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### Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

### Working Party on Pollution and Energy

#### Eighty-first session

Geneva, 9–11 June 2020

## Chair's notes on the Working Party on Pollution and Energy meeting in lieu of its eighty-first session

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## I. Attendance

1. The Working Party on Pollution and Energy (GRPE) met from 9 to 11 June 2020 online and without interpretation (informal in lieu of its eighty-first session), with André Rijnders (Netherlands) as Chair and Duncan Kay (United Kingdom of Great Britain and Northern Ireland) as Vice-Chair. Experts from the following countries participated in the work following Rule 1(a) of the Rules of Procedure of the World Forum for Harmonization of Vehicle Regulations (WP.29) (TRANS/WP.29/690, as amended): Australia, Austria, Canada, China, Czech Republic, France, Germany, Hungary, India, Israel, Italy, Japan, Netherlands, Norway, Poland, Republic of Korea, Romania, Russian Federation, San Marino, South Africa, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland (UK), United States of America and Viet Nam. Experts from the European Commission (EC) also participated. Experts from the following non-governmental organizations (NGOs) took part in the session: American Automotive Policy Council (AAPC), Association for Emissions Control by Catalyst (AECC), European Association of Automobile Suppliers (CLEPA/MEMA/JAPIA), European Association of Internal Combustion Engine Manufacturers (EUROMOT), European Garage Equipment Association (EGEA), Fahrzeugsystemdaten GmbH (FSD), Fédération Internationale de l'Automobile (FIA), Federation of European Manufacturers of Friction Materials (FEMFM), International Association for Natural Gas Vehicles (NGV Global), International Motorcycle Manufacturers Association (IMMA), International Motor Vehicle Inspection Committee (CITA), International Organization of Motor Vehicle Manufacturers (OICA), International Road Transport Union (IRU), and Liquid Gas Europe.

## II. Adoption of the agenda (agenda item 1)

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/9  
Informal documents GRPE-81-01, GRPE-81-02-Rev.3, GRPE-81-03,  
GRPE-81-04, GRPE-81-05 and GRPE-81-25

2. Mr. Rijnders, Chair of GRPE, opened the meeting, held virtually because of the COVID19 pandemic, and welcomed the participants. GRPE adopted the provisional agenda of the eighty-first session (ECE/TRANS/WP.29/GRPE/2020/9), as updated and consolidated in GRPE-81-02-Rev.3, and GRPE-81-03 as a tentative running order. GRPE took note of GRPE-81-01 on the organization of GRPE Informal Working Group (IWG) meetings held during the weeks prior to this meeting.

3. The informal documents distributed before and during the GRPE session are listed in Annex I. Annex II lists the informal meetings held in conjunction with this GRPE session. Annex III lists IWGs of GRPE, task forces and subgroups, giving details on their Chairs, Secretaries and the end of their mandates.

4. The secretariat introduced GRPE-81-04 and GRPE-81-05 presenting guidelines for this session of GRPE held virtually and the proceedings for the decision taken during the session. Furthermore, the WP.29 secretariat informed the GRPE that there will be no interpretation available during the meeting and that the virtual meeting included a 'silence procedure' of ten days during which Contracting Parties (CPs) can react on the proposals in the three languages (Annex VIII).

5. The secretariat introduced GRPE-81-25, announcing that the next GRPE session would tentatively take place on from 12 to 15 January 2021 and recalling the corresponding deadline (20 October 2020) for the submission of official documents. The Chairs and Secretaries of IWGs were invited to approach the secretariat to define the calendar of IWGs meetings in conjunction with the January 2021 GRPE session. The secretariat also requested amendments proposals to now be submitted using tracking changes.

### **III. Report on the last session of the World Forum for Harmonization of Vehicle Regulations (WP.29) (agenda item 2)**

*Documentation:* ECE/TRANS/WP.29/1151  
Informal documents GRPE-81-07-Rev.1

6. The secretariat introduced GRPE-81-07-Rev.1 and reported on relevant items discussed during the 180th session of the World Forum for Harmonization of Vehicle Regulations (WP.29) and during the 82nd Inland Transport Committee. He referred to ECE/TRANS/WP.29/1151 for further details.

