

GFV-12-03

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Heavy-Duty Dual Fuel (Diesel-gas) Regulation status January 2011

GRPE

Geneva 13 January 2011

Priorities (based on Commission desires)

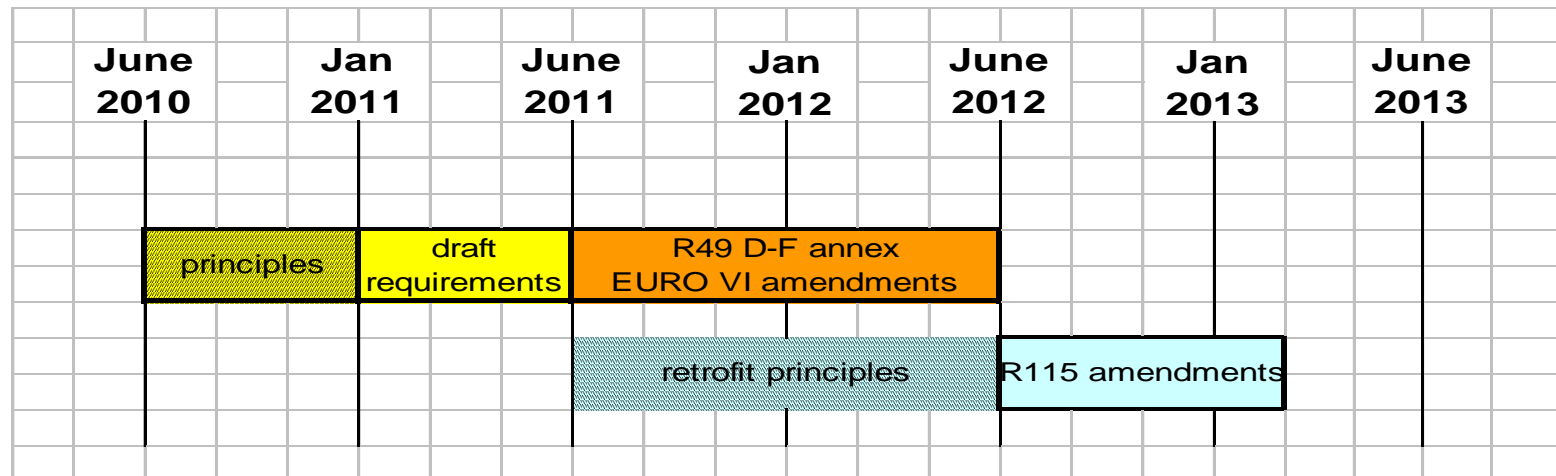
- *The main focus for the TF is new vehicles*
 - *Highest priority is to adapt the Euro VI legislation and procedures to enable type approval of dual fuelled engines.*
 - *Second highest priority is to adapt the Euro V and EEV legislations and procedures. The TF should try to do that work simultaneously with the adaptation of the EURO VI legislation.*

→ 2 New annexes in R49

- *The adaptation of the R115 (retrofit) legislation shall be done in a later stage and be based on the requirements for new vehicles.*
- *Amendments to R85 – and possibly R24, R67 and R110 (to be checked) are required*

Draft time-plan

- Aug – Dec 2010: principles - done
- GRPE Jan 2011: status report + informal document
- Jan – June 2011: draft requirements
- Jan – June 2011: draft amendments to EURO VI Comitology
- GRPE June 2011: status report + informal document
- July – Dec 2011: amendments to UNECE-R49
- GRPE Jan 2012: informal HDDF annexes.
- Jan - Mar 2012: draft HDDF annexes
- GRPE June 2012: approval of the amendments to UNECE-R49
- WP29 Nov 2012: approval of the amendments to UNECE-R49



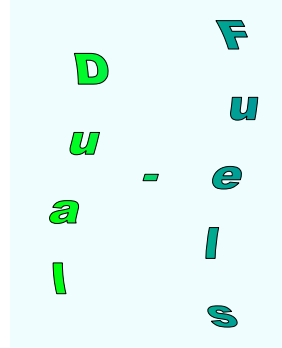
Characterisation of the types of HDDF engines

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- A Type 1 HDDF engine will be regarded as a positive ignition engine because the Diesel fuel is essentially used for providing the ignition of the gas instead of e.g. a spark plug, a laser beam, or any other external ignition mean.
- A Type 2 HDDF engine will be regarded as an intermediate between a positive ignition and a compression ignition engine because the Diesel fuel is also used in a typical manner for the normal motion of the vehicle.
 - A Type 2+ HDDF engine (i.e. a Type2 engine that can run with only Diesel fuel all through a normal vehicle operation) will be regarded as a type2 and a Diesel engine.
- A Type 3 HDDF engine will be assimilated to a Diesel mono-fuel engine.

