

Transmitted by the chairman from the informal GRPE GFV group

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 49 rev.4

Note: The text reproduced below was prepared by the experts from the GRPE GFV group in order to include gas fuelled engines in annex 9B (OBD according to GTR No5) to Regulation 49 rev.4

**PROPOSAL**

1. Annex 9B, amend the title to read:

"Annex 9B

TECHNICAL REQUIREMENTS FOR ON-BOARD DIAGNOSTIC SYSTEMS (OBD)  
FOR DIESEL ENGINES (WWH-OBD, gtr No. 5) AND GAS FUELLED ENGINES FOR  
ROAD VEHICLES"

(Editorial note: the elements of this proposal mentioned in square brackets and/or highlighted in yellow need to be further discussed in order to ensure consistency with Annex 4B and to address as appropriate the needs of the Contracting Parties.)

2. Annex 9B section 1, amend to read:

"1. APPLICABILITY

This annex is applicable upon decision of the Contracting Parties [instead of Annex 9A], provided Annex 4B is also applied.

[In the case a Contracting Party decides to apply this annex, some requirements of annex 9A may still remain applicable at the explicit request of that Contracting Party provided these requirements are not in contradiction to the specifications of the present annex.]

This annex is applicable to Diesel or Gas (NG and LPG) fuelled engines to be mounted on road vehicles but is not applicable to dual- or bi-fuelled engines."

3. Annex 9B section 3.35, amend to read:

"3.35. "Warm-up cycle" means sufficient engine operation such that the coolant temperature has risen by at least **22 K** (22 °C / 40 °F) from engine starting and reaches a minimum temperature of 333 K (60 °C / 140 °F) 1/."

3.35. "Warm-up cycle" means sufficient engine operation such that the coolant temperature has risen by at least 295 K (22 °C / 40 °F) from engine starting and reaches a minimum temperature of 333 K (60 °C / 140 °F) 1/.

4. Annex 9B section 3.36, amend to read:

"3.36. Abbreviations

CV	Crankcase Ventilation
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter or Particulate Trap including catalyzed DPFs and Continuously Regenerating Traps (CRT)
DTC	Diagnostic trouble code
EGR	Exhaust Gas Recirculation
HC	Hydrocarbon
LNT	Lean NO <sub>x</sub> Trap (or NO <sub>x</sub> absorber)
<b>LPG</b>	<b>Liquefied Petroleum Gas</b>
MECS	Malfunction Emission Control Strategy
<b>NG</b>	<b>Natural Gas</b>
NO <sub>x</sub>	Oxides of Nitrogen
OTL	OBD Threshold Limit
PM	Particulate Matter
SCR	Selective Catalytic Reduction
SW	Screen Wipers
TFF	Total Functional Failure monitoring
VGT	Variable Geometry Turbocharger
VVT	Variable Valve Timing"

5. Annex 9B section 4 1<sup>st</sup> paragraph, amend to read:

"4. GENERAL REQUIREMENTS

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1/ This definition does not imply that a temperature sensor is necessary to measure the coolant temperature.

In the context of this annex, the OBD system shall have the capability of detecting malfunctions, of indicating their occurrence by means of a malfunction indicator, of identifying the likely area of the malfunctions by means of information stored in computer memory, and communicating that information off-board."

In the context of this annex, the OBD system shall have the capability of detecting **In** malfunctions, of indicating their occurrence by means of a malfunction indicator, of identifying the likely area of the malfunctions by means of information stored in computer memory, and communicating that information off-board.

6. Annex 9B section 4.7.1.2 (l), amend to read:

- "4.7.1.2. Information about active emission-related malfunctions  
(l) the confirmed and active DTCs **for** Class B1 malfunctions;"
- (l) the confirmed and active DTCs Class B1 malfunctions;

7. Annex 9B section 5.2.3, amend to read:

- "5.2.3. Low fuel level
- Manufacturers may request approval to disable monitoring systems that are affected by low fuel level / **pressure** or running out of fuel (e.g. diagnosis of a malfunction of the fuelling system or misfiring) **as follows:**
- Manufacturers may request approval to disable monitoring systems that are affected by low fuel level or running out of fuel (e.g. diagnosis of a malfunction of the fuelling system or misfiring).