### **IV. Light vehicles (agenda item 3)**

#### **A. UN 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), 103 (Replacement pollution control devices) and [154] (Worldwide Light duty Test Procedure (WLTP))**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/10,  
(ECE/TRANS/WP.29/2020/92),  
(ECE/TRANS/WP.29/2020/93),  
Informal documents GRPE-81-19, GRPE-81-21, GRPE-81-29-Rev.1,  
GRPE-81-30, GRPE-81-35 and GRPE-81-36

7. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2020/10 amended by GRPE-81-21 permitting the usage, in UN Regulation No. 83, of the calibration and maintenance intervals from UN GTR No. 15 for test facilities capable of testing to that UN GTR. GRPE endorsed the proposal to amend the 05, 06 and 07 series of amendments to UN Regulation No. 83, as amended by Annex IV.

8. GRPE requested the secretariat to submit Annex IV to WP.29 and AC.1 for consideration and vote at their November 2020 sessions as draft Supplements 13, 15 and 12 to the 05, 06 and 07 series of amendments to UN Regulation No. 83 respectively.

9. The Chair briefly introduced ECE/TRANS/WP.29/2020/92 and ECE/TRANS/WP.29/2020/93 that were submitted to the June 2020 session of WP.29 from EU and Japan as amendments to the new UN Regulation No. [154] on WLTP already adopted by GRPE during the January 2020 session. Both documents proposed changes to improve the text emerging from the development of Amendment 6 to UN GTR No. 15. GRPE noted the amendments and thanked the Informal Working Group (IWG) on WLTP and the Contracting Parties (CPs) involved in the preparation of these documents.

10. The representative from OICA introduced GRPE-81-30 and GRPE-81-35, amended by GRPE-81-29-Rev.1 during the session. These documents contained clarifications to UN Regulation No. [154] on WLTP. As requested during the last session of GRPE (ECE/TRANS/WP.29/GRPE/80, para. 15), these documents were aimed at providing guidance to future users of UN Regulation No. [154] on WLTP. The secretariat then introduced GRPE-81-36 presenting various options to provide visibility to such clarification / guidance documents. GRPE agreed to create a new section on the GRPE website, similar to those appearing in the GRE and GRBP sections, under " Documents for reference only", where GRPE-81-29-Rev.1 would be uploaded.

11. The Chair requested GRPE to have GRPE-81-19 introduced under agenda item 5 as GRPE-81-18 planned under that agenda item dealt with a similar issue.

## **B. UN Global Technical Regulations Nos. 15 on Worldwide harmonized Light vehicles Test Procedures (WLTP) and 19 (Evaporative emission test procedure for the Worldwide harmonized Light vehicle Test Procedures (WLTP EVAP))**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/14  
Informal documents GRPE-81-10, GRPE-81-11, GRPE-81-14,  
GRPE-81-15 and GRPE-81-20-Rev.1

12. The representative from EC, drafting coordinator for WLTP activities, introduced ECE/TRANS/WP.29/GRPE/2020/14, as amended by GRPE-81-14, as draft Amendment 6 to UN GTR No. 15, together with its technical report (GRPE-81-15). The Chair from the IWG on Particulate Measurement Protocol (PMP) also presented GRPE-81-10 introducing revisions also to be included in ECE/TRANS/WP.29/GRPE/2020/14 as part of Amendment 6 to UN GTR No. 15 on a supplementary methodology to measure sub-23nm particulates. The Chair of the IWG on PMP also introduced GRPE-81-11 providing explanatory note on the sub-23nm procedure part of Amendment 6 to UN GTR No. 15. He also informed GRPE that GRPE-81-11 had been included in the technical report of Amendment 6 to UN GTR No. 15 (GRPE-81-11 is included in GRPE-81-15).

13. GRPE adopted ECE/TRANS/WP.29/GRPE/2020/14, GRPE-81-14 and GRPE-81-10 as amended by Addendum 1 to this chair's notes. GRPE also adopted the technical report (GRPE-81-15) as reproduced in Annex V. GRPE requested the secretariat to submit Addendum 1 and Annex V to WP.29 and Executive Committee of the 1998 Agreement (AC.3) for consideration and vote at their November 2020 sessions as draft Amendment 6 to UN GTR No. 15.

