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UN Regulations Nos. 68 (measurement of the maximum speed, including electric vehicles), 83 (emissions of M₁ and N₁ vehicles), 101 (CO₂ emissions/fuel consumption) and 103 (replacement pollution control devices)

Proposal for supplement 1 to the 07 series of amendments to UN Regulation No. 83

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) in order to update the OBD requirements to the state of the art.

The modifications to the original English text are marked using track changes.

* 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 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. (d) of Annex XI, 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 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 ~~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. (d) of Annex XI, 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, shall be provided."

Annex 11, paragraph 2.10., amend to read:

"2.10. A "driving cycle" consists of engine start-up, driving mode where a malfunction would be detected if present, and engine shut-off. **It includes the period of engine off time up to the next engine startup.**"

Annex 11, paragraph 2.11., amend to read:

"2.11. A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by a least 22 K from engine starting and reaches a minimum temperature of 343 K (70 °C).

Alternatively, manufacturers may define a warm-up cycle as a driving cycle with vehicle operation in which the criteria specified in sections 7.5.1. (a) to

(c) of Annex 11, Appendix 1 are met. 'Engine start' implies that the vehicle is ready to be driven."

Annex 11, paragraphs 3.3.4.1. to 3.3.4.3., amend to read:

- "3.3.4.1. Where fitted, reduction in the efficiency of the catalytic converter. **Manufacturers may monitor the first catalyst alone or in combination with the next catalyst(s) downstream.**
- 3.3.4.2. Where fitted, the functionality and integrity of the particulate trap. **Manufacturers may monitor the first trap alone or in combination with the next trap(s) downstream.**
- 3.3.4.3. The fuel-injection system electronic fuel quantity and timing actuator(s) is/are monitored for circuit continuity and total functional failure."

Annex 11, paragraphs 3.3.4.7. to 3.3.4.8., amend to read:

- "3.3.4.7. Malfunctions and the reduction in efficiency of a NO_x after-treatment system using a reagent and the reagent dosing sub-system shall be monitored. **Manufacturers may monitor the first catalyst alone or in combination with the next catalyst(s) downstream.**
- 3.3.4.8. Malfunctions and the reduction in efficiency of NO_x after-treatment not using a reagent shall be monitored. **Manufacturers may monitor the first catalyst alone or in combination with the next catalyst(s) downstream."**

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 6.5.3.1(e) of Annex XI, 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 1., amend to read:

- "1. Introduction
- ...
- 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. of this annex by more than 20 per cent. **For electrical failures (short/open circuit), the OBD system is also approved if the MI is activated at vehicle emissions exceeding the limits of paragraph 3.3.2 by more than 20 per cent.**
- ..."

Annex 11, Appendix 1, paragraphs 6.3.1.4. and 6.3.1.5., amend to read:

- "6.3.1.4. Electrical disconnection of any other emission-related component connected to a power-train management computer (if active on the selected fuel type). **For these failure modes, a Type I Test need not be performed.**

The manufacturer may demonstrate the failure using driving conditions, in which the component is used and the monitoring conditions are encountered.

- 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. The manufacturer may demonstrate the failure using driving conditions, in which the component is used and the monitoring conditions are encountered."

Annex 11, Appendix 1, paragraphs 6.3.2.3. and 6.3.2.4., amend to read:

- "6.3.2.3. Electrical disconnection of any fuelling system electronic fuel quantity and timing actuator. For these failure modes, a Type I Test need not be performed.

The manufacturer may demonstrate the failure using driving conditions, in which the component is used and the monitoring conditions are encountered.

- 6.3.2.4. Electrical disconnection of any other emission-related component connected to a power-train management computer. For these failure modes, a Type I Test need not be performed.

The manufacturer may demonstrate the failure using driving conditions, in which the component is used and the monitoring conditions are encountered."

Annex 11, Appendix 1, paragraph 6.4.1.1., amend to read:

- "6.4.1.1. After vehicle preconditioning according to paragraph 6.2., the test vehicle is driven over a Type I test (Parts One and Two).

The MI shall be activated before the end of this test at the latest 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. However, the total number of failures simulated shall not exceed four (4) for the purpose of type approval.

