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**Economic Commission for Europe****Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****Working Party on Pollution and Energy****Seventieth session**

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Item 3(a) of the provisional agenda

**Light vehicles – Regulations Nos. 68 (Measurement of the maximum speed, including electric vehicles), 83 (Emissions of M<sub>1</sub> and N<sub>1</sub> vehicles), 101 (CO<sub>2</sub> emissions/fuel consumption) and 103 (Replacement pollution control devices)****Proposal for amendments to the 07 series of amendments to Regulation No. 83 (Emissions of M<sub>1</sub> and N<sub>1</sub> vehicles)****Submitted by the expert from the International Organization of Motor Vehicle Manufacturers\***

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA) to update the on-board diagnostics (OBD) requirements to the state of the art. The modifications to the current text of Regulation No. 83 are marked in bold for new or strikethrough for deleted characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

## I. Proposal

*Annex 1, paragraph 3.2.12.2.7.6.3., amend to read:*

- "3.2.12.2.7.6.3. A comprehensive document describing all sensed components with the strategy for fault detection and MI activation (fixed number of driving cycles or statistical method), including a list of relevant secondary sensed parameters for each component monitored by the OBD system. A list of all OBD output codes and format used (with an explanation of each) associated with individual emission related power-train components and individual non-emission related components, where monitoring of the component is used to determine MI activation. In particular, a comprehensive explanation for the data given in service \$05 Test ID \$21 to FF and the data given in service \$06 ~~must~~ **shall** be provided. In the case of vehicle types that use a communication link in accordance with ~~ISO 15765-4 "Road vehicles - Diagnostics on Controller Area Network (CAN) - Part 4: Requirements for emissions-related systems"~~ **the standard listed in paragraph 6.5.3.1.(a) of Annex 11, Appendix 1 of this Regulation**, a comprehensive explanation for the data given in service \$06 Test ID \$00 to FF, for each OBD monitor ID supported, ~~must~~ **shall** be provided."

*Annex 2, Appendix 1, paragraph 3., amend to read:*

- "3. A comprehensive document describing all sensed components with the strategy for fault detection and MI activation (fixed number of driving cycles or statistical method), including a list of relevant secondary sensed parameters for each component monitored by the OBD system and a list of all OBD output codes and format used (with an explanation of each) associated with individual emission related power-train components and individual non-emission related components, where monitoring of the component is used to determine MI activation. In particular, a comprehensive explanation for the data given in service \$05 Test ID \$21 to FF and the data given in service \$06 shall be provided. In the case of vehicle types that use a communication link in accordance with **the standard listed in paragraph 6.5.3.1.(a) of Annex 11, Appendix 1 of this Regulation** ~~ISO 15765-4 "Road vehicles - Diagnostics on Controller Area Network (CAN) - Part 4: Requirements for emissions-related systems"~~, a comprehensive explanation for the data given in service \$06 Test ID \$00 to FF, for each OBD monitor ID supported, shall be provided."

*Annex 11, paragraph 3.9.3.1., amend to read:*

- "3.9.3.1. On a request from a diagnostic scan tool, the diagnostic signals shall be transmitted on one or more source addresses. The use of source addresses is described in **the standard listed in paragraph 6.5.3.2.(a) of Annex 11, Appendix 1 of this Regulation** ~~ISO DIS 15031-5 "Road vehicles - communication between vehicles and external test equipment for emissions-related diagnostics - Part 5: Emissions-related diagnostic services"~~, dated 1 November 2001."

Annex 11, Appendix 1, paragraph 6.5.3., amend to read:

- "6.5.3. The emission control diagnostic system ~~must~~ **shall** provide for standardised and unrestricted access and conform with the following ISO standards and/or SAE specification. **Later versions may be used at the manufacturers' discretion.**
- 6.5.3.1. ~~One of the~~The following standards ~~with the restrictions as described~~ **shall** be used as the on board to off-board communications link:
- ~~ISO 9141-2: 1994 (amended 1996) "Road Vehicles - Diagnostic Systems - Part 2: CARB requirements for interchange of digital information;~~
- ~~SAE J1850: March 1998 Class B Data Communication Network Interface". Emission related messages must use the cyclic redundancy check and the three byte header and not use interbyte separation or checksums;~~
- ~~ISO 14230:2000 - Part 4 "Road Vehicles - Keyword protocol 2000 for diagnostic systems - Part 4: Requirements for emission relate systems";~~
- (a) ~~ISO DIS 15765-4:2011~~ **ISO 15765-4:2011** "Road vehicles - Diagnostics on Controller Area Network (CAN) - Part 4: Requirements for emissions-related systems", dated 1 ~~November 2004~~ **February 2011**;
- 6.5.3.2. **Standards used for the transmission of OBD relevant information:**
- (a) **ISO 15031-5 "Road vehicles - communication between vehicles and external test equipment for emissions-related diagnostics - Part 5: Emissions-related diagnostic services", dated 1 April 2011 or SAE J1979 dated 23 February 2012;**
- (b) **ISO 15031-4 "Road vehicles - Communication between vehicle and external test equipment for emissions related diagnostics - Part 4: External test equipment", dated 1 June 2005 or SAE J1978 dated 30 April 2002;**
- (c) **ISO 15031-3 "Road vehicles - Communication between vehicle and external test equipment for emissions related diagnostics Part 3: Diagnostic connector and related electrical circuits: specification and use", dated 1 July 2004 or SAE J 1962 dated 26 July 2012;**
- (d) **ISO 15031-6 "Road vehicles - Communication between vehicle and external test equipment for emissions related diagnostics - Part 6: Diagnostic trouble code definitions", dated 13 August 2010 or SAE J2012 dated 07 March 2013;**
- (e) **ISO 27145 "Road vehicles - Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD)" dated 2012-08-15 with the restriction, that only 6.5.3.1.(a) may be used as a data link;**
- (f) **ISO 14229:2013 "Road vehicles - Unified diagnostic services (UDS) with the restriction, that only 6.5.3.1.(a) may be used as a data link".**
- The standards (e) and (f) may be used as an option instead of (a) not earlier than 1 January 2019.**
- 6.5.3.3. Test equipment and diagnostic tools needed to communicate with OBD systems ~~must~~ **shall** meet or exceed the functional specification given in ~~the standard listed in paragraph 6.5.3.2.(b) of this Appendix~~ **ISO DIS 15031-**

~~4 "Road vehicles — Communication between vehicle and external test equipment for emissions related diagnostics — Part 4: External test equipment", dated 1 November 2001.~~

- 6.5.3.4.** Basic diagnostic data, (as specified in paragraph 6.5.1.) and bi-directional control information ~~must~~ **shall** be provided using the format and units described in **the standard listed in paragraph 6.5.3.2.(a) of this appendix** ~~ISO DIS 15031-5 "Road vehicles — Communication between vehicle and external test equipment for emissions related diagnostics — Part 5: Emissions related diagnostic services", dated 1 November 2001, and must be available using a diagnostic tool meeting the requirements of the standard listed in paragraph 6.5.3.2.(b) of this appendix~~ ~~ISO DIS 15031-4.~~

The vehicle manufacturer shall provide to a national standardisation body the details of any emission-related diagnostic data, e.g. PID's, OBD monitor Id's, Test Id's not specified in ~~of the standard listed in paragraph 6.5.3.2.(a) of this Regulation~~ ~~ISO DIS 15031-5~~ but related to this Regulation.

- 6.5.3.5.** When a fault is registered, the manufacturer ~~must~~ **shall** identify the fault using an appropriate **ISO/SAE controlled** fault code ~~consistent with those given in Section 6.3. of~~ **specified in one of the standards listed in paragraph 6.5.3.2.(d) of this appendix** ~~ISO DIS 15031-6 "Road vehicles — Communication between vehicle and external test equipment for emissions related diagnostics — Part 6: Diagnostic trouble code definitions", relating to "emission related system diagnostic trouble codes". If such identification is not possible, the manufacturer may use manufacturer controlled diagnostic trouble codes according to Sections 5.3. and 5.6. the same standard of ISO DIS 15031-6. The fault codes must shall be fully accessible by standardised diagnostic equipment complying with the provisions of paragraph 6.5.3.2. of this Annex.~~

The vehicle manufacturer shall provide to a national standardisation body the details of any emission-related diagnostic data, e.g. PID's, OBD monitor Id's, Test Id's not specified in ~~of the standard listed in paragraph 6.5.3.2.(a) of this appendix~~ ~~ISO DIS 15031-5~~ but related to this Regulation.

