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Addendum 18: Global technical regulation No. 18

Global technical regulation on tyres

Established in the Global Registry on 17 November 2016

Appendix

Proposal and report pursuant to Article 6, paragraph 6.2.7. of the Agreement

- Authorization to develop global technical regulation No. 18 on the measurement procedure for two- or three-wheeled motor vehicles with regard to on-board diagnostics (ECE/TRANS/WP.29/AC.3/36/Rev.1)
- Technical report on the development of a global technical regulation No. 18 on the measurement procedure for two- or three-wheeled motor vehicles with regard to on-board diagnostics (ECE/TRANS/WP.29/2016/113, adopted by AC.3 at its forty-eighth session (ECE/TRANS/WP.29/1126, para. 117)

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Authorization to develop global technical regulation No. 18 (Measurement procedure for two- or three-wheeled motor vehicles with regard to on-board diagnostics)

A. Objectives

1. The objective of this proposal is to significantly extend the time for the working group to continue working on the mandate (ECE/TRANS/WP29/AC.3/36) given by the World Forum for Harmonization of Vehicle Regulations (WP.29) to establish amendments to UN Global Technical Regulation (UN gtr) No. 2 (Worldwide harmonized Motorcycle emissions Certification/test procedure (WMTC)) with respect to Environmental and Propulsion unit Performance Requirements (EPPR), currently only applicable for two-wheel motorcycles in the framework of the 1998 Global Agreement. If the scope and the purpose of UN gtr No. 2 is not considered to be appropriate it will be proposed to amend the scope and purpose or develop new UN gtrs making reference to the relevant parts of UN gtr No. 2.

2. The objective is to develop requirements and/or test procedures under the 1998 Agreement, and create synergies with the 1958 Agreement UN Regulations. Where possible, develop common requirements in the form of one or more UN Regulations and one or more UN gtrs as well as associated amendments and/or supplements;

3. To exchange information on current and future regulatory requirements in the area of environmental and propulsion unit performance requirements for "category 3 vehicles" or "L-category vehicles";

4. To minimize the differences between these regulatory requirements, with a view towards facilitating the development of light vehicles to comply with such internationally harmonised requirements;

5. Assessing the coherency with other regulatory requirements and groups, such as those regarding Worldwide harmonized Light vehicles Test Procedure (WLTP), Electric Vehicles and the Environment (EVE) and Vehicle Propulsion System Definitions (VPSD);

6. To build further on the output of the group after finalising its first mandate (January 2013 – January 2016). The group managed to work on a number of priority items and the goal of this next stage of work is to continue working in order to further progress in harmonising EPPR for light vehicles.

B. Introduction

7. The proposal for setting up an Informal Working Group (IWG) regarding EPPR for light vehicles operating under the Working Party on Pollution and Energy (GRPE) came at the initiative of the European Union, represented by the European Commission, DG GROW. The intention of setting up the group was announced at the GRPE meetings in January and June 2012 and at the WP.29 plenary session in June 2012. A mandate to start the activities in the EPPR informal group was endorsed by WP.29 at its November 2012 session. The group had its first meeting in January 2013.

8. The working group is established under both the 1958 and 1998 Agreements to create the basis for the possible development of UN Regulations and UN gtrs in the area of

EPPR. All global partners are invited to join the group and share experiences regarding setting relevant regulatory requirements as well as from the market.

9. The group aims replicating the successful approach of the UN gtr No 2 subgroup operating under GRPE, which facilitated an exchange of information among participants when each party had domestic regulatory requirements for an emission laboratory test cycle to measure exhaust gas emissions from a motorcycle after cold start. In 2011 a unique event took place in which Contracting Parties endorsed Amendment 2 to UN gtr No. 2 putting forward global exhaust gas emission limit values for type I emissions test for motorcycles (WMTC). Building on this success the process of international collaboration should continue to further harmonise requirements in the area of EPPR for the whole range of light vehicles.

10. The group will furthermore review technical progress of current and near future powertrain technology, including e.g. electrified powertrains and different fuel types and develop appropriate requirements for such technical progress.