14. The Chair of the IWG on WLTP presented GRPE-81-20-Rev.1, highlighting the latest activities of the IWG. He concluded by stating that the IWG mandate was expiring in June 2020 and no Contracting Parties had the resources to become the main sponsor to carry on with the activities. He suggested WLTP-related activities that still require further work, if any, would be developed by interested parties on an ad-hoc basis and be submitted to GRPE for its consideration. The representatives from the EC, the United Kingdom of Great Britain and Northern Ireland (UK) and of the United States of America showed their support for such approach and confirmed their willingness to be involved to ad-hoc discussions should the need arises.

15. The Chair of GRPE thanked the IWG on WLTP for the tremendous achievements over the last 15 years and reckoned WLTP is an acronym well-known all over the world, not only by expert involved in WP.29 activities. He regretted a proper farewell to the WLTP family could not be done in person, and offered, if possible, to have a physical event during the next session of GRPE in January 2021. GRPE shared the congratulations to the IWG and praised the achievements of the group.

16. GRPE noted the request for a meeting room for half a day during the GRPE week in January 2021 for the ad-hoc group looking at WLTP-related issues.

## **C. Worldwide harmonized Real Driving Emissions (RDE) test procedure**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/15  
Informal documents GRPE-81-16, GRPE-81-17 and GRPE-81-26

17. The Chair of the IWG on RDE introduced the status report of the IWG (GRPE-81-17); mainly focusing on the development of the draft new UN Regulation on RDE submitted to GRPE as ECE/TRANS/WP.29/2020/15 as amended by GRPE-81-16. She also introduced GRPE-81-26 complementing the draft text of the UN Regulation with a template of the data report file that shall be used to gather the data collected during the test and to check some of the trip validity conditions, specifically designed for the RDE tests contained in the draft new UN Regulation. She finally informed GRPE that some elements remained in square brackets as there are still regulatory work going-on at the European which might have an impact on the text proposed and might lead to a postponement to later session of WP.29 if the EU regulatory process is not finalized by then. GRPE noted those considerations.

18. The representative from OICA sought further clarifications on the update to UN Regulation No. 83 needed as a consequence of the new UN Regulations on WLTP and RDE. The expert from the EC stated there was a need to further evaluate the changes for UN Regulation No. 83 also taking the EU legal framework into account. She clarified such assessment was expected to be finalized before the next GRPE session in January 2021, especially with respect to in-service conformity provisions. The representative from Japan agreed the inclusion of in-service conformity into UN Regulation No.83 should be looked after carefully as it could also be part of WLTP provisions.

19. The Chair congratulated the IWG on RDE for the achievements in such limited time frame, getting consensus so that the draft UN regulation reaches full harmonization.

20. GRPE adopted ECE/TRANS/WP.29/GRPE/2020/15 and GRPE-81-16 as amended by Addendum 2 to this chair's notes and complimented by GRPE-81-26 that will be uploaded on the UN Regulation webpage once it is available. GRPE requested the secretariat to submit Addendum 2 to WP.29 and AC.1 for consideration and vote at their November 2020 sessions as draft new UN Regulation No. [XXX] on RDE. The representative of the EC informed some elements were left in square brackets waiting for the outcome of local discussions in the region. She indicated that the square bracket would be removed prior to the adoption by WP.29/AC.1.

21. She finally updated GRPE on the latest development and forthcoming plans for the development of a draft new UN GTR on RDE still being discussed with a larger group of stakeholders involved.

22. GRPE noted the request for a meeting room for half a day during the GRPE week in January 2021.

## **V. Heavy duty vehicles (agenda item 4)81-01**

### **A. UN Regulations Nos. 49 (Emissions of compression ignition and positive ignition (LPG and CNG) engines) and 132 (Retrofit Emissions Control devices (REC))**

23. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

### **B. UN Global Technical Regulations Nos. 4 (World-wide harmonized Heavy Duty Certification procedure (WHDC)), 5 (World-Wide harmonized Heavy duty On-Board Diagnostic systems (WWH-OBD)) and 10 (Off-Cycle Emissions (OCE))**

24. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

### **C. Worldwide provisions for Heavy Duty vehicles Fuel Economy**

25. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

## **VI. UN Regulations Nos. 24 (Visible pollutants, measurement of power of C.I. engines (Diesel smoke)), 85 (Measurement of the net power), 115 (LPG and CNG retrofit systems), 133 (Recyclability of motor vehicles) and 143 (Heavy Duty Dual-Fuel Engine Retrofit Systems (HDDF-ERS)) (agenda item 5)**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/11,  
ECE/TRANS/WP.29/GRPE/2020/13,  
Informal documents GRPE-81-18, GRPE-81-28 and GRPE-81-37

26. The expert from OICA informed GRPE that OICA wished to withdraw ECE/TRANS/WP.29/GRPE/2020/13 from consideration by GRPE. He detailed recent findings could allow the scope to be enlarged and the document therefore to be more comprehensive for the forthcoming sessions of GRPE. GRPE took note of OICA's decision.

27. The expert from Liquid Gas Europe introduced ECE/TRANS/WP.29/GRPE/2020/11, as amended by GRPE-81-37. The proposal was supported by the representative from Italy. The representative from the UK requested some clarifications around the notion of special provisions in the context of UN Regulation No. 115. The expert from Liquid Gas Europe agreed to add more clarity in forthcoming amendment proposals and to ease the processing in the case of specific vehicle technologies for Type Approval Authorities (TAAs).

28. GRPE adopted ECE/TRANS/WP.29/GRPE/2020/11 and GRPE-81-37, as amended by Annex VI and requested the secretariat to submit Annex VI to WP.29 and AC.1 for consideration and vote at their November 2020 sessions as draft Supplement 9 to UN Regulation No. 115 (LPG and CNG retrofit systems).

29. The representative from CITA introduced GRPE-81-18 and GRPE-81-19 proposing the introducing of Particulate Number (PN) reference value tests in UN Regulations Nos. 24 and 83, that could be used, for example, as part of roadworthiness tests during the lifetime of the vehicle. The representative from CITA explained this first introduction to the documents was primarily aiming at gathering the interest of GRPE to work on such issue.

30. The representative from OICA regretted that both informal documents had been submitted soon before GRPE, and therefore limited time was available to carefully study the proposals. He highlighted GRPE-81-19 was not in line with GRPE-81-28 proposed by OICA (para. 0). He finally wondered if the proposals from OICA would have an impact on the cost of Periodic Technical Inspections (PTI).

31. The representative from EC deplored a premature proposal given the importance of the issue for assessing Diesel Particulate Filters (DPFs) deterioration. She stated the EC would be willing to redefine the test included in UN Regulations Nos. 24 and 83 to include PN. The representatives from NL, which is likely to include PN tests during PTI as of 2021, declared his willingness to work on a more refined proposal. The representative of Germany also supported the initiative and stated he would be happy to contribute.

32. The representative from OICA briefly introduced GRPE-81-28 proposing to remove UN Regulation No. 24 from the scope of UN Regulation No. 49. The representative from EC underlined such proposal was not on the table at this stage.

33. The Chair proposed GRPE to consider a full package during the next session of GRPE in January 2021 including the views of stakeholders having shown interest to work on the topic.

## **VII. Agricultural and forestry tractors, non-road mobile machinery (agenda item 6)**

### **A. UN Regulations Nos. 96 (Diesel emission (agricultural tractors)) and 120 (Net power of tractors and non-road mobile machinery)**

34. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

## **B. UN Global Technical Regulation No. 11 (Non-road mobile machinery engines)**

35. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

## **VIII. Particle Measurement Programme (PMP) (agenda item 7)**

*Documentation:* Informal documents GRPE-81-12, GRPE-81-13 and GRPE-81-31

36. The representative from the EC, chair of the IWG on PMP, introduced GRPE-81-31, presenting a status report of the activities of the IWG on PMP since the last session of GRPE. He highlighted the strong progress made by the IWG on both exhaust and non-exhaust emissions sources that, for example, led to the inclusion of sub-23 nm PN methodology in Amendment 6 to UN GTR No. 15 (para. 0). He also described the latest activities on non-exhaust particulate emissions and requested GRPE to host a one-day workshop on brake emission in conjunction with the next GRPE in January 2021.