In the case of testing a bi-fuel gas vehicle, both fuel types shall be used within the maximum of four (4) simulated failures at the discretion of the Type Approval Authority."

Annex 11, Appendix 1, paragraph 6.4.2.1., amend to read:

- "6.4.2.1. After vehicle preconditioning according to paragraph 6.2. of this appendix, the test vehicle is driven over a Type I test (Parts One and Two).

The MI shall be activated before the end of this test at the latest 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. However, the total number of failures simulated shall not exceed four (4) for the purposes of type approval."

Annex 11, Appendix 1, paragraph 6.5.3. and its sub paragraphs, amend to read:

- "6.5.3. The emission control diagnostic system must 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.

All references to standards in UN/ECE Regulation No 83, if listed in paragraph 6.5.3.1. of this appendix, shall be understood as references to the standards mentioned in the abovementioned paragraph.

{For vehicles approved to emission limit values contained in <Table 1 in paragraph 5.3.1.4. of Annex 1 of this Regulation> the standards listed in paragraph 6.5.3.1(d) of this Appendix shall be used as the on-board to off-board communications link. }

6.5.3.1. The following standards shall be used for transmission of OBD relevant information.

One of the ~~following~~ standards (a) to (d) with the restrictions as described must be used as the on-board to off-board communications link.

- (a) ISO 9141 - 2: 1994 (amended 1996) "Road Vehicles – Diagnostic Systems – Part 2: CARB requirements for interchange of digital information;
- (b) 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 inter-byte separation or checksums;
- (c) ISO 14230 – Part 4 "Road Vehicles – Keyword protocol 2000 for diagnostic systems – Part 4: Requirements for emission-related systems";
- (d) ISO DIS 15765-4 "Road vehicles – Diagnostics on Controller Area Network (CAN) – Part 4: Requirements for emissions-related systems", dated 1 ~~November~~ February 20012011;
- (e) 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;
- (f) 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;
- (g) 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 J1962 dated 26 July 2012;
- (h) ISO 15031-6 "Road vehicles – Communication between vehicle and external test equipment for emissions related diagnostics – Part 6: Diagnostic trouble code definitions", dated 1 December 2005 or SAE J2012 dated 10 December 2007.

6.5.3.2. Test equipment and diagnostic tools needed to communicate with OBD systems must meet or exceed the functional specification given in the standard listed in paragraph 6.5.3.1. (f) 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.~~

- 6.5.3.3. Basic diagnostic data, (as specified in paragraphs 6.5.1.1. to 6.5.1.5.) and bi-directional control information must be provided using the format and units described in ~~the standard listed in paragraph 6.5.3.1. (e) 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 6.5.3.1. (f) 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. PID²s, OBD monitor Id²s, Test Id²s not specified in ~~the standard listed in paragraph 6.5.3.1. (e) of this appendix ISO DIS 15031-5~~ but related to this Regulation.

- 6.5.3.4. When a fault is registered, the manufacturer must identify the fault using an appropriate ~~ISO/SAE controlled~~ fault code ~~consistent with those given in Section 6.3. specified in one of ISO DIS 15031-6 "Road vehicles—Communication between vehicle and external test equipment for emissions-related diagnostics—Part 6: Diagnostic trouble code definitions"~~the standards listed in paragraph 6.5.3.1. (h) of this appendix, relating to "emission related system diagnostic trouble codes". If such identification is not possible, the manufacturer may ~~manufacturer controlled~~ use diagnostic trouble codes according to ~~Sections 5.3. and 5.6. of ISO DIS 15031-6~~the same standard. The fault codes must be fully accessible by standardised diagnostic equipment complying with the provisions of paragraph 6.5.3.2. of this appendix.

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 6.5.3.1.(e) of this appendix ISO DIS 15031-5~~ but related to this Regulation.

- 6.5.3.5. The connection interface between the vehicle and the diagnostic tester must be standardised and must meet all the requirements of ~~the standard listed in paragraph 6.5.3.1.(g) 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 be subject to agreement of the Type Approval Authority such that it is readily accessible by service personnel but protected from tampering by non-qualified personnel.

- 6.5.3.6. ..."