	DIESEL	GAS	
		NG	LPG
(a) The low fuel level considered for such a disablement shall not exceed 100 litres or 20 per cent of the nominal capacity of the fuel tank, whichever is lower.	X		X
(b) The low fuel pressure in the tank considered for such a disablement shall not exceed 20 per cent of the nominal fuel pressure in the tank		X	

8. Annex 9B section 5.2., add section 5.2.8. to read:

- "5.2.8. Re-fuelling
- After a refuelling the manufacturer of a gas fuelled vehicle may temporarily disable the OBD system when the system has to adapt to the recognition by the ECU of a change in the fuel quality and composition.
- The OBD system shall be re-enabled as soon as the new fuel is recognised and the

engine parameters are readjusted. This disablement shall be limited to a maximum of 10 minutes."

9. Annex 9B section 6., add paragraph (d) to read:

"6. DEMONSTRATION REQUIREMENTS

(d) procedure for selecting the reference fuel in case of a gas engine"

10. Annex 9B section 6.1.1. (a), amend to read:

"6.1.1. Parameters defining an emission-OBD family

(a) emission control systems"

(a) mission control systems

11. Annex 9B section 6.3.2 and foot note, amend to read:

"6.3.2. Procedures for qualifying a deteriorated component (or system)

This paragraph applies to the cases where the malfunction selected for an OBD demonstration test is monitored against tailpipe emissions 10/ (emission threshold monitoring - see paragraph 4.2.) and it is required that the manufacturer demonstrates, by an emission test, the qualification of that deteriorated component."

This paragraph applies to the cases where the malfunction selected for an OBD demonstration test is monitored against tailpipe emissions 10/ (emission threshold monitoring - see paragraph 4.2.), by an emission test, the qualification of that deteriorated component.

12. Annex 9B section 6., add section 6.5 to read:

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10 / This paragraph will be extended to other monitors than emission threshold monitors at a later stage.

- "6.5. PROCEDURE FOR SELECTING THE REFERENCE FUEL IN CASE OF A GAS ENGINE  
Demonstration of the OBD performance and malfunction classification shall be performed by using one of the reference fuels mentioned in Annex 5 on which the engine is designed to operate.  
The selection of this reference fuel is done by the type-approval authority, who shall provide sufficient time for the test laboratory to supply the selected reference fuel"

13. Annex 9B section 8.1.3., amend last line to read:

"In addition, the manufacturer shall provide a list of all electronic input and output and identification of the communication protocol utilized by each emission-OBd family."

In addition, the manufacturer shall provide a list of all electronic input and output an identification of the communication protocol utilized by each emission-OBd family.

14. Annex 9B appendix 3, amend to read:

"Annex 9B - Appendix 3

MONITORING REQUIREMENTS

The Items of this appendix list the systems or components required to be monitored by the OBD system, according to paragraph 4.2.

Unless specified otherwise, the requirements apply to both Diesel and Gas Engines"

15. Annex 9B appendix 3 Item 1 1<sup>st</sup> paragraph, amend to read:

"Appendix 3 - Item 1

ELECTRIC / ELECTRONIC COMPONENTS MONITORING

Electric/electronic components used to control or monitor the emission control systems described in this appendix shall be subject to Component Monitoring according to the provisions of paragraph 4.1. of this annex. This includes, but is not limited to, pressure sensors, temperature sensors, exhaust gas sensors and oxygen sensors when present, knock sensors, in-exhaust fuel or reductant injector(s), in-exhaust burners or heating elements, glow plugs, intake air heaters."

Electric/electronic components used to control or monitor the emission control systems described in this appendix shall be subject to Component Monitoring according to the provisions of paragraph 4.1. of this annex. This includes, but is not limited to, pressure sensors, temperature sensors, exhaust gas sensors, in-exhaust fuel or reductant injector(s), in-exhaust burners or heating elements, glow plugs, intake air heaters.

16. Annex 9B appendix 3 Item 5, amend to read:

"Appendix 3 - Item 5

**OXIDATION CATALYSTS (incl. DIESEL OXIDATION CATALYST - DOC)  
MONITORING**

This Item applies to **oxidation catalysts** that are separate from other after-treatment systems. Those that are included in the canning of an after-treatment system are covered within the appropriate Item of this appendix.

The OBD system shall monitor the following elements of the **oxidation catalysts** on engines so-equipped for proper operation:

- (a) HC conversion efficiency: the **oxidation catalysts** ability to convert HC upstream of other after-treatment devices - total functional failure monitoring.
- (b) HC conversion efficiency: the **oxidation catalysts** ability to convert HC downstream of other after-treatment devices - total functional failure monitoring."