37. The representatives from the UK and EC explained they would now like, as a next step, to include sub-23 PN requirements into UN GTR No. 4 on emissions from Heavy Duty Vehicles (HDV). The representative from EC also offered the possibility to host the workshop on brake emissions at the EC facilities in Geneva. The representative from OICA sought clarifications on the inclusion of sub-23 PN in UN GTR No. 4 and how differences between light duty vehicles and HDVs could be taken into account when designing a procedure for HDVs. The Chair of the IWG on PMP said initial thoughts would be to sample directly raw exhaust in the case of HDVs and stated no preferences with respect to the process of its inclusion in HDV legislation. The representative from EC added that how and when it would be included was still being discussed among interested parties.

38. The expert from EC, Chair of the task forces on brake emissions introduced GRPE-81-12 on an interim report on the activities on brake emissions. He detailed the achievements reached so far, including the definition of the brake emissions test cycles taken from the WLTC database, as part of the activities of the task force 1. He highlighted the on-going work on defining a procedure (task force 2) to measure brake dust emissions had been slowed down because of the Co-VID19 crisis and the difficulty to perform lab and other types of physical tests.

39. The representative from the UK highlighted non-exhaust are becoming a priority for come CPs, and that for example, microplastics from tyre wear represented a significant share of microplastics in the environment. The expert from EC explained that tyre wear was indeed a topic of high interest and that a research project was expected to be initiated soon at the European level to look closely at this issue. GRPE congratulated the excellent feedback on the brake emissions activities and encouraged regular updates on progress of this item that is part of GRPE priority list (Chapter XIV).

40. The Chair of the IWG on PMP introduced GRPE-81-13 on a revision of the Terms of References (ToRs) of the IWG to include on-road test procedure definitions, which are expected to be developed for light- and heavy- duty application concerning the sub-23 nm PN emissions. GRPE agreed to revise the ToRs of the IWG on PMP as proposed in GRPE-81-13.

41. GRPE noted the request for a meeting room for a day during the GRPE week in January 2021 to host the workshop on brake emissions.

## **IX. Motorcycles and mopeds (agenda item 8)**

### **A. UN Regulations Nos. 40 (Emission of gaseous pollutants by motorcycles) and 47 (Emission of gaseous pollutants of mopeds)**

42. GRPE did not receive any new proposal to amend UN Regulations Nos. 40 and 47.



## **B. UN Global Technical Regulations Nos. 2 (World-wide Motorcycle emissions Test Cycle (WMTC)), 17 (Crankcase and evaporative emissions of L-category vehicles) and 18 (On-Board Diagnostic (OBD) systems for L-category vehicles)**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/17,  
Informal document GRPE-81-24-Rev.2

43. The Chair of IWG on Environmental and Propulsion Performance Requirements for L-category vehicles (EPPR) introduced ECE/TRANS/WP.29/GRPE/2020/17, as amended by GRPE-81-24-Rev.2, containing a draft Amendment 1 to UN GTR No. 18. He added that the technical report coming together with draft Amendment 1 to UN GTR No. 18 would be submitted subsequently by some of the CPs involved in the development of this new amendment. He thanked the contributions from all parties.

44. GRPE adopted ECE/TRANS/WP.29/GRPE/2020/17 and GRPE-81-24-Rev.2 as amended by Addendum 3 to this chair's notes. GRPE also took note regarding the later submission of the technical report. GRPE requested the secretariat to submit Addendum 3 to WP.29 and Executive Committee of the 1998 Agreement (AC.3) for consideration and vote at their November 2020 sessions as draft Amendment 1 to UN GTR No. 18.

## **C. Environmental and Propulsion Performance Requirements (EPPR) for L-category vehicles**

*Documentation:* Informal documents GRPE-81-22 and GRPE-81-23-Rev.1

45. The Chair of IWG on EPPR presented a status report (GRPE-81-22). He updated GRPE on the progress of IWG and introduced GRPE-81-23-Rev.1 on amended ToRs of the IWG. The proposed ToRs included the upcoming activities of the group with a draft new timeline going until 2025. The Chair requested to add interim reporting mid-2022 so GRPE was updated of the progress and latest activities throughout the mandate. The Chair of the IWG on EPPR agreed to this principle.