11. The IWG started to work under its first mandate on harmonized test procedures for two-wheeled vehicles equipped with conventional combustion engine technology but the objectives also includes three-wheeled vehicles and other propulsion types in the next stage of work. It was decided that the scope of discussions does not cover light four-wheeled vehicles on emission related gtrs under the 1998 Agreement in EPPR IWG. The scope of discussions for the UN Regulations under the 1958 Agreement was not discussed yet and this may be discussed under GRPE or WP.29. Regarding the three-wheeled vehicles, it is necessary to recognize the situation of present regulation in each country and then to consider the appropriate regulation. Nevertheless three-wheeled vehicles are regarded to be in the scope of work of the group. For the five considered gtrs and corresponding five UN Regulations draft proposals as well several amendments to deal with different levels of stringency were submitted to the group, but owing to time constraints three priority subjects were identified and selected for the first stage of work:

(a) A draft gtr on test types III (crankcase emissions) and test type IV (evaporative emissions);

(b) A draft gtr with regard to on-board diagnostics, UN stage 1;

(c) Entire revision of gtr No 2 to dedicate separate sections to test types I (tailpipe emission after cold start), II (idle / free acceleration emissions) and VII (energy efficiency) and update the gtr for technical progress.

12. In this second stage the group is going to discuss the remaining draft proposals and to attempt to finalise the tasks identified in the base mandate.

13. For the remaining subjects in this second stage, the group will continue to first develop requirements for 2-wheeled vehicles (motorcycles and mopeds; categories 3-1, L-1 and 3-3 and L3) with conventional combustion engine technology. Progressively other vehicles categories and other propulsion unit types will be considered to be included.

C. Areas of work in the working group

14. The main activities of the group are proposed to be focussing on revising or establishing the following environmental performance verification test types:

Type I Tailpipe emissions test after cold start;

Type II Tailpipe emissions test at (increased) idle / free acceleration test;

Type III Emission test of crankcase gases, including appropriate test procedures, if deemed necessary;

Type IV Evaporative emissions test;

Type V Durability testing of pollution control devices;

(Type VI) (Cold ambient emissions. This test type is considered out of scope)

Type VII Measurement of energy efficiency (CO_2 emissions, fuel consumption, electric energy consumption and electric range determination);

Type VIII Environmental on-board diagnostic verification tests.

15. In addition the group should assess and develop functional aspects of On-Board Diagnostic (OBD) systems.

16. In addition the group should assess and develop propulsion unit performance requirements for conventional vehicles equipped with combustion engines only as well as for advanced concepts such as electric and hybrid electric powertrains. Unified rules and test procedures to measure power and torque for this wide range of propulsion technologies fitted on light vehicles as well as unified measurement of maximum design vehicle speed and/or power for restricted light vehicles should be developed and agreed upon.

17. For both environmental and propulsion unit performance requirements all possible fuels should be taken into consideration: petrol, petrol-ethanol mixtures, diesel, biodiesel but also gaseous fuels such as compressed natural gas, liquified petroleum gas, hydrogen and their blends.

18. In addition it should be assessed whether “light vehicle” classification can be further optimised and refined. After an initial assessment by the EPPR IWG, to clarify whether there are needs of these issues or not for the purpose of environmental requirements, the result should be reported to WP.29.

D. Existing regulations and directives

19. A stocktake of the regional regulations and directives applicable to L-category vehicles as well as UN Regulations Nos. 40, 47, 68, 83, 85, 101, UN gtr No. 2 and the work in progress regarding WLTP has been a first step on which the group based its work. Further consultation of developing regional/country specific legislation will be done to ensure coherence and meeting the needs of the Contracting Parties to the 1958 and 1998 Agreements.

E. Timeline

20. The plan is based on the draft roadmap and will regularly be reviewed and updated to reflect the latest situation on progress and the feasibility of the timeline.

(a) 9-12 June 2015: GRPE (71st session) official meeting of the informal working group. Presentation of roadmap and related programme management items to GRPE submitted for adoption;

(b) 10-13 November 2015: World Forum for Harmonization of Vehicle Regulations (167th session of WP.29), adoption of GRPE decision regarding the roadmap and related programme management items;

(c) 2016-2020: meetings of the working group, regularly reporting to GRPE and the Administrative Committees;

(d) Jan 2020: presentation of a final report as an informal document at GRPE;

(e) 2020: possible adoption of UN Regulation(s) and Global Technical Regulation(s), with respective amendments.

Technical report on the development of global technical regulation No. 18 on the measurement procedure for two- or three-wheeled motor vehicles with regard to on-board diagnostics

A. Introduction

1. The industry that produces two- and three-wheeled motor vehicles in the scope of this global technical regulation (gtr) is global with companies selling products in many different countries. The Contracting Parties to the 1998 Agreement have determined that work should be undertaken to address the environmental and propulsion unit performance requirements of two- and three-wheeled motor vehicles, among others as a way to help improve air quality internationally. This gtr is directed at harmonizing On-Board Diagnostic requirements (OBD) for two- and three-wheeled motor vehicles, though not fully similar as was targeted with gtr No. 5 for OBD requirements of heavy-duty motor vehicles. The common set of agreed rules in the area of OBD allows the Contracting Parties to realise their own domestic objectives and to pursue their own levels of priorities. Nonetheless, this gtr has been structured in a manner that facilitates a further extension of OBD requirements and to enhance the OBD objectives in the future.