17. Annex 9B appendix 3 Item 6, amend to read:

"Appendix 3 - Item 6

**EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING**

The OBD system shall monitor the following elements of the EGR system on engines so-equipped for proper operation:

	DIESEL	GAS
(a1) EGR low/high flow: the EGR system's ability to maintain the commanded EGR flow rate, detecting both "flow rate too low" and "flow rate too high" conditions - emission threshold monitoring.	X	
(a2) EGR low/high flow: the EGR system's ability to maintain the commanded EGR flow rate, detecting both "flow rate too low" and "flow rate too high" conditions - performance monitoring (monitoring requirement to be further discussed)		X
(b) slow response of the EGR actuator: the EGR system's ability to achieve the commanded flow rate within a manufacturer specified time interval following the command - performance monitoring.	X	X
(c) EGR cooler under cooling performance: the EGR cooler system's ability to achieve the manufacturer's specified cooling performance - performance monitoring	X	X

18. Annex 9B appendix 3 Item 7, amend to read:

"Appendix 3 - Item 7

FUEL SYSTEM MONITORING

The OBD system shall monitor the following elements of the Fuel system on engines so-equipped for proper operation:

	DIESEL	GAS
(a) Fuel system pressure control: fuel system ability to achieve the commanded fuel pressure in closed loop control - performance monitoring.	X	
(b) Fuel system pressure control: fuel system ability to achieve the commanded fuel pressure in closed loop control in the case where the system is so constructed that the pressure can be controlled independently of other parameters - performance monitoring.	X	
(c) Fuel injection timing: fuel system ability to achieve the commanded fuel timing for at least one of the injection events when the engine is equipped with the appropriate sensors - performance monitoring.	X	
(d) Fuel injection system: ability to maintain the desired air-fuel ratio (incl. but not limited to self adaptation features) – performance monitoring		X

19. Annex 9B appendix 3 Item 8, amend to read:

"Appendix 3 - Item 8

AIR HANDLING AND TURBOCHARGER/BOOST PRESSURE CONTROL SYSTEM

The OBD system shall monitor the following elements of the Air Handling and Turbocharger/Boost Pressure Control System on engines so-equipped for proper operation:

	DIESEL	GAS
(a1) Turbo under/over boost: turbo boost system's ability to maintain the commanded boost pressure, detecting both "boost pressure too low" and "boost pressure too high" conditions – emission threshold monitoring.	X	
(a2) Turbo under/over boost: turbo boost system's ability to maintain the commanded boost pressure, detecting both "boost pressure too low" and "boost pressure too high" conditions – performance monitoring? (monitoring requirement to be further discussed)		X
(b) Variable geometry turbo (VGT) slow response: VGT system's ability to achieve the commanded geometry within a manufacturer	X	X

- specified time -performance monitoring.
- |  |   |   |
|--|---|---|
| (c) Charge air cooling: Charge air cooling system efficiency - total functional failure. | X | X |
|--|---|---|

20. Annex 9B appendix 3 Item 10, amend to read:

"Appendix 3 - Item 10

MISFIRE MONITORING

	DIESEL	GAS
(a) No prescriptions	X	
(b) misfire that may cause catalyst damage (e.g. by monitoring a certain percentage of misfiring in a certain period of time) – performance monitoring (monitoring requirement to be further discussed together with items 6 and 8)		X

21. Annex 9B appendix 3 Item 12 section (a), amend to read:

"Appendix 3 - Item 12

ENGINE COOLING SYSTEM MONITORING

- (a) Engine coolant temperature (thermostat): Stuck open thermostat. Manufacturers need not monitor the thermostat if its failure will not disable any other OBD monitors - total functional failure."
- (a) Engine coolant temperature (thermostat): Stuck open thermostat Manufacturers need not monitor the thermostat if its failure will not disable any other OBD monitors - total functional failure.

22. Annex 9B appendix 3 Item 13, amend to read:

"Appendix 3 - Item 13

EXHAUST GAS & OXYGEN SENSORS MONITORING

The OBD system shall monitor the

	DIESEL	GAS
(a) electrical elements of the exhaust gas sensors on engines so-	X	X



equipped for proper operation according to item 1 to this appendix  
– component monitoring.

