

Draft GFV report to GRPE

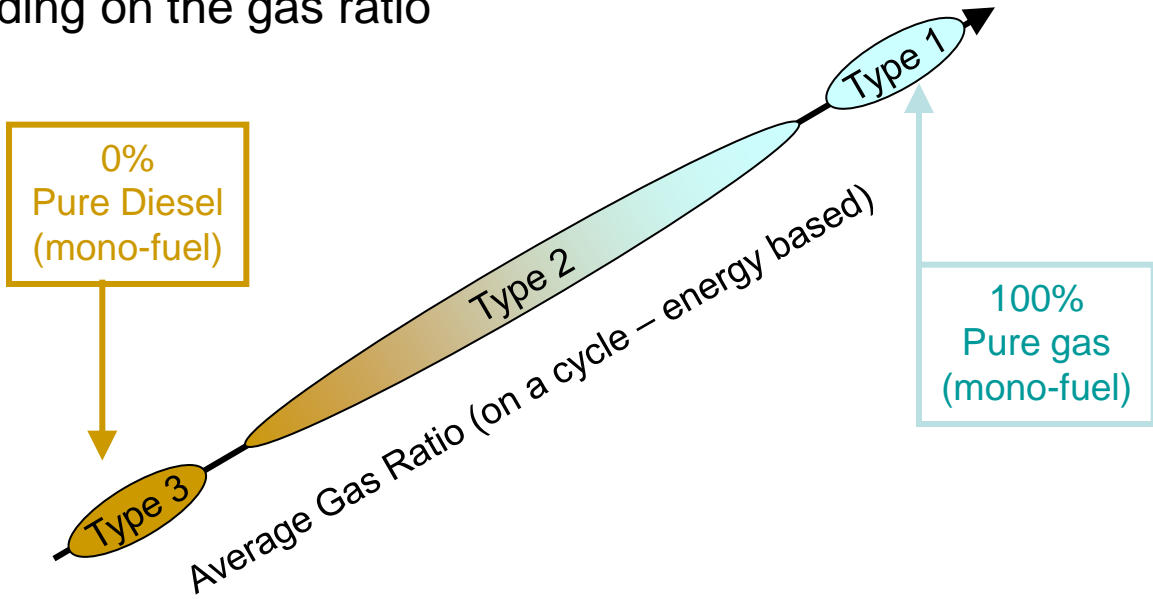
GRPE 62 – June 2011

Geneva 07 june 2011

suggested HDDDF terminology

"HDDDF i X"

- Digit i:
category of HDDDF, depending on the gas ratio
 - 1 for $GR > 90\%$
 - 2 for $10\% < GR < 90\%$
 - 3 for $GR < 10\%$



- Character X:
possible operating modes in the category
 - A for engines operating solely in Dual Fuel mode
 - B for engines capable of operating either in Dual Fuel or in Diesel mode

Definition issues

- GFV recommends the following definitions
 - "Dual-Fuel engine"
means an engine that uses simultaneously 2 different types of fuels supplied from separate storage systems and where the consumed amount of one of the fuels versus the other one may vary depending on the operation.
 - "Dual-Fuel vehicle"
means a vehicle that is powered by a Dual-Fuel engine and that supplies the fuels used by the engine from separate on-board storage systems.
- GFV recommends these definitions be included in the core of regulation R49, not in the Dual-fuel annexes

Note:

GFV wonders whether, for harmonisation purposes, and for having a single series of definitions all through the UNECE Regulations, GRPE could not suggest to WP29 having a special Resolution containing these definitions.

Specific rules regarding the HDDDF type

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- An engine that can operate or idle solely on diesel fuel cannot be considered as a HDDDF Type 1A. It shall be considered as HDDDF Type 2A.
- HDDDF Type 1A and cold start
 - As an exception it shall be allowed that HDDDF Type 1A may start and warm-up on idle on 100% diesel until the engine coolant reaches a certain temperature.
 - The exception shall not apply to HDDDF Type 1B (because they are able to warm-up on the Diesel mode).
- Verification of the HDDDF type
 - The verification shall be part of the demonstration at type-approval
 - Demonstration test: hot part of WHTC (EURO VI) or ETC (EURO V)
 - In absence of demonstration (e.g. due to measurement difficulties of LPG-LNG consumption, lack of accuracy of the LPG-LNG consumption, etc...): HDDDF type 2A or HDDDF type 2B
- In case of HDDDF Type 1A engines the demonstration test to show that the engine does not operate on Diesel only at idle, shall be agreed with the Approval authority and described in the report.