- 6.5.3.6.** The connection interface between the vehicle and the diagnostic tester ~~must~~ **shall** be standardised and ~~must shall~~ meet all the requirements of **the standard listed in paragraph 6.5.3.2.(c) of this appendix** ~~ISO DIS 15031-3 "Road vehicles — Communication between vehicle and external test equipment for emissions related diagnostics — Part 3: Diagnostic connector and related electrical circuits: specification and use", dated 1 November 2001. The installation position must shall be subject to agreement of the administrative department such that it is readily accessible by service personnel but protected from tampering by non-qualified personnel.~~

- 6.5.3.7.** The manufacturer shall also make accessible, where appropriate on payment, the technical information required for the repair or maintenance of motor vehicles unless that information is covered by an intellectual property right or constitutes essential, secret know-how which is identified in an appropriate form; in such case, the necessary technical information shall not be withheld improperly.

Entitled to such information is any person engaged in commercially servicing or repairing, road-side rescuing, inspecting or testing of vehicles or in the manufacturing or selling replacement or retro-fit components, diagnostic tools and test equipment. "

*Annex 11, Appendix 1, paragraph 7.6.1., amend to read:*

- "7.6.1. The OBD system shall report, in accordance with the **ISO 15031-5** specifications **of the standard listed in paragraph 6.5.3.2.(a) of this appendix**, the ignition cycle counter and general denominator as well as separate numerators and denominators for the following monitors, if their presence on the vehicle is required by this annex:
- (a) Catalysts (each bank to be reported separately);
  - (b) Oxygen/exhaust gas sensors, including secondary oxygen sensors (each sensor to be reported separately);
  - (c) Evaporative system;
  - (d) EGR system;
  - (e) VVT system;
  - (f) Secondary air system;
  - (g) Particulate filter;
  - (h) NOx after-treatment system (e.g. NOx absorber, NOx reagent/catalyst system);
  - (i) Boost pressure control system."

*Annex 11, paragraph 2., amend to read:*

- "2. ...  
For the purposes of this **Annex only**:"

*Annex 11, paragraph 2.10., amend to read:*

- "2.10. A "*driving cycle*" consists of engine start-up **key-on**, a driving mode where a malfunction would be detected if present, and engine shut-off **key-off**."

*Annex 11, paragraph 3.8.1., amend to read:*

- "3.8.1. The OBD system may erase a fault code and the distance travelled and freeze-frame information if the same fault is not re-registered in at least 40 engine warm-up cycles **or 40 driving cycles with vehicle operation in which the criteria specified in sections 7.5.1.(a)–(c) of Annex 11, Appendix 1 are met**."

*Annex 11, Appendix 1, paragraph 1., amend to read:*

- "1. ...  
The manufacturer shall make available the defective components and/or electrical devices which would be used to simulate failures. When measured over the Type I Test cycle, such defective components or devices shall not cause the vehicle emissions to exceed the limits of paragraph 3.3.2 by more than 20 per cent. **For electrical failures (short/open circuit), the emissions may exceed the limits of paragraph 3.3.2. by more than twenty per cent.**  
When the vehicle is tested with the defective component or device fitted, the OBD system is approved if the MI is activated. The OBD system is also approved if the MI is activated below the OBD threshold limits."

*Annex 11, Appendix 1, insert a new paragraphs 6.1.1., to read:*

- "6.1.1.        **The Type I Test need not be performed for the demonstration of electrical failures (short/open circuit). The manufacturer may demonstrate these failure modes using driving conditions in which the component is used and the monitoring conditions are encountered. These conditions shall be documented in the type approval documentation. "**

*Annex 11, Appendix 1, insert a new paragraph 6.2.3., to read:*

- "6.2.3.        **The use of additional preconditioning cycles or alternative preconditioning methods shall be documented in the type approval documentation."**

*Annex 11, Appendix 1, paragraph 6.3.1.5., amend to read:*

- 6.3.1.5.        Electrical disconnection of the electronic evaporative purge control device (if equipped and if active on the selected fuel type). ~~For this specific failure mode, the Type I Test need not be performed.~~

*Annex 11, Appendix 1, paragraphs 6.4.1.1. and 6.4.2.1., amend to read:*

- "6.4.1.1.        ...  
The MI shall **be activated at the latest** before the end of this test under any of the conditions given in paragraphs 6.4.1.2. to 6.4.1.5. **The MI may also be activated during preconditioning.** The Technical Service may substitute those conditions with others in accordance with paragraph 6.4.1.6.