- (b) both the Primary and Secondary (fuel control) oxygen sensors.  
These sensors are considered as exhaust gas sensors to be  
monitored for proper operation according to item 1 to this appendix  
– component monitoring.”

X

23. Annex 9B appendix 3, add Item 15 to read:

“Appendix 3 – Item 15

THREE-WAY CATALYST

The OBD system shall monitor the three-way catalyst on engines so-equipped for proper operation:

Three-way Catalyst Conversion efficiency: the catalyst ability to  
convert NO<sub>x</sub> and CO – performance monitoring.”

DIESEL

GAS

X

24. Annex 9B appendix 4, amend to read:

"FINAL COMPLIANCE REPORT

The documentation package and the herewith described OBD system / emission OBD family  
comply with the requirements of the following regulation:

Regulation ... / version .../ enforcement date .... / type of fuel ..."

25. Annex 9B appendix 4 item 4 section 1.1. table line "Test information", amend to read:

"Item 4 to the technical compliance report (example)

DEMONSTRATION TESTS OF THE OBD SYSTEM

1.1. OBD system tested on the engine test-bed

<u>Test information</u> - Ambient testing conditions (temperature, humidity, pressure): - Place of test (incl. altitude): - <b>Reference</b> fuel: - Engine lubricating oil: - Date of test:	..... ..... ..... ..... .....
- <u>Test information</u> - - <u>Ambient testing conditions (temperature, humidity, pressure):</u> - - <u>Place of test (incl. altitude):</u> - - <u>Testing fuel:</u> - - <u>Engine lubricating oil:</u> - - <u>Date of test:</u> -	- - ..... - ..... - ..... - ..... - ..... - ..... -

26. Annex 9B appendix 5 table 3, amend to read:

"Annex 9B - Appendix 5

FREEZE FRAME AND DATA STREAM INFORMATION

Table 3: OPTIONAL INFORMATION, IF USED BY THE EMISSION OR THE OBD SYSTEM TO ENABLE OR DISABLE ANY OBD INFORMATION

	Freeze frame	Data stream
fuel level <b>or tank fuel pressure (as appropriate)</b>	x	x
Engine oil temperature	x	x
vehicle speed	x	x
status of the fuel quality adaptation (active / not active) in case of gas engines		x
engine control computer system voltage (for the main control chip)	x	x

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27. Annex 9B appendix 5 table 4, amend to read:

"Table 4: OPTIONAL INFORMATION, IF THE ENGINE IS SO EQUIPPED, SENSES OR CALCULATES THE INFORMATION:

	Freeze frame	Data stream
Absolute throttle position / intake air throttle position (position of valve used to regulate intake air)	x	x

Fuel control system status in case of a close loop system (e.g. in case of a fuel pressure close loop system)	x	x
Fuel rail pressure	x	x
Injection control pressure (i.e. pressure of the fluid controlling fuel injection)	x	x
Representative fuel injection timing (beginning of first main injection)	x	x
Commanded fuel rail pressure,	x	x
Commanded injection control pressure (i.e. pressure of the fluid controlling fuel injection)	x	x
Intake air temperature	x	x
Ambient air temperature	x	x
Turbocharger inlet / outlet air temperature (compressor and turbine)	x	x
Turbocharger inlet / outlet pressure (compressor and turbine)	x	x
Charge air temperature (post intercooler if fitted)	x	x
Actual boost pressure	x	x
Air flow rate from mass air flow sensor	x	x
Commanded EGR valve duty cycle/position, (provided EGR is so controlled)	x	x
Actual EGR valve duty cycle/position	x	x
PTO status (active or not active)	x	x
Accelerator pedal position	x	x
Redundant absolute pedal position	x	if sensed
Instantaneous fuel consumption	x	x
Commanded/target boost pressure (if boost pressure used to control turbo operation)	x	x
DPF inlet pressure	x	x
DPF outlet pressure	x	x
DPF delta pressure	x	x
Engine-out exhaust pressure	x	x
DPF inlet temperature	x	x
DPF outlet temperature	x	x
Engine-out exhaust gas temperature	x	x
Turbocharger/turbine speed	x	x
Variable geometry turbo position	x	x
Commanded variable geometry turbo position	x	x
Wastegate valve position	x	x
Air/fuel ratio sensor output		x
Oxygen sensor output		x
Secondary Oxygen sensor output (when fitted)		x
NO <sub>x</sub> sensor output		x

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