Annex 11, Appendix 1, paragraph 7.1., amend to read:

"7.1. General Requirements

~~For the purpose of calculating counters and ratios under the In-use performance requirements, "engine start" is defined as the start of the internal combustion engine. For the calculation of the general denominator and the denominator M "cumulative time since engine start" in 7.5.1. (a) and "cumulative vehicle operation" in 7.5.1. (b) shall imply that the internal combustion engine is running. Vehicles of small series productions with less than 1000 vehicles are exempted from minimum IUPR requirements as well as the requirement to demonstrate this to the Type Approval Authority."~~

Annex 11, Appendix 1, paragraphs 7.6.1. and 7.6.2., 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 6.5.3.1. (e) 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) NO_x after-treatment system (e.g. NO_x adsorber, NO_x reagent/catalyst system);
 - (i) Boost pressure control system.
- 7.6.2. For specific components or systems that have multiple monitors, which are required to be reported by this paragraph (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. **Regardless of the number of monitors for a specific component or system, those monitoring for short circuit or open circuit failures are exempted from reporting.** 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."

II. Justification

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, move all references to communication standard to a separate paragraph and delete the version information from all other references.
 2. Annex 11 of UN Regulation No. 83 contains the definition of a driving cycle in the definition section under point 2.10: depending on the monitoring strategy, the period of engine-off time up to the next engine start is required (comparatively CARB regulation).
 3. Annex 11 of Regulation No. 83 contains the definition of a warm-up cycle in the definition section under point 2.11:
- "2.11 A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by a least 22 K from engine starting and reaches a minimum temperature of 343 K (70° C).

4. Under section 3.8., "erasing a fault code", this defined cycle 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."
5. The intention of this section 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 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 13 to 20 days in the memory which is long enough for the above described purpose.
6. 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 available.
7. CARB will amend the Warm Up Cycle definition for this reason.
8. For positive ignition vehicles, the manufacturer may choose to monitor the front catalyst alone or in combination with the next catalysts downstream. For compression ignition engines, the requirements/degrees of freedom should simply be aligned to those for positive ignition engines.
9. Electrical failures (disconnection, short to battery and short to ground) are either present in a system, resulting in a emissions specific to the component/system, or are not present, resulting in the normal emissions of the vehicle. Therefore it is technically impossible to define error limits for these failures correlating to some emission limits or OBD thresholds. There is no such thing as a partial failure for an electrical disconnection.
10. For electrical failures (disconnection, short to battery and short to ground) it is technically impossible to define error limits correlating to some emission limits or OBD thresholds. Such a failure is either present or not, resulting in emissions depending on the failure/component. There is no such thing as a partial failure for an electrical disconnection.
11. Demonstrating these failures in a type 1 test is therefore not necessary, requiring only valuable resources. 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.
12. This is true also for the electronic evaporative control device. Paragraphs 6.3.1.4 6.3.1.5, 6.3.2.3 and 6.3.2.4 should be amended.
13. UN 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. 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 MI has to be illuminated before the type 1 test, in which emissions are measured.
14. Hybrids with an increased electrical range, especially those, which could be charged externally (plug in hybrids), are using the internal combustion engines less frequent than non-hybrid vehicles, thereby minimizing fuel consumption and emissions but also time for running monitors to detect a malfunction of the internal combustion engine.
15. For 'non-hybrid' vehicles, the definition:

- "3.5.1. The general denominator is a counter measuring the number of times a vehicle has been operated. It shall be incremented within 10 seconds, if and only if, the following criteria are satisfied on a single driving cycle:
- (a) cumulative time since engine start is greater than or equal to 600 seconds while at an elevation of less than 2,440 m above sea level and at an ambient temperature of greater than or equal to -7°C ;
 - (b) cumulative vehicle operation at or above 40 km/h occurs for greater than or equal to 300 seconds while at an elevation of less than 2,440 m above sea level and at an ambient temperature of greater than or equal to -7°C ;
- ..."

implies, that the engine, e.g. the internal combustion engine, is working constantly. To avoid misunderstandings, add the above to Annex 11, Appendix 1 under paragraph 3.

16. 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 containing only an electrical monitor.

17. Although any reporting of electrical failure ratios is not possible due to the regulations and standards concerning scan tool communication, the proposed new text confirms this, thus avoiding any ambiguities.