- ...  
6.4.2.1.        ...  
The MI shall **be activated at the latest** before the end of this test under any of the conditions given in paragraphs 6.4.2.2. to 6.4.2.5. **The MI may also be activated during preconditioning.** The **Technical Service** may substitute those conditions by others in accordance with paragraph 6.4.2.5.

..."

*Annex 11, Appendix 1, paragraph 7.6.2., amend to read:*

- "7.6.2.        For specific components or systems that have multiple monitors, which are required to be reported by this point (e.g. oxygen sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD system shall separately track numerators and denominators for each of the specific monitors ~~except those monitoring for short circuit or open circuit failures~~ and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator shall be reported for the specific component."

*Annex 11, Appendix 1, insert a new paragraph 7.6.2.1., to read:*

- "7.6.2.1.        **Numerators and denominators for specific monitors of components or systems, that are monitoring continuously for short circuit or open circuit failures are exempted from reporting.**

**"Continuously," if used in this context means monitoring is always enabled and sampling of the signal used for monitoring occurs at a rate no less than two samples per second and the presence or the absence of**

the failure relevant to that monitor has to be concluded within 15 seconds.

If for control purposes, a computer input component is sampled less frequently, the signal of the component may instead be evaluated each time sampling occurs.

It is not required to activate an output component/system for the sole purpose of monitoring that output component/system."

*Paragraph 9.3.5.2., amend to read:*

"9.3.5.2. ...  
**Vehicles of small series productions with less than 1000 vehicles per OBD family are exempted from minimum IUPR requirements as well as the requirement to demonstrate these to the approval authority"**

*Annex 11, insert a new paragraph 3.10., to read:*

- 3.10. Additional provisions for vehicles employing engine shut - off strategies**
- 3.10.1. Driving cycle**
- 3.10.1.1. Autonomous engine restarts commanded by the engine control system following an engine stall may be considered a new driving cycle or a continuation of the existing driving cycle."**

*Annex 11, insert a new paragraph 3.2.3., to read:*

**"3.2.3. Identification of deterioration or malfunctions may be also be done outside a driving cycle (e.g. after engine shutdown)."**

*Annex 11, delete paragraphs 3.3.4.9. and 3.3.4.10.*

*Annex 11, insert new paragraphs 3.3.5.1. and 3.3.5.2., to read:*

- "3.3.5.1. The following devices should however be monitored for total failure or removal (if removal would cause the applicable emission limits to be exceeded):**
- (a) A particulate trap fitted to compression ignition engines as a separate unit or integrated into a combined emission control device;**
  - (b) A NO<sub>x</sub> after-treatment system fitted to compression ignition engines as a separate unit or integrated into a combined emission control device;**
  - (c) A diesel oxidation catalyst (DOC) fitted to compression ignition engines as a separate unit or integrated into a combined emission control device.**
- 3.3.5.2. The devices referred to in paragraph 3.3.5.1. shall also be monitored for any failure that would result in exceeding the applicable OBD threshold limits."**

## II. Justification

### A. Update of communication standards

1. The communication standards referenced throughout the regulation are outdated. All references to ISO 15031-x and 15765-4 should be updated to the latest version. With the standards currently referenced it would be impossible to fulfil other requirements in Regulation No. 83, i.e. reporting of IUPR information. Furthermore some standards are referenced several times throughout the document, which may result in future inconsistencies. To avoid this, it was decided to move all references to communication standard to a separate paragraph and delete the version information from all other references.
2. Two new standards for communication to external test equipment are introduced into the Regulation. ISO 27145 (WWH OBD), which is already used in Heavy Duty vehicles and ISO 14229, which forms the basis for WWH OBD.
3. Such an introduction needs to be carefully considered, as OBD is not only used in independent workshops but also during periodical technical inspection (PTI) in several regions.
4. To introduce these new protocols in workshop testers and on the equipment of PTI stations, a lead time of approximately 4 years is introduced to allow the update testers in the workshop and the PTI equipment.

### B. Definitions

#### (i) General

5. To avoid confusion and contradictions with future amendments of other provisions, the definitions of Annex 11 should be amended to be valid only for OBD.
6. Update of the definition of "driving cycle" to reflect changes in vehicle technology (e.g. hybrid electric vehicles), that do not need a start of the internal combustion engine for operation.