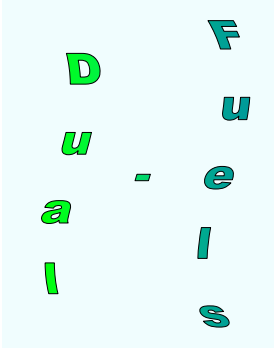
Laboratory tests and limits

EURO VI HDDF – laboratory tests



	Type 1	Type 2	Type 2+	Type 3
WHTC	NMHC; CH ₄ ; CO; NO _x ; PM; PN	THC; NMHC; CH ₄ ; CO; NO _x ; PM; PN	<u>powered with diesel+ gas:</u> THC; NMHC; CH ₄ ; CO; NO _x ; PM; PN <u>powered with Diesel only:</u> THC; CO; NO _x ; PM; PN	THC; CO; Nox; PM; PN
WHSC	- no test -	NMHC; CO; Nox; PM; PN	<u>powered with diesel+ gas:</u> NMHC; CO; NO _x ; PM; PN <u>powered with Diesel only:</u> THC; CO; NO _x ; PM; PN	THC; CO; Nox; PM; PN
WNTe laboratory test	- no test -	[HC]; CO; Nox; PM	<u>powered with diesel+ gas:</u> [HC]; CO; NO _x ; PM <u>powered with Diesel only:</u> THC; CO; NO _x ; PM	THC; CO; Nox; PM

EURO V and EEV HDDF – laboratory tests



	Type 1	Type 2	Type 2+	Type 3
ETC	NMHC; CH4; CO; NOx; PM	THC; NMHC; CH4; CO; NOx; PM	<u>powered with diesel+ gas:</u> THC; NMHC; CH4; CO; NOx; PM <u>powered with Diesel only:</u> THC; CO; NOx; PM; PN	THC; CO; NOx; PM; PN
ESC	- no test -	NMHC; CO; NOx; PM	<u>powered with diesel+ gas:</u> NMHC; CO; NOx; PM <u>powered with Diesel only:</u> NMHC; CO; NOx; PM	NMHC; CO; NOx; PM
ELR	- no test -	- no test -	<u>powered with diesel+ gas:</u> - no test - <u>powered with Diesel only:</u> smoke	smoke

