroke / two stroke/ rotary <sup>(1)</sup>						
3.2.1.1.1.	Type of <b>dual-fuel engine</b> : Type 1A/Type 1B/Type 2A/Type 2B/Type 3B <sup>(1) (df)</sup>  Gas Energy Ratio over the hot part of the WHTC test cycle <sup>(df)</sup> : .....%						
...	...						
3.2.1.6.2.	Idle on Diesel: yes/no <sup>(1) (df)</sup>						
...	...						
3.2.2.2.	Heavy duty vehicles Diesel/Petrol/LPG/NG-H/NG-L/NG-HL/Ethanol (ED95)/-Ethanol (E85)/ <b>dual-fuel</b> <sup>(1) (dh)</sup>						
...	...						
3.2.4.2.	By fuel injection ( <b>only</b> compression ignition only <b>or dual-fuel</b> ): yes/no <sup>(1)</sup>						
...	...						
3.2.12.7.0.6	When appropriate, manufacturer reference of the documentation for installing the <b>dual-fuel engine in a vehicle</b>						
...	...						
3.2.17.	Specific information related to gas fuelled engines <b>and dual-fuel engines</b> for heavy-duty vehicles (in the case of systems laid out in a different manner, supply equivalent information)						
...	...						
3.5.4.1.	CO <sub>2</sub> mass emissions WHSC test <sup>(dg)</sup> : ..... (g/kWh)						
3.5.4.1.1.	For dual-fuel engines, CO <sub>2</sub> mass emissions WHSC test in diesel mode <sup>(d)</sup> : .....g/kWh  For dual-fuel engines, CO <sub>2</sub> mass emissions WHSC test in dual-fuel mode <sup>(d)</sup> (if applicable): ..... g/kWh						
3.5.4.2.	CO <sub>2</sub> mass emissions WHTC test <sup>(dg)</sup> : ..... (g/kWh)						
3.5.4.2.1.	For dual-fuel engines, CO <sub>2</sub> mass emissions WHTC test in diesel mode <sup>(d)</sup> : ..... g/kWh  For dual-fuel engines, CO <sub>2</sub> mass emissions WHTC test in dual-fuel mode <sup>(d)</sup> : ..... g/kWh						

		Parent Engine or Engine Type	Engine Family Members				
			A	B	C	D	E
3.5.5.	Fuel consumption for heavy duty engines						
3.5.5.1.	Fuel consumption WHSC test <sup>(dg)</sup> : ..... (g/kWh)						
3.5.5.1.1.	For dual-fuel engines, fuel consumption WHSC test in diesel mode <sup>(d)</sup> : ..... g/kWh For dual-fuel engines, fuel consumption WHSC test in dual-fuel mode <sup>(d)</sup> : ..... g/kWh						
3.5.5.2.	Fuel consumption WHTC test <sup>(g)</sup> <sup>(dg)</sup> : ..... (g/kWh)						
3.5.5.2.1.	For dual-fuel engines, fuel consumption WHTC test in diesel mode <sup>(d)</sup> : ..... g/kWh For dual-fuel engines, fuel consumption WHTC test in dual-fuel mode <sup>(d)</sup> : ..... g/kWh						
...	...						

Annex 2A, Addendum to Type-approval Communication No ... concerning the type-approval of an engine type or family as a separate technical unit with regard to exhaust emissions pursuant to Regulation No. 49, 06 series of amendments, and

Annex 2C, Addendum to Type-approval Communication No ... concerning the type-approval of a vehicle type with regard to the emission of pollutants pursuant to Regulation No. 49, 06 series of amendments,

Paragraphs 1.1.5., is corrected to read:

"1.1.5. Category of engine: Diesel/Petrol/LPG/NG-H/NG-L/NG-HL/Ethanol (ED95)/ Ethanol (E85)/dual-fuel<sup>(1)</sup>"

Annex 5, the title of the first section, is corrected to read:

"Technical data on fuels for testing compression-ignition and dual-fuel engines"

Annex 5, the title of the second section, is corrected to read:

"Technical data on fuels for testing positive ignition and dual-fuel engines"

The new Annex 15, is corrected to read:

4.2.3.1. Unavailability of gaseous fuel – empty gaseous fuel tank

In the case of an empty gaseous fuel tank, the service mode or, as appropriate according to paragraph 4.2.3., the diesel mode shall be activated as soon as the engine system has detected that the tank is empty.

