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Global Registry

Created on 18 November 2004, pursuant to Article 6 of the Agreement concerning the establishing of global technical regulations for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles (ECE/TRANS/132 and Corr.1) done at Geneva on 25 June 1998

Addendum 2: United Nations Global technical regulation No. 2

United Nations Global Technical Regulation on measurement procedure for two-wheeled motorcycles equipped with a positive or compression ignition engine with regard to the emissions of gaseous pollutants, CO_2 emissions and fuel consumption

Established in the Global Registry on 13 November 2019

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

- Proposal for establishing two informal working groups addressing the safety and environmental requirements for electric vehicles to enhance regulatory cooperation including developing global technical regulations in the framework of the 1998 Agreement (ECE/TRANS/WP.29/AC.3/36/Rev.1)

- Final report on the development of Global Technical Regulation No. 2 (ECE/TRANS/WP.29/2019/122, adopted by AC.3 at its fifty-seventh session (ECE/TRANS/WP.29/1149, para. 121)

UNITED NATIONS

Revised authorization to develop amendments to UN Global Technical Regulation No. 2 and to develop new UN Global Technical Regulations and UN Regulations in the area of Environmental and Propulsion unit Performance Requirements (EPPR) for light vehicles

I. 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.

II. 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.

III. 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.

IV. 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.

V. 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.

Final report on the development of Amendment 4 to UN GTR No. 2 on the measurement procedure for two-wheeled motorcycles equipped with a positive or compression ignition engine with regard to the emissions of gaseous pollutants, CO_2 emissions and fuel consumption

I. Mandate

1. Amendment 4 to global technical regulation (GTR) No. 2 was developed by the Informal Working Group (IWG) on Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR). The Executive Committee (AC.3) of the 1998 Agreement adopted the authorisation to develop amendments to UN Global Technical Regulation (UN GTR) No. 2 at its 45th session (12 November 2015) (ECE/TRANS/WP.29/AC.3/36/Rev.1).

II. Objectives

2. Harmonization of test procedures for two-wheeled vehicles equipped with conventional combustion engine technology, but the objectives also include three-wheeled vehicles and other propulsion types in the next stage of work.

3. The scope of discussions does not cover light four-wheeled vehicles on emission related UN GTRs

4. The IWG first developed requirements for two-wheeled vehicles with conventional combustion engine technology.

5. Progressively other vehicles categories and other propulsion unit types will be considered to be included.

6. Entire revision of UN 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)

7. Update the GTR for technical progress.

III. Meetings held by the IWG

8. The proposed text of Amendment 4 to UN GTR No. 2 addressing the points listed in section II above were discussed at length and agreed upon by all participants in numerous Informal Working Group (IWG) meetings. These meeting took the format of eithers face-to-face or audio/web meetings.

IV. Main resolutions agreed by the IWG

What follows is a summary of the main resolutions agreed by the IWG are indicated explaining the reasons of such decisions.

9. Purpose.

This Regulation provides a worldwide-harmonized measurement method for the determination of the levels of gaseous and particulate pollutant emissions at the tailpipe, the emissions of carbon dioxide and the energy efficiency in terms of fuel consumption of two-wheeled motor vehicles that are representative for real world vehicle operation.

10. Applicability.

The Informal Working Group followed the agreed terms of reference and prepared Amendment 4 to UN GTR No. 2 for two-wheeled vehicles under the 1998 Agreement. The

IWG will, in due time prepare an equivalent UN Regulation for L-category vehicles in its scope under the 1958 Agreement.

11. Fuels considered.

Only petrol and diesel were considered. India proposed to add alternative fuel to the scope of this UN GTR in order to support their national plans to fully implement any GTR developed under the UNECE umbrella. Nonetheless many Contracting Parties (CPs) were of the opinion that alternate fuel is not used for two-wheeled vehicles in large scale, adding alternate fuels to the scope of this GTR will increase the work load considering the timeline for formulation of GTR. However, addition of alternate fuel shall be taken up in further revision within the scope of this GTR.

12. Definitions.

The definitions used in this GTR are taken from the draft common definitions incorporated in S.R.1 as well as from the work of the UN VPSD group operating under GRPE with the goal to harmonise high level powertrain definitions and from other international and regional legislation.

13. Vehicle category.

Only two-wheeled vehicles are considered in the scope. Twinned wheel vehicles considered as two-wheeled vehicles are also in the scope, however BEV, HEV and H2 are not in scope at the moment. Priority was given for two-wheeled vehicles, although some of the CPs have regional cycles. Hence it was decided to address three-wheeled vehicles at a later stage. In the same line, both India and Japan were having concerns for implementing Class 0 vehicle in domestic regulation due to different maximum speed. Hence it was decided to leave the details of Class 0 vehicles as Contracting Party option.

14. Performance Requirements

Due to the disparity of level of stringencies present in different regions of the world, it was decided to define performance requirements at two levels: Principal performance requirements (or the most stringent ones for two-wheeled motorcycles) equivalent to the emission limits of Regulation (EU) 168/2013 (i.e. EUR 5 levels) and Alternative performance requirements (or less stringent) and corresponding to performances already in application in some CPs. This approach encourages the CPs to advance towards the most stringent performance in the shortest possible time without jeopardising their present regulatory framework.