2. An OBD system is an electronic system fitted on-board of a motor vehicle that has the capability of identifying the likely area of malfunction by means of fault codes stored in a computer memory which can be accessed by means of a generic scan tool. The Diagnostic Trouble Codes (DTCs), diagnostic signals like, e.g. data stream and freeze frame and the communication protocol are harmonized and standardized so that a repair person can efficiently determine which functionality of the vehicle is malfunctioning and analyse the failures before starting the actual repair of the vehicle. Generic scan-tools are widely available at a relatively low price and allow access to the OBD information without having to resolve technical incompatibilities and constraints. A major output of the OBD system is activation of a Malfunction Indicator (MI) on the instrument cluster to indicate to the driver that the vehicle is possibly broken and that the malfunction is serious enough to repair the vehicle as soon as possible.

3. For the purpose of coherency between gtrs on the same subject but with different motor vehicle types in its scope AC.3 underlined the importance of the principles laid down in gtr No. 5 regarding on-board diagnostic systems of heavy-duty motor vehicles, reading:

"*Recent years have seen a rapid increase in the number of vehicle functions that depend upon the use of electrical/electronic control. This trend is expected to continue. Further, the emissions control systems on highway vehicles are not the only systems for which OBD capability is important. Vehicle systems provided to manage or deliver safety control are also equipped with diagnostic capability. Recognizing this fact, and the negative implications that non-standardized diagnostics can have on maintenance and inspection procedures, this gtr has been structured such that further OBD functionality - e.g. OBD for safety related systems - could be added in the future as and when appropriate.*"

4. Despite different views within the EPPR IWG during the drafting process it has been possible to resolve controversial issues and bridge different positions of Contracting Parties and jointly develop wording that in the end was acceptable for country representatives and stakeholders. Herewith finding a common denominator in the complex field of OBD for two- and three-wheeled vehicles, allowing each Contracting Party to address national needs but on a solid basis of world harmonized requirements. The gtr text

was drafted allowing harmonization to the extent possible and to pave the road for further converging of rules in the future.

B. Objective of the gtr on on-board diagnostics

5. The objectives of this gtr are:

(a) Able to provide an internationally harmonized set of functional OBD requirements on the "infra-structure" on-board of a motor vehicle in the scope of this gtr, which determines hardware and software design in a technology neutral way and that considers technical feasibility and cost-effectiveness, such as:

(i) Minimum monitoring requirements of electric and electronic circuits and failure mode detection as well as for monitoring of the control module(s) within the scope of OBD stage I;

(ii) Provisions regarding Diagnostic Trouble Codes (DTC), diagnostic signals and connection interfaces;

(iii) Provisions regarding access to OBD information which is needed as input to the repair process of a broken motor vehicle;

(b) Allowing referencing of international technical standards already established for other motor vehicle types with a proven track record of providing clarity for the design and configuration of the OBD system;

(c) Able to provide an internationally harmonized set of tests to ensure efficient and practicable testing;

(d) Corresponding to state-of-the-art testing technology, allowing to simulate failures where technically feasible;

(e) Applicable in practice to existing and foreseeable future powertrain technologies;

(f) Definition of propulsion unit families with regards to OBD.

6. The gtr also cover harmonized requirements to conduct the environmental verification test procedure (test type VIII) relating to OBD, which is a test procedure by simulating a failure of an emission relevant component in the powertrain management system and its emission control system which is used for type approval of an OBD system. Subsequently the OBD system reaction and detection of the failure is monitored and reported where necessary during type I tailpipe emission verification tests.