When the gas availability in the tank again reaches the level that justified the activation of the empty tank warning system specified in paragraph 4.3.2. the service mode may be deactivated, or, when appropriate, the dual-fuel mode may be reactivated.

4.6.2. Communicated torque when a dual-fuel engine operates in diesel mode

When a dual-fuel engine operates in diesel mode, the reference torque curve retrievable according to the requirements related to data stream information

specified in Annex 9B and referred to by Annex 8 shall be the one obtained according to Annex 4 when the engine is tested on an engine test bench in diesel mode.

- 6.5 ~~Demonstration~~ Requirements for demonstrating the durability of a dual-fuel engine  
Provisions of Annex 7 shall apply.
- 7.1. General OBD requirements  
All dual-fuel engines and vehicles shall comply with the requirements specified in Annex 9A and applicable to diesel engines, independent whether operating in dual-fuel or diesel mode.  
In case a dual-fuel engine system is equipped with oxygen sensor(s), the requirements applicable to gas engines in item 13 in Appendix 3 of Annex 9B shall apply.  
In case a dual-fuel engine system is equipped with a 3-way catalyst, the requirements applicable to gas engines in items 7, 10., and 15 in Appendix 3 of Annex 9B shall apply.
- 7.3. Monitoring of the gaseous fuel consumption  
Dual-fuel vehicles shall include a means of determining gas fuel consumption and providing off-board access to consumption information. Abnormality of the gaseous fuel consumption (e.g. a deviation of 50 per cent of the normal gaseous fuel consumption) shall be monitored – performance monitoring.  
The monitor for insufficient gaseous fuel consumption shall run continuously whenever in dual-fuel mode, however the maximum detection period is 48 hours of operation in dual-fuel mode.  
The monitor shall not be subject to the “IUPR” requirements.
12. Appendices
- Appendix 1 Types of HDDF engines and vehicles - illustration of the definitions and requirements
- Appendix 2 Activation and deactivation mechanisms of the counter(s), warning system, operability restriction, service mode in case of HDDF engines and vehicles- Description and illustrations
- Appendix 3 HDDF dual-fuel indicator, warning system, operability restriction - Demonstration requirements
- Appendix 4 Additional emission test procedure requirements for dual-fuel engines
- Appendix 5 Additional PEMS emission test procedure requirements for dual-fuel engines
- Appendix 6 Determination of molar component ratios and  $u_{gas}$  values for dual-fuel engines

*The new Annex 15, Appendix 2, is corrected to read:*

- A.2.2.1. Empty gas tank  
Figure A2.2 gives an illustration of the events occurring in the case of a HDDF vehicle when a gas tank becomes empty through one typical use-case.  
In that use case:  
(a) The warning system specified in paragraph 4.3.2. of this Annex becomes active when the level of gas reaches the critical level defined by the manufacturer;

- (b) The service mode is activated (in the case of a Type A HDDF) or the engine switches to Diesel mode (in the case of a Type B HDDF).

In the case of a Type A HDDF, the service mode becomes active and the vehicle speed is limited to 20 km/h after the next time the vehicle is stationary or after 30 minutes operating time without standstill (see paragraph 4.2.2.1 of this Annex).

The gas tank is refilled.

The vehicle operates again in dual-fuel mode as soon as the tank is refilled above the critical level.

## II. Justification

The text reproduced above was prepared by the chairmen of the informal group on Gaseous Fuelled Vehicles (GFV) – Heavy Duty Dual-Fuel –Task-Force (HDDF-TF), to introduce corrigenda to working document ECE/TRANS/WP.29/GRPE/2012/13/Rev.1.

GFV presented in March 2012 to the attention of GRPE working document **GRPE/2012/13/Rev.1**, that contains all the major amendments to Regulation No. 49 that are considered necessary to type approve Heavy-Duty dual-fuel engines and vehicles, except appendixes 3, 4, 5 and 6 of the dual-fuel dedicated annex (Annex 15) that were not finalized at the time when the working document was published.

Further to the publication on the GRPE web-site of GRPE working document **GRPE/2012/13/Rev.1**, GFV received some comments aiming essentially at correcting typographic errors and cross-references in the proposal. These corrigenda are included in this document (Document **GRPE-64-xx2**).

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