46. GRPE agreed to revise the ToRs of the IWG on EPPR during the session, as proposed in GRPE-81-23-Rev.1.

47. GRPE acknowledged the progress made by IWG on EPPR and noted the request for a meeting room for one day during the GRPE week in January 2021.

## **X. Electric Vehicles and the Environment (EVE) (agenda item 9)**

### **A. UN GTR on the Determination of Electrified Vehicle Power (DEVP)**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/12,  
Informal documents GRPE-81-27 and GRPE-81-33

48. The representative from the United States, drafting coordinator for the proposed new UN GTR, presented GRPE-81-33 as a brief introduction to ECE/TRANS/WP.29/GRPE/2020/12, as amended by GRPE-81-27 on a proposal for a new UN GTR on DEVP. The representative from the Netherlands requested if there was any evidence on the equivalence between Test Procedure 1 (TP1) and Test Procedure 1 (TP2), as described in the proposal. The drafting coordinator of the proposal highlighted tests performed by the Joint Research Centre of the EC on vehicles where both TP1 and TP2 test could be performed. He emphasized the test results were closely related and finally added that in the majority of hybrid vehicle architecture, only one of the test procedure can be performed, depending on software/hardware configurations.

49. The representative from OICA asked how family concepts was being tackled in the proposal, especially thinking about which and how many vehicles should be tested when

approaching type approval authorities. The drafting coordinator acknowledged the issue had been raised and that final solutions were still being considered; he wondered if other family concepts from other legislative texts (for example using WLTP family concepts) could be used when applying the proposed UN GTR requirement as part of other regulatory needs. The Chair of GRPE reminded GRPE that UN GTRs are not related to type approval and the relating administrative provisions, and that the proposed UN GTR on DEVP would still need to be transposed into the 1958 Agreement, for example as part of UN Regulation No. [154] on WLTP or UN Regulation No. 85. He proposed to have such discussion during forthcoming sessions of GRPE.

50. GRPE adopted ECE/TRANS/WP.29/GRPE/2020/12 and GRPE-81-27 as amended by Addendum 4 to this chair's notes, as draft new UN GTR No. [XX] on DEVP, together with Annex VII as its technical report that will be extracted from the adopted documents, as proposed by the secretariat. GRPE requested the secretariat to submit Addendum 4 and Annex VII to WP.29 and AC.3 for consideration and vote at their November 2020 sessions as draft new Un GTR No. [XX] on DEVP.

## **B. Other activities of IWG on EVE**

*Documentation:* Informal document GRPE-81-32

51. The Chair of IWG on EVE presented the status report introducing the latest activities of the group (GRPE-81-32). He detailed the latest activities with respect to in-vehicle battery durability. He reminded GRPE that WP.29/AC.3 was expected to grant authorization to develop a new UN GTR on the topic during their June 2020 sessions.

52. He underlined the ambitious timeline agreed for the development of this new UN GTR and explained that given existing circumstances and the necessity to hold virtual meetings to make progress, the IWG decided to meet monthly at least until the end of 2020. He also stressed that the activities gained a lot of attention from various stakeholders and invited any interested parties to join the regulatory elaboration work.

53. The Chair of the IWG on EVE finally briefly updated GRPE on the method for stating energy consumption and the collaboration with the Energy Division of UNECE and its Group of Experts on Energy Efficiency (GEEE).

54. GRPE acknowledged the progress made by IWG on EVE and noted the request for a meeting room for half a day during the GRPE week in January 2021.

## **XI. Mutual Resolution No. 2 (M.R.2) (agenda item 10)**

55. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

## **XII. International Whole Vehicle Type Approval (IWVTA) (agenda item 11)**

56. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

## **XIII. Vehicles Interior Air Quality (VIAQ) (agenda item 12)**

*Documentation:* ECE/TRANS/WP.29/GRPE/2020/16,  
Informal documents GRPE-81-08 and GRPE-81-09-Rev.1

57. The Chair of IWG on Vehicles Interior Air Quality (VIAQ) presented a status report on the ongoing activities of the group (GRPE-81-08). He detailed the proposed revision to Mutual Resolution No. 3 (M.R.3) as found in ECE/TRANS/WP.29/GRPE/2020/16

containing new provisions to measure interior vehicle air quality, for example the description of the test procedure for emissions entering to the vehicle cabin with exhaust gases.