C. Controversially discussed subjects in the area of the measurement procedure for two- or three-wheeled motor vehicles with regard to on-board diagnostics, compromises and decisions taken by the EPPR IWG

7. A number of subjects within the draft gtr on on-board diagnostics led to discussions within the EPPR IWG and the different views and positions among the participants were debated at length, sometimes leading to long-standing open issues. For the largest share of these more difficult subjects a compromise could be worked out; for a few subjects the EPPR IWG decided to postpone the discussions and to reopen the debate at a later point in time when more scientific evidence is collected and available for assessment. The

controversially discussed subjects, the associated compromises and decisions by the EPPR IWG are the following:

8. Objectives as well as fundamental principles of use and applicability of OBD

(a) Despite fundamental differences in opinion among the EPPR IWG members on objectives, the use and applicability of the OBD gtr, solutions were found that are satisfactory for the parties involved. It was possible to find wording that allows the Contracting Parties to harmonize OBD requirements to the largest extend possible and to apply it for the purposes needed. In many sessions the debate was held in the EPPR IWG meetings regarding the justification of introducing OBD requirements and the prioritisation in applicability of OBD;

(b) Traditionally the OBD requirements of light-duty motor vehicle categories 1 and 2, that have served as the basis for this gtr, have exclusively served the purpose of environmental protection with an associated rationale and practical implementation. The core OBD elements are given below:

(i) Diagnostic Trouble Code (DTC)

One or more DTCs are logged in the powertrain controller’s memory if one or more malfunctions are detected and confirmed. These harmonized codes allow identification of the failing devices in the vehicle’s powertrain and help the service technician to investigate and analyse the malfunctioning systems and components. Historically in emission legislation DTCs have been defined within a narrow scope. The DTCs have only been standardised for light- and heavy-duty motor vehicles in the past when these were affecting the vehicle´s environmental performance in terms of tailpipe and evaporative emissions, detected, confirmed and stored in the emission controller on-board of the motor vehicle.

At the same time vehicle manufacturers defined their own proprietary DTCs that allow authorized repairers to identify broken functionality on-board of the entire vehicle above and beyond the boundaries of emission relevant diagnostics. It concerns diagnosis of failing auxiliaries, safety-critical powertrain functionality as well as for failure identification of vehicle comfort functions that do not any longer operate according to the manufacturer’s design specifications;

(ii) Freeze frame

A so-called freeze frame is stored in the controller’s memory upon a detected, confirmed and stored DTC. This electronic file is a snapshot of powertrain data and relevant ambient conditions allowing a repairer or an enforcement authority to retrieve relevant powertrain information retroactively in order to reproduce the conditions under which the system or component has failed, e.g. the engine and vehicle speeds, throttle position, etc. Again, the freeze frame has been defined within the narrow scope of environmental performance, only storing data if a tailpipe emissions relevant malfunction is detected, which has been confirmed and stored in the controller’s memory;

(iii) Malfunction Indicator (MI)

The MI, typically a standardised warning light visible on the instrument panel, is briefly activated at key-on, engine off or ignition-on as bulb check and then turned-off again if the system has not detected a malfunction. The orange engine symbol shall be permanently illuminated on the cluster if an emission relevant malfunction is detected, confirmed by the OBD system and logged in the controller's memory. This, in order to notify the driver that the system has detected one or multiple emission relevant DTCs. The underlying assumption is that if the driver is notified by the MI in time, he/she will visit a service station (repair workshop) as quickly as possible and have the emission relevant failure repaired, resulting in significantly lower tailpipe emissions.

For other types of detected errors, e.g. failing comfort and/or safety critical malfunctions, it is left to the discretion of the vehicle manufacturer if and how this information is transmitted to driver and repairer. The vehicle manufacturer might opt installing a second tell-tale displayed on the instrument cluster, sometimes referred to as "service soon light". However, with a few exceptions like the anti-lock brake system check light or lighting indicators there are no legal requirements for tell tales fitted to two- and three-wheeled motor vehicles informing the driver of a malfunctioning vehicle. Consequently, each manufacturer is free to handle the transmission of such information as well as the diagnostic contents differently as they deem appropriate;

(iv) Communication protocol

A standardised communication protocol for emission relevant failures is obligatory in approval legislation. This is a common computer language, allowing an off-board generic scan tool to communicate with the on-board diagnostic system and for the service mechanic to read-out stored malfunctions and the freeze frame. The harmonized protocol also allows actuator tests commanded by the scan tool to verify if actuators on-board of the vehicle still work as designed. The protocol is also used in case of re-programming the emission controller, if needed;

(v) OBD connector

In the initial proposal for the gtr, the OBD connector that was standardised for cars or any alternative connector was included in the proposal as interface for two- and three-wheeled vehicles. To reduce the number of connector configurations around the globe, the alternative connector was replaced, taking into account the development an ISO standard for OBD connector for two- and three-wheeled vehicles.[1]

Following some questions raised within the IWG on the vibration and temperature performance of the draft ISO standard,[1] the ISO working group that developed the standard (ISO TC22/SC38/WG4) provided an explanation to EPPR IWG.

[1] Motorcycles and Mopeds - Communication between vehicle and external equipment for diagnostics - Diagnostic connector and related electrical circuits, specification and use. ISO/DIS 19689.