Amendments to R85

- Principles
 - The declared power and torque are those obtained in the Dual Fuel mode (HDDF Type 1B; HDDF Type 2B; HDDF Type 3)
 - Same reference fuels as the ones for the emission test
- Informal document xx includes proposal for amending R85
 - To be noted an amendment proposal that does not affect solely Dual-fuel vehicles:
 - 5.2.1 reads currently
"5.2.1. The net power test shall consist of a run at full throttle for positive-ignition engines and at fixed full-load fuel injection pump setting for diesel engines, the engine being equipped as specified in Table 1 of Annex 5 to this Regulation."
 - 5.2.1 shall be amended to read
"5.2.1. The net power test shall consist of a run at full-load, the engine being equipped as specified in Table 1 of Annex 5 to this Regulation."

EURO VI HDDF

streamed / broadcasted power / torque data

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- When the engine operates in the DF mode,
 - the reference torque curve retrievable with the EURO VI Communication Standards shall be the one obtained when the engine operates in the DF mode
 - the recorded actual torques (indicated torque and friction torque) shall be the result of the DF combustion and not the result from solely the Diesel combustion
- when the engine operates in the Diesel mode,
 - the reference torque curve retrievable with the EURO VI Communication Standards shall be the one obtained when the engine operates in the Diesel mode

EURO VI - HDDF

NOx control measures

- EURO VI NOx control measures shall apply "mutatis mutandis" to HDDF engines:
 - the torque considered to apply the low level inducement in case of HDDF Type 1B and HDDF Type 2B shall be the lowest of the torques obtained in the Diesel mode and on the DF mode.
 - It shall be allowed in case of a "NOx control issue" in the DF mode to switch to the pure Diesel mode (for HDDF Type 1B and HDDF Type 2B)

HDDF indicators

- The HDDF mode indicator
 - indicates the actual operating mode: Dual Fuel, service, or, when appropriate Diesel mode
 - is set on service mode as soon as the service mode is activated (i.e. before it becomes actually active) and
 - remains ON as long as the service mode is active
 - Is set for at least one minute on DF or Diesel mode as soon as the engine operates on DF or Diesel mode.
 - This indication is required at key-on during at least 1min
 - This indication shall be given upon driver's request
- The Empty gas tank warning indicator
 - Indicates the gas tank will soon become empty
 - It shall be activated as long as the amount of gas is below a certain level (value left to the manufacturer)

Note:

A possible 3rd indicator may be decided in case of warm-up of a HDDF Type 1A engine on a Diesel mode

EURO VI - Lack of gas availability

- An operability restriction is activated as soon as a lack of gas supply is detected
 - This restriction is the same as the "severe inducement" specified in EURO VI Annex XIII (i.e. 20km/h)
 - Instead of this restriction HDDF Type 1B and HDDF Type 2B may switch to the Diesel mode
- The restriction becomes active
 - in case of a malfunction of the gas supply system either 30 minutes after activation or after the next time the vehicle is stationary, whatever the earliest
 - in case of an empty tank immediately (the driver has been warned)

EURO VI - HDDDF OBD

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- EURO VI HDDDF shall be subject to full EURO VI OBD applicable to compression ignition engines
- Gas supply system shall be subject to component monitoring
- Gas consumption may be subject to monitoring – pending further investigation by GFV

Note:

There is an issue with the scope of R49 and that of EURO VI ("Gas engines" vs "positive ignition engines").