58. GRPE adopted ECE/TRANS/WP.29/GRPE/2020/16 and requested the secretariat to submit it to WP.29 and AC.3 for consideration and vote at their November 2020 sessions as a proposal for Amendment 1 to M.R.3.

59. The Chair of the IWG on VIAQ also presented GRPE-81-09-Rev.1 on extend ToRs for the IWG. He explained new and forthcoming activities were expected to require an extension until November 2025. The Chair of GRPE requested the IWG to present interim progress and results midway through the proposed term of the IWG so GRPE was well informed about the work and its evolution.

60. GRPE agreed to revise the ToRs of the IWG on VIAQ during the session as proposed in GRPE-81-09-Rev.1., acknowledged the progress made by IWG on VIAQ and noted the request for a meeting room for half a day during the GRPE week in January 2021.

#### **XIV. Lifetime compliance (agenda item 13)**

61. Given the circumstances and the limited time for the virtual meeting, GRPE did not consider this agenda item.

#### **XV. Priority topics for GRPE activities (agenda item 14)**

*Documentation:* Informal documents GRPE-81-06-Rev.1 and GRPE-81-34

62. The Chair introduced GRPE-81-06 as the revised GRPE priority list following the latest guidelines received by the Administrative Committee for the Coordination of Work (WP.29/AC.2). The representative from the EC introduced GRPE-81-34 on proposed amendments to GRPE-81-06 which deleted the timeline indication for tyre wear emissions. The representative from the UK underlined that in some countries including his, tyre emissions were a high priority. The representative from the EC explained that in her view, there was not enough knowledge nor literature on the issue yet to develop regulatory material. Furthermore, she noted very few activities were expected in the near future that could feed the development of a robust test procedure. The Representative from the UK argued that priorities did not necessarily mean on-going or forthcoming activities, and that resources could be allocated based on priorities to fast track the development of knowledge for regulatory purposes.

63. The representative from OICA sought clarification on sub-23 nm PN measurements and its scope. The Chair of the IWG on PMP underlined that Sub-23 nm PN measurement was aimed for both light- and heavy-duty applications, in the laboratory and on-road. He added that the proposed Amendment 6 to UN GTR No. 15 endorsed by GRPE (para. XX) only covered the laboratory part for light-duty vehicles, and that on-road applications for both light and duty vehicles, and heavy duty lab test were still to be developed.

64. The representative from Australia also emphasized that transposition of the latest European regulation on Heavy Duty (Euro VI Step E) into UN Regulation No. 49 should be prioritized.

65. GRPE agreed to such proposals and amended GRPE-81-06 into GRPE-81-06-Rev.1 during the session, and requested the secretariat to send GRPE-81-06-Rev.1 to WP.29 secretariat for further consideration by WP.29/AC.2.

#### **XVI. Election of Officers (agenda item 15)**

66. In compliance with Rule 37 of the Rules of Procedures (TRANS/WP.29/690, as amended) GRPE unanimously elected Mr. André Rijnders (Netherlands) as Chair of GRPE, and Mr. Duncan Kay (United Kingdom of Great Britain and Northern Ireland) as Vice-Chair for the sessions in the year 2021.

## **XVII. Any other business (agenda item 16)**

67. GRPE had not received any new proposals for discussion under this agenda item.

## **XVIII. Provisional agenda for the next session**

### **A. Next GRPE session**

68. The next GRPE session, including IWG meetings, is scheduled to be held in Geneva, Palais des Nations, starting on Monday, 11 January 2021, from 9.30 a.m. until Friday, 15 January 2021, at 12.30 p.m., subject to confirmation by the secretariat (see GRPE-82-01). Interpretation services would be provided from 12 January (2.30 p.m.) to 15 January (12.30 p.m.) 2021.