9. A paradigm shift was proposed by the EU in the fundamental principles of use and applicability of OBD though some items such as the shift regarding functional safety and comfort were not retained to be part of the scope of this gtr:

(a) The conventional paradigm in OBD requires that if an "emission" relevant malfunction occurs is detected, the associated DTCs and freeze frame are stored in the controller's memory. Subsequently the MI is activated to notify the driver, who then should go to a service station to have the malfunction repaired. Upon arrival at the service station of the highly polluting vehicle owing to the active malfunction(s), the repairer can connect a generic scan tool directly to the OBD connector and swiftly obtain the vehicle's on-board diagnostic information as input for the analysis and the actual repair. After successful repair of the vehicle the pollutant emission levels should again be low, complying to the designed levels under the approved pollutant emission limits that are prescribed in regional or national environmental performance legislation over the vehicle's useful life;

(b) In the view of the EU many components in the powertrain management system are not only critical for the environmental performance of a vehicle but are also of key importance for functional safety and other vital vehicle functions. Functions of systems and components can only artificially be separated in environmental and other functionality, in practice sensors, actuators, the data transfer system and powertrain management functions serve many purposes simultaneously. For example, the crankshaft sensor provides rotation speed information to the powertrain controller, which is used as input for a large number of different functions build into the powertrain software. This functionality concerns among others:

    (i) Functional safety, e.g. rotation speed information to determine if the engine is running as one of the variables to automatically turn on lighting or day-time running lights;

    (ii) Environmental protection, e.g. rotation speed information used as input for the closed loop fuelling system;

    (iii) Default information providing partial redundancy for other functions and back-up mode information in case of broken sensors, e.g. rotation speed as input to calculate roughly vehicle speed in case of a broken vehicle speed sensor or allowing to start and partially operate the engine in case of a broken cam sensor;

    (iv) Information to the rider, e.g. rotation speed information as input to the engine speed gauge on the instrument cluster directly or to calculate a ratio, composed by the rotation speed divided by vehicle speed, allowing to determine the gear selected without having to install a gear selection sensor, which can be used as input to the gear indicator display on the instrument cluster;

    (v) Comfort functions, e.g. rotation speed information as indicator for electric generator power used as one of the input variables to activate and operate electric seat or handle heating.

(c) With other words, the choice that e.g. the crank sensor is relevant for environmental protection only and to make it therefore subject to on-board diagnostic requirements has been a matter of debate in a historic decision process in the IWG EPPR;

(d) In the EU this traditional paradigm has already been shifted in approval legislation of L-category vehicles in force towards OBD information mainly needed for the effective and efficient repair of the vehicle. Effective repair means that the repairer is able to replace or repair that part of the vehicle that is actually broken. Efficient repair means that the repairer can fast identify the smallest identifiable or exchangeable "broken" unit;

(e) European Commission promoted that changing priorities from environmental protection only to the actual repair of the vehicle should help create a level playing field between authorized repairers and independent operators in the repair market. This, independent if the repair concerns an environmental protection issue, functional safety or any other type of vehicle functionality related malfunction. Moreover, this approach emphasizes the importance of OBD for the consumer as increased competition among service providers is expected to lead to lower repair prices and a better repair quality;

(f) Nevertheless, the OBD provisions set out in EU approval legislation[2] have been based on chapter 11 of Revision 4 of Regulation No. 83, which has been developed and agreed in the past based on the conventional paradigm related to environmental protection only. The EU OBD package for two- and three-wheeled vehicles in force is ready for further adaptation to technical progress in support of this paradigm shift and is aligned at the same time with the requirements set out in this gtr;

(g) The EU proposed this same approach to the EPPR IWG but this was not deemed acceptable for the larger share of Contracting Parties and stakeholders for various reasons. The EPPR IWG agreed that the gtr, once established, might be further developed in the future and other useful areas of harmonization in the field of OBD might be explored. It was deemed most important to establish the gtr within the planned timeframe, addressing the agreed mandate aiming to environmental protection by identifying common denominators in requirements and to phrase the requirements so as to allow all Contracting Parties to use the requirements for their purposes and objectives.