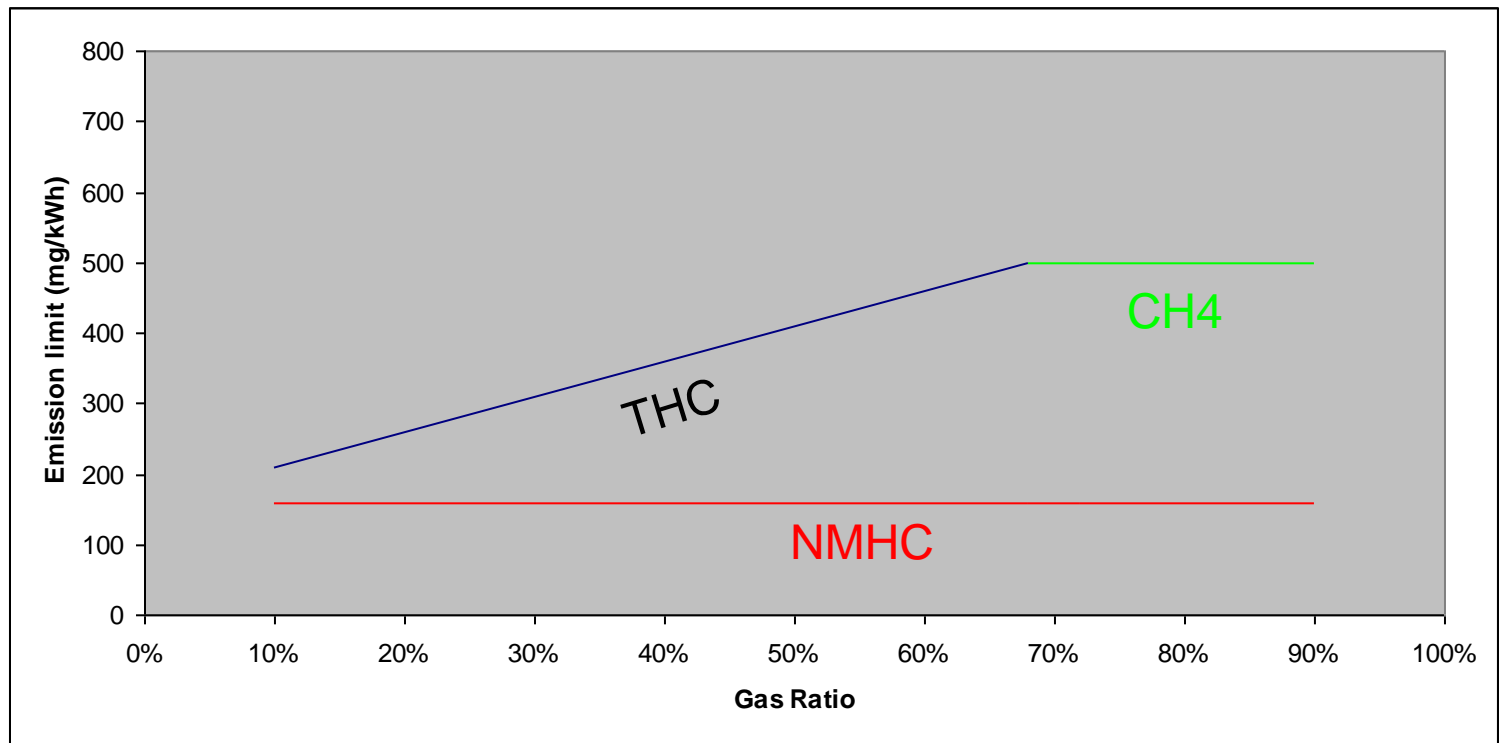
HDDF engines – applicable limits

- The emission limits applicable to Type1 HDDF engines are those of a PI engine (EURO VI) or a gas engine (EURO V and EEV)
- The emission limits applicable to Type3 HDDF engines are those of a compression ignited engine (EURO VI) or a Diesel engine (EURO V and EEV)
- The CO, NMHC, NOx and PM limits applicable to Type2 HDDF engines are those applicable for monofuel engines

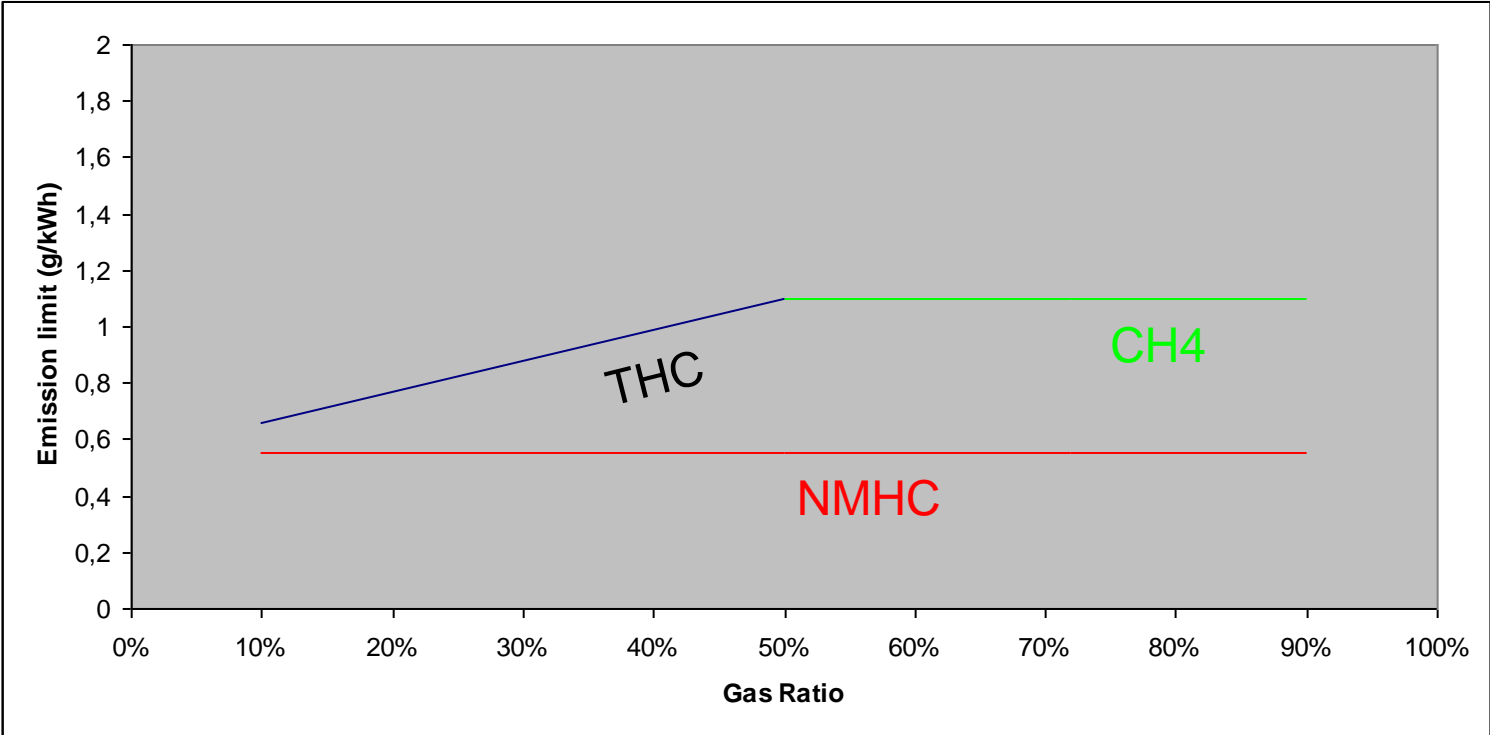
HDDF Type2 engines – GFV recommended limits