GFV considered this issue should be resolved when discussing the transposition of EURO VI into R49 (rev6)

EURO V - HDDDF OBD

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- Basic principles
 - EURO V Diesel OBD rules shall apply
 - Electrical failures of the DF system as well as major functional failures of the specific catalysts of the DF system (in the sense of stage 1 OBD) shall be monitored when the engine is on DF mode.
 - The EURO IV / V derogation clause shall apply when operated in a DF mode (no monitoring if the thresholds are not exceeded).
 - It will be allowed in case of a failure in the DF mode to switch to the pure Diesel mode (for HDDDF Type 1B and HDDDF Type 2B engines)

EURO VI - PEMS test at certification

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- Already agreed principles
 - In case of a HDDF Type 1A or HDDF Type 2A
 - Perform a PEMS test at certification on the dual fuel mode according to Annex VI
 - the resulting NOx level shall be lower or equal to $(1.5 * \text{NOx emission limit})$
 - In case of a HDDF Type 1B or HDDF Type 2B
 - Perform a PEMS test on the Diesel mode according to Annex VI and conclude
 - Perform a PEMS test on the DF mode and conclude as for HDDF Type 1A and HDDF Type 2A engines
 - Conclude to pass if both the PEMS test on DF mode and the PEMS test on Diesel modes have concluded to pass

Note:

Further work need to be performed on this issue, e.g. for addressing the access to the gas ratio

EURO V and VI – ISC

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- ISC tests shall be performed in the Dual Fuel mode
 - According to the applicable EURO V or EURO VI processes
- In case of HDDDF Type 1B or HDDDF Type 2B
 - the tests will be also performed in the pure Diesel mode on the same engine.
 - Pass would mean pass both in Diesel mode and in DF mode

EURO V specific issues

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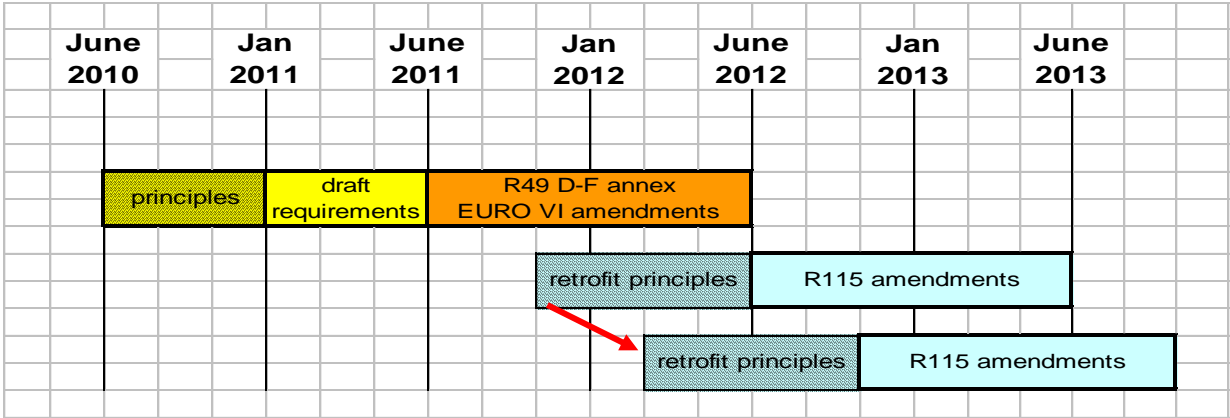
- PEMS test at certification
 - The eventual need and content has not yet been addressed by GFV
 - Issue to be solved before considering any retrofitting rule of HDDF engines
- EURO V HDDF Type 2A present substantial difficulties:
 - What should be the operability restriction in case of lack of gas
 - What should be the OBD requirements
- GFV recommends EURO V HDDF Type 2A engines not be subject to certification according to R49 at this stage
 - May be addressed at a later stage upon request of GRPE

EURO VI - LNG tanks

- GRSG has been informed that an amendment to R110 is necessary to certify HDDF vehicles.
- A dedicated TF will be launched to address the issue
 - Current expectation: the amendments to R110 may only be ready 1 year after the amendments to R49

Draft time-plan – on time except for R115

- Aug – Dec 2010: principles - done
- GRPE Jan 2011: status report + informal document - done
- Jan – June 2011: draft requirements
- GRPE June 2011: status report + informal document – done for R85 + EURO VI HDDF
- July – Dec 2011: amendments to UNECE-R49
- GRPE Jan 2012: informal HDDF annexes. + guidance Re Retrofit
- Jan - Mar 2012: HDDF annexes
- GRPE June 2012: approval of the amendments to UNECE-R49
- WP29 Nov 2012: approval of the amendments to UNECE-R49



DELAY necessary for amending R115 !