10. Scope in terms of functionality included; split between OBD stages I and II:

(a) The OBD requirements for light- and heavy-duty motor vehicles globally have been compiled over several decades starting roughly in the 1970's in the Unites States of America. Owing to growing similarities in principle engine management system designs between modern two- and three-wheeled motor vehicles on the one hand and light-duty motor vehicles on the other hand, it seems obvious to carry over existing light-duty motor vehicle requirements as much as possible. However, it appeared that the gap between not being subject to any OBD requirement in approval legislation of two- and three-wheeled motor vehicles and the established rules applicable for light-duty motor vehicles today cannot be closed in one step for several reasons. This gap may therefore be bridged in two distinct steps, through OBD stages I and II;

[2] OBD requirements for the approval of L-category vehicles for the European internal market are laid down in Regulation (EU) No 168/2013, Annex XII of Regulation (EU) No 44/2014 and Annex VIII of Regulation (EU) No 134/2014.

(b) The precise boundaries what type of diagnostics should be allocated to OBD stage I and which ones to OBD stage II have not been precisely defined in light-duty motor vehicle approval legislation under UNECE, which could therefore not be used as benchmark for the EPPR IWG. The EPPR IWG decided to apply OBD I and II as set out in the EU and to incorporate explicit malfunctions and symptoms to precisely define OBD stage I with appropriate requirements. Roughly the EPPR IWG decided that OBD stage I is to contain monitoring requirements of electric and electronic circuits of the powertrain management system and failure mode detection as well as for monitoring of the powertrain control module(s);

(c) OBD stage I should not oblige manufacturers to change or add fuelling or ignition hardware and should not impose fitting of an electronic carburettor, electronic fuel injection or electronically controlled ignition coils, providing the vehicle complies with the applicable environmental performance requirements. Compliance with the OBD stage I requirements implies that if fuel delivery, spark delivery or intake air hardware is electronically controlled by electric and/or electronic circuits as well as by a dedicated control module, the applicable input or output circuits of that control module need to be monitored, limited to the items and failure modes listed in the table of the gtr. OBD stage I should also not oblige Contracting Parties to change their objectives what should be achieved with on-board diagnostic requirements, in particular not be limited to environmental protection only;

(d) Consequently, in the future, if deemed appropriate by WP.29 and once the basis for OBD stage I is established, the gtr may be further developed and amended to incorporate OBD stage II requirements. This further stage might then also cover enhanced electric and electronic circuit diagnostics, not yet covered by and in addition to the circuit malfunctions such as sensor rationality diagnostics. It should then also be discussed whether diagnostics related to degradation of systems and components should be included in the future scope as it is today the case for other motor vehicle types. Also, in-use performance ratio monitoring and harmonized OBD performance requirements, such as degradation thresholds triggering the OBD system may be discussed;

(e) The EPPR IWG decided in this first stage not to harmonize dedicated functional safety requirements.

11. Discussion of scope in terms of motor vehicle types included:

(a) The scope in terms of vehicle types included was a horizontal issue for all the draft gtrs developed by the EPPR IWG involving the questions:

(i) Whether three-wheeled should be taken in the scope of the draft gtr?;

(ii) Whether other propulsion unit types besides the conventional combustion engine should be included in the scope?;

(iii) Whether the classification criteria of Special Resolution No. 1 are appropriate and whether the specific classification 3-1, 3-2, 3-3, etc. should be directly referenced or the reference should be done in a more generic way?;

(iv) Whether the exclusion criteria of the scope should be set out as well in the scope table or these exclusion criteria should have been described in full text?;

(v) How to deal with in- or exclusion of the various propulsion unit and fuelling types?

(b) The scope in terms of motor vehicle types included has been one of the more challenging items to resolve. The EPPR IWG settled for a compromise as set out in the scope section of the gtr submitted for adoption by GRPE.

12. Scope in terms of harmonized OBD data and information

The IWG on EPPR had an intense debate on and the assessment of access to relevant data and information:

(a) Access to OBD data: This is typically data from the on- and/or off-board diagnostic systems, which requires interpretation to become diagnostic information relevant for the repair of the vehicle. Obtaining this information in the diagnostic or pre-repair stage is paramount to identify the system or component of the vehicle that has failed and that needs repair or maintenance. The EPPR IWG agreed that this type of diagnostic data and information should be within the scope of the gtr;

(b) Access to repair and maintenance information: This is the step that typically commences after successful diagnostics has been completed or is needed in an iterative process of diagnostics and repair. The appropriateness of repair and maintenance information therefore is highly dependent on correct pre-repair stage OBD information as input so as to effectively and efficiently be able to repair a vehicle. The EPPR IWG decided that, similar as in the case of gtr No. 5 on heavy-duty vehicle on-board diagnostics, this type of repair and maintenance information shall remain outside the scope of the gtr, which offers the flexibility to each Contracting Party to formulate requirements on this type of information, e.g. in line with the relevant standard: ISO/DIS 18541-6, Standardized access to automotive RMI - Part 6: L-Category vehicle specific RMI use cases and requirements or as deemed appropriate;

(c) Diagnostic signal regarding freeze frame and data stream: There was a long discussion regarding the freeze frame and data stream among the Contracting Parties from the viewpoint of the aspect of reparability. The EPPR IWG finally agreed that both requirements to be exempted in case of Grade-A, provided that these exemptions are only applied to OBD-I. That is to say, the freeze frame and the data stream are implemented at the first stage when the discussion resumes on OBD-II in the near future.