- GFV was asked whether it could be possible to take into account possible lower CO2 emission by using Dual-fuel engines by not applying or relaxing THC and CH4 limits for Type2 HDDF engines
- In line with previous recommendations of GRPE
 - GFV considered its mandate was not to put into questions WP29 political decisions (resulting from EU codecision) and to consider HDDF Type2 engines shall also be submitted to CH4 and THC limits
 - GFV agreed that the CH4 emissions of an HDDF Type 2 engine shall never exceed the CH4 limit applicable to gas engines
 - GFV agreed the applicable THC limit shall be proportionate to the Diesel/gas ratio (energy basis)
 - GFV agreed to reconsider this position in the case where CH4 will be considered in a next HD regulation as a green house gas and not as a gaseous pollutant
- It is requested from GRPE to formally validate the GFV decisions

Type 2 – EURO VI hydrocarbon limits (WHTC test cycle)

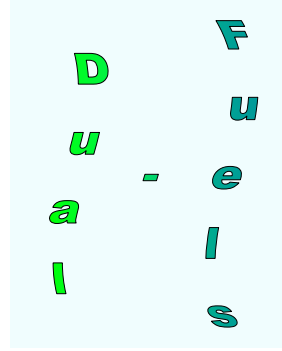


Type 2 – EURO V hydrocarbon limits (ETC test cycle)



Other requirements

HDDF- additional requirements



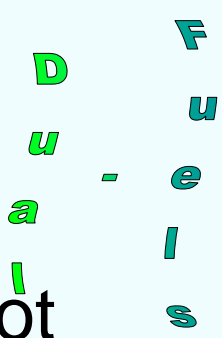
- Off-cycle requirements
 - All off-cycle requirements applicable to mono-fuel engines will also be applicable to HDDF engines
- OBD
 - Not yet addressed by GFV
- Requirements to ensure the correct operation of NOx control measures
 - Not yet addressed by GFV

EURO VI HDDF – ISC tests

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- GFV recommends that a single "PEMS" test be performed at certification
 - On a prototype vehicle
 - On a representative route selected together with the approval authority
- ISC rules and statistics
 - Calculation methods not yet addressed by GFV
 - EURO VI Conformity factor applicable to EURO VI HDDF
 - Statistics identical to those of mono-fuel engines

Limp home modes (HDDF operating as a diesel engine)



- The Diesel mode of a Type 2+ engine shall not be considered as a limp-home mode
- GFV decided the following rules be applied for limp-homes strategies.
 - A 2-step mobility restriction is introduced at respectively 70 and 20 km/h
 - The 20km/h restriction is introduced after 8hrs at 70km/h
 - Rules of Annex XIII will be adapted
 - Warning will be introduced as well as MI illumination and OBD fault recording

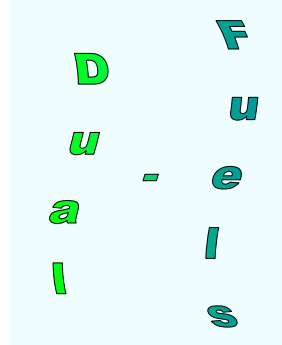
Fuels

HDDF fuels - LNG and bio-methane

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- There is a trend to use LNG and/or Liquefied bio-methane for HDDF engines.
- GFV agreed
 - to introduce G20 (high caloric reference gas) into the reference fuels list in accordance with the LDV Regulation (EC) 692/2008
 - to introduce the possibility of having a "single" gas-fuel type-approval mechanism introduced that would not require a double testing (e.g. with G20 and G23)
 - Pending the Commission decision, this feature may be part of the EURO VI Comitology package 2

HDDF fuels – GFV priorities



	LNG (G ₂₀)	L Range	H Range	HL Range	Manuf. Range	LPG A	LPG B	LPG A+B
Regular Diesel	1	2	2	3	3	1	1	2
Extended Bio- diesel	2	3	3	3	3	2	2	3

1= low hanging fruit
 2= normal priority
 3= lower priority