15. Particle Number (PN) Limit.

Although the topic was discussed by the IWG and since the base text do not include PN currently in Regulation (EU) 2019/129 (Euro 5 emission test provisions/technical requirements), it was finally decided not to consider PN emissions in the Amendment 4 to UN GTR 2.

16. Reference fuel.

The principal performance requirements of this UN GTR are based on the use of reference fuels. The use of this standardised reference fuel for determining compliance with the Principal emission limits (norms) is considered as an ideal condition for ensuring the reproducibility of regulatory emission testing, and CPs are encouraged to use such fuel in their compliance testing. However, the Alternative performance requirements are applicable with the corresponding reference fuels (see points a) and b))

(a) For Type I Principal norms, the reference fuel for PI vehicles shall be either E0 or E5. For Alternative norms, regional reference fuels available in CPs can be used for Type I test. This decision was taken because according to the data presented by Japan (EPPR-21-Japan proposal GTR2 B2 (E0 Fuel)_171011.pptx), E0 and E5 can be considered equivalent for the tailpipe emissions, even if it is not the case for the power determination;

(b) For Alternate norms, regional reference fuels available with CPs can be used for Type I test (Alt A = India BS IV, Alt B = Euro 4 Alt C = Euro 3).

17. Temperature conversion.

After deliberation in EPPR-IWG and exchange with GRPE Chair and IWGs during 75th GRPE session, it was finally agreed that, wherever temperature conversion is required from degrees C to K, the following conversion factor shall be used: 0oC= 273.15 K

18. Use of Super-charger (definition).

Following an exchange via email between the EPPR Secretariat and the WLTP Coordinator, it was agreed not to use only the term “Supercharger” but to define “Forced Induction System”, as umbrella definition, adding the relevant sub-definitions for "Super-charger" and “Turbocharger”

19. Open/Closed system.

In the EPPR-22 IWG meeting India raised concerns that an open system might create further dilution of the exhaust flow. IMMA provided data showing that the leakage effect is small enough to be able to be considered negligible in an open system. Therefore, in order to minimise the risk to create extra dilution and reach consensus, the IWG agreed to include both open and closed type (CFV type CVS system) in UN GTR No. 2, with the indication that it is up to the Type Approval Authority whether to accept or not the open type CFV-CVS system for the test, based on data and demonstration by the manufacturer that the leakage can be considered negligible.

20. Extraordinary Characteristics.

It was agreed to keep the note on Extraordinary Characteristics, because in the European Union Regulation is applicable for special vehicles.

21. Test room humidity.

A long and difficult discussion took place on whether it was needed to define the humidity range within which a test can be considered valid. It is known the importance of considering the humidity of either the air in the test cell or the intake air of the engine for the correct calculation of the final NOx emission factors. UN Regulation No. 83 indicates that the humidity in the test cell has to be within $5.5 \leq Ha \leq 12.2$ (g H2O/kg dry air) for the test to be considered valid. IMMA argued that this imposed on some manufacturers an excess burden as in many regions that range of humidity was not easily achievable without having a conditioned test cell with the corresponding cost. It was noted that the correction factors originated from empirical data of the seventies, on engines without any after-treatment system. The regression analysis included empirical data from 2.85 to 17.2 g H2O/kg dry air. It should thus be investigated whether these correction factors were still valid nowadays for engines having after-treatment technology. Finally, an agreement by the CPs was reached by not declaring a test void if performed outside the above range but it requests to apply appropriate correction factors. Further investigation by the CPs on the validity of the correction factors is encourage in order to extend this humidity range also to two-wheeled vehicles. The final test in the UN GTR No. 2 reflects these agreements by the following text: “The absolute humidity (Ha) of either the air in the test cell or the intake air of the engine shall be measured, recorded and correction factors for NOx shall be applied.”

22. HC applicable correction factors.

The IWG decided not to add any HC correction factors to the formula for calculating the corrected concentration of Hydrocarbon in the type II idle test, since ISO has not defined any applicable formula about this matter and no Contracting Party could find HC factors despite all the efforts made.

23. CO2 tolerance (Test type VII, energy efficiency).

The IWG has discussed on the difference between the CO2 declared by the manufacturer and that measured by the Approval Authority could be in order to keep the measured value declared by the manufacturer within +4%. While the European Commission proposed to keep the values given in the European Regulation; i.e. +4%, because it is not a tolerance in the measurements, but a given excess for the declaration, India was of the opinion that the difference needs to be based on real data submitted by India EPPR-24-05, which reflects values from specific vehicle categories of Class 1, 2 and 3. India would have preferred

policy aligned with real-world data. However, the final consensus was to retain the values given in the European regulation (i.e. +4 %)

24. Reference mass, mref.

The IWG revised the different equations where either mref (reference mass of the vehicle) and mk (unladen mass of the vehicle) appears. It was decided to use mref rather than mk + 75 kg when appropriate.