13. Malfunction Indicator (MI) performance thresholds:

(a) In the context of the debated paradigm shift in OBD requirements the EU proposed introducing MI performance thresholds based on tailpipe emission thresholds and a torque threshold, independent if the triggered malfunction is allocated to circuit diagnostics attributed to OBD stage I or to more comprehensive diagnostics features possibly set out in future OBD stage II requirements. The proposed rationale behind this proposal, which is applied in EU approval legislation in force, is that the driver only needs to be informed of a significant emission relevant failure or in case of a default mode triggered by the powertrain software that significantly reduces propulsion unit torque. For other failure cases the EU proposed the manufacturer to decide whether or not the MI should be activated for malfunctions that are properly addressed by well-designed back-up modes by making use of powertrain system redundancy and:

(i) That compensate for the malfunction in terms of preventing tailpipe emission levels exceeding harmonized OBD emission thresholds. In this case it is assumed that a well-designed back-up mode mitigates the tailpipe emission increase from one or more malfunctions; and/or

(ii) Prevents a significant propulsion unit torque loss, e.g. more than 10% of normal torque after the OBD system has activated a back-up mode to protect the driver or the vehicle's powertrain. In case of failure the OBD system might activate such a back-up mode that may not be noticeable by the driver under certain driving conditions. For this case, e.g. an OBD tell-tale on the instrument cluster could be illuminated to warn the driver of an anticipated, abnormal drive-ability;

(b) Activation of the MI would therefore have been partially decoupled from storing diagnostic information in the powertrain controller's memory. Diagnostic information storage and availability upon request of a generic scan tool would have remained mandatory as prerequisite to effectively and efficiently repair the vehicle. The underlying justification of the EU proposal was to confront drivers as little as possible with the activated MI and to provide incentives to manufacturers to design excellent back-up and default modes to mitigate the adverse effects of a vehicle failure. Nevertheless, this methodology ensures that the diagnostic information is conveniently available to a repairer, free of charge and without technical constraints, which should help to level the playing field in the repair market. Again, it is assumed that a well maintained motor vehicle on which faults, if any, can easily be detected and diagnosed will result in lower emissions and a higher level of functional safety;

(c) Other Contracting Parties wished to deal with electric / electronic circuit diagnostics as digital faults (fault or no fault) and perceived the proposed performance requirements as too complex in this first stage. China was interested in developing simple diagnostic functionality and stepping-up requirements in complexity in due course following technical progress. India proposed additional grades of OBD complexity within OBD stage I allowing a minimum common denominator of requirements to be available to all Contracting Parties. Several iteration rounds of discussions have been held and proposals assessed but in the end it was decided to harmonize the requirements as much as possible allowing sufficient flexibility to apply the OBD requirements so as to ensure each Contracting Party to implement the harmonized requirements to satisfy national or regional needs. The EPPR IWG decided to compile a flow chart with recommended scenarios, based on a proposal from Japan, to deal with this complexity in the first stage and to incorporate this chart in the explanatory part of the gtr. In the future, upon need and if desired by Contracting Parties this flow chart can then be further developed covering increased harmonization of functionality.

14. Test type VIII, harmonized environmental verification testing of OBD:

(a) Owing to the fact that when implementing OBD stage I there are some Contracting Parties requiring harmonized tailpipe emission verification test procedures and that such requirements may be needed for all Contracting Parties in the future when developing enhanced diagnostic requirements in a future OBD stage II, the EPPR IWG could agree on optional provisions allowing to harmonize such an environmental verification test procedure. The starting point of this harmonized verification test procedure for two- and three-wheeled vehicles has been Annex 1 to chapter 11 of Regulation No. 83;

(b) In basic terms the fault under assessment is induced or simulated on a test vehicle which is subsequently run in a test type I emission laboratory cycle, applicable under national or regional requirements. The objective of test type VIII, which is a special test type I that in future might be harmonized as the WMTC set out in gtr No. 2, is to verify if the OBD system has detected the failure in time, stored the appropriate DTC and freeze frame. It offers also the possibility to assess the MI activation strategy and back-up mode activation, e.g. within one key cycle for certain malfunctions or within three key cycles for lesser urgent malfunctions or those requiring more data sampling to prevent false DTCs.