#### (ii) Erasure of fault codes

7. Annex 11 of Regulation No. 83 contains the definition of a warm-up cycle in the definition section under para. 2.11.:
8. Paragraph 3.8.1. defines the cycle that is used to erase healed error code information from the fault code memory:  

"3.8.1. The OBD system may erase a fault code and the distance travelled and freeze-frame information if the same fault is not re-registered in at least 40 engine warm-up cycles."
9. The intention of this paragraph is to keep fault code information in the memory long enough to give the service technician this information if a customer shows up at the workshop driven by the previous Malfunction Indicator Lamp (MIL) illumination. Assuming 2 to 3 warm up cycles per day, this information on healed codes (the system is OK and does not need repair!) stays thirteen to twenty days in the memory, which is long enough for the above described purpose.
10. For hybrid electrical vehicles, which are plugged in regularly, causing rare engine operation, the history information on healed errors will most likely stay much longer in the



fault code memory. Customers showing up at their service garage for the regular service intervals might get unnecessary repairs because this information is still present. Customers will fail PTI in some member states because of fault codes not erased.

11. To erase a fault code, the engine has to be operated (7.5.1(a) requires an engine start). For this reason, paragraph 3.8.1. should be amended.

### **C. Electrical failures**

12. Electrical failures (disconnection, short to battery and short to ground) have only one of two states, present or not present. There is no such thing as a partial failure therefore the concept of threshold monitoring is inappropriate.

13. Demonstrating these types failures in a type 1 test is often inappropriate or wasteful. The demonstration of the monitor working properly should therefore be possible in a driving cycle defined by the manufacturer, in which the component (sensor/actuator) is used. This is true also for the electronic evaporative control device. Paragraphs 6.1.1., and 6.3.1.5. should be amended.

14. The proposed changes do not alter the requirements of monitoring the electrical failures, but intend to clarify the situation during the OBD system test.

### **D. OBD system test**

15. Typically an OBD system test consists of two preconditioning cycles and a final type 1 test. The type 1 test is always performed, even if alternative driving cycles are used, more preconditioning cycles are added or the MIL is activated during one of the preconditioning cycles.

16. Regulation No. 83 allows in paragraph 3.5.2. more than two preconditioning cycles for MI activation. According to paragraph 6.2.2., the manufacturer may request alternative preconditioning cycles.

17. One reason for doing this might be that the operating conditions for monitoring a component might not be encountered in a type 1 test. In such a case, the MIL has to be illuminated before the type 1 test, in which emissions are measured.

18. For vehicles developed according to CARB OBD II requirements, the MIL has to be illuminated after two driving cycles with the fault detected. Such vehicles will illuminate the MI during the second preconditioning cycle as well.

19. Additionally there should be no bar to activating the MIL earlier than the minimum requirements. In some cases it is desirable to alert the driver as soon as possible to the fault condition.

### **E. IUPR reporting**

20. The intention of the text of paragraph 7.6.2. in Appendix 1 to Annex 11 saying "... except those monitoring for short circuit or open circuit failures ..." was to exempt the ratios of monitors for electrical failures from being reported. This wording could however give the impression that electrical failures are exempted from being reported only for systems with multiple monitors but are requested for systems consisting of only one electrical monitor.

21. Ratios for continuously monitored components or systems need not be reported, because their ratio is per definition above the minimum required ratio for any system or component.

22. A definition of "continuously", aligned with the provisions of the heavy duty OBD requirements is added.

## **F. Definitions for hybrids and failure detection**

23. For hybrid vehicles and vehicles employing engine shut-off strategies, some additional provisions need to reflect technical development.

24. Vehicle usage, without the need of an engine start, has to be considered and the handling of engine restarts after an unintended engine shut-off (e.g. engine stall). Thereby different technologies hat to be taken into account.

25. Some monitors of the OBD system need special conditions (e.g. engine stop), which are not encountered during a driving cycle as it is defined in Annex 11. Therefore it has to be clarified, that these monitors may be performed outside a normal driving cycle. In conjunction with already existing provisions regarding preconditioning cycles, the OBD system test is ensured.

## **G. Reorder requirements for diesel after treatment provisions**

26. Exemptions from monitoring requirements are handled in paragraph 3.3.5. Special provisions for the monitoring of diesel after-treatment components (to monitor for total functional failure even if the OBD threshold limits are nor exceeded) should be addressed as sub paragraphs of 3.3.5. as it is done in the 06 series of amendments. The proposal moves paragraphs 3.3.4.9. and 3.3.4.10. without any changes to 3.3.5.1. and 3.3.5.2.

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