15. Reference fuel:

(a) Another horizontal issue for all EPPR gtrs in development has been the reference fuel specifications. The relevant questions were among others:

(i) Which types of reference fuels should be prescribed, all regional fuel types or just a reduced set?;

(ii) If the reference fuel has to be blended with ethanol or not?;

(iii) If the reference fuel specifications could be centrally stored in a repository like e.g. in a revised gtr No. 2 or as for example an annex of a mutual resolution?;

(b) Similar to the outcome of the discussions on a new gtr setting out requirements for two- and three-wheeled motor vehicles with respect to crankcase and evaporative emissions, the EPPR IWG decided that for the moment it is appropriate not to harmonize the reference fuel specifications yet. However, the EPPR IWG strongly recommended using the same test fuel specification for type VIII environmental OBD verification testing as also used for type I tailpipe emissions after cold start testing. It was decided to collect scientific data and to assess what the impact of the different fuel characteristic parameters may be in case of type VIII, environmental OBD verification testing. When sufficient scientific data is available and if deemed acceptable the EPPR IWG will undertake efforts to reduce the number of reference fuels and amend the gtr accordingly in due course.

16. Administrative provisions

Owing to the difference in views between the EPPR IWG members on the objectives and the need in split of information between diagnostic data and repair and maintenance information the initially proposed administrative provisions were assessed in depth, debated and revisited. The EPPR IWG managed to agree on the administrative provisions, despite the many controversial discussed subjects in the substantial requirements. Again, these provisions are regarded as minimum requirements and leave the flexibility to Contracting Parties to require the vehicle manufacturer to provide supplemental data and information. It was agreed to regularly review these provisions and to supplement them following technical progress and future enhancements of the gtr.

17. Harmonized OBD engine load variable

The European Commission introduced the idea of a harmonized OBD engine load variable which was considered out of scope of OBD I. Today it is hardly possible for parties other than the vehicle manufacturer to understand in which engine speed – engine load area an engine is running, relative to the maximum engine load that is typically achieved at wide open throttle, when e.g. a vehicle is tested in an emission laboratory test or under real world conditions. Being able to identify the engine load allows the legislator and enforcement authorities to comprehend which engine speed – engine load area is not sampled in regulatory testing. This helps authorities to estimate the caveats of environmental testing in approval of the vehicle or during in service conformity testing if applicable and to explain why there might be gaps between criteria pollutant emissions and fuel consumption in the emission laboratory testing and under real world conditions[3].

The proposed common OBD engine load variable was carried over from Regulation No. 83, chapter 11, definition 2.13., calculated load value. Despite the fact that the OBD engine load variable is based on airflow it is not necessary that a vehicle for that purpose is equipped with an expensive airflow sensor. The airflow is typically mapped in the development process of the engine on the dynamometer and subsequently calibrated in the powertrain control software. In dependence of the applicable load variable on-board of the vehicle, e.g. throttle position or MAP sensor reading, this unit-less, calculated OBD engine load variable can easily be predicted and be made available through the data link interface. The advantages of being able to continuously read a common available engine load variable largely outweigh the claimed disadvantages such as increased cost of software development, engine mapping and calibration for the manufacturer.

18. Definition and provision on "useful life"

The need for a definition of "useful life" has been debated at length in the EPPR IWG. Based on coherence with gtr Nos. 4, 5 and 11 the EPPR IWG decided to include a definition as well as a provision in the draft gtr in order to clarify during which time frame or accumulated distance and under which conditions the on-board diagnostic requirements have to be complied with by the motor vehicle type represented by the tested parent vehicle used in the approval process of the vehicle type. It was decided to specify this in a common way between all the draft gtrs in the scope of work of the EPPR IWG.

19. Temperature unit °C vs K

Indication of harmonized temperature unit (WLTP-09-19e) based on DIN EN ISO 80000-5. In summary:

(a) Define 0° C as 273.15 K;

(b) Use "°C" for definition of temperatures;

(c) Use Kelvin (with 273.15 K equal 0°C) in calculations;

(d) Delete redundant information where possible: (± 5 °C) (Example).

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[3] For the technical relevance and more detailed explanation please refer to the JRC report: "Preparatory work for the Environmental Effect Study on the Euro 5 step of L-category vehicles", ISBN 978-92-79-57248-7 (print) or ISBN 978-92-79-57247-0 (pdf).