### **B. Provisional agenda for the next proper GRPE session**

69. GRPE agreed on the following provisional agenda for its next session:
1. Adoption of the agenda.
  2. Report on the last sessions of the World Forum for Harmonization of Vehicle Regulations (WP.29).
  3. Light vehicles:
    - (a) UN 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), 103 (Replacement pollution control devices) and [154] (WLTP);
    - (b) UN Global Technical Regulations Nos. 15 (Worldwide harmonized Light vehicles Test Procedures (WLTP)) and 19 (Evaporative emission test procedure for the Worldwide harmonized Light vehicle Test Procedure (WLTP EVAP));
    - (c) Worldwide harmonized Real Driving Emissions test procedure.
  4. Heavy duty vehicles:
    - (a) UN Regulations Nos. 49 (Emissions of compression ignition and positive ignition (LPG and CNG) engines) and 132 (Retrofit Emissions Control devices (REC));
    - (b) UN Global Technical Regulations Nos. 4 (World-wide harmonized Heavy Duty Certification procedure (WHDC)), 5 (World-Wide harmonized Heavy Duty On-Board Diagnostic systems (WWH-OBD)) and 10 (Off-Cycle Emissions (OCE));
    - (c) Worldwide provisions for Heavy Duty vehicles Fuel Economy.
  5. UN Regulations Nos. 24 (Visible pollutants, measurement of power of C.I. engines (Diesel smoke)), 85 (Measurement of the net power), 115 (LPG and CNG retrofit systems), 133 (Recyclability of motor vehicles) and 143 (Heavy Duty Dual-Fuel Engine Retrofit Systems (HDDF-ERS)).
  6. Agricultural and forestry tractors, non-road mobile machinery:
    - (a) UN Regulations Nos. 96 (Diesel emission (agricultural tractors)) and 120 (Net power of tractors and non-road mobile machinery);
    - (b) UN Global Technical Regulation No. 11 (Non-road mobile machinery engines).
  7. Particle Measurement Programme (PMP).

8. Motorcycles and mopeds:
  - (a) UN Regulations Nos. 40 (Emission of gaseous pollutants by motor cycles) and 47 (Emission of gaseous pollutants of mopeds);
  - (b) UN Global Technical Regulations Nos. 2 (World-wide Motorcycle emissions Test Cycle (WMTC)), 17 (Crankcase and evaporative emissions of L-category vehicles) and 18 (On-Board Diagnostic (OBD) systems for L-category vehicles);
  - (c) Environmental and Propulsion Performance Requirements (EPPR) for L-category vehicles.
9. Electric Vehicles and the Environment (EVE);
  - (a) UN GTR on the Determination of Electrified Vehicle Power (DEVPP);
  - (b) other activities of IWG on EVE.
10. Mutual Resolution No. 2 (M.R.2).
11. International Whole Vehicle Type Approval (IWVTA).
12. Vehicles Interior Air Quality (VIAQ).
13. Lifetime Compliance.
14. Priority topics for GRPE activities.
15. Any other business.

### C. Informal meetings scheduled to be held in conjunction with the next GRPE session

70. The following informal meetings were scheduled to be held, subject to confirmation:

<i>Date</i>	<i>Group</i>	<i>Acronym</i>	<i>Time</i>
Monday, 11 January 2021	Ad-hoc expert group on WLTP		9.30 a.m. – 12.30 p.m.
	Electric Vehicles and the Environment	EVE	2.30 p.m. – 5.30 p.m.
Tuesday, 12 January 2021	Brake emissions workshop	PMP	9.30 a.m. – 12.30 p.m. 2.30 p.m. – 5.30 p.m.
	Environmental and Propulsion Performance Requirements of L-category vehicles	EPPR	9.30 a.m. – 12.30 p.m. 2.30 p.m. – 5.30 p.m.
Wednesday, 13 January 2021	Global Real Driving Emissions	RDE	9.30 a.m. – 12.30 p.m.
	Vehicle Interior Air Quality	VIAQ	9.30 a.m. – 12.30 p.m.

71. The agendas of these meetings will be prepared by the respective Technical Secretaries and distributed to the members of each group prior to each meeting.

## Annex I

## List of informal documents (GRPE-81- ) distributed without an official symbol before and during the session

<i>No.</i>	<i>(Author) Title</i>	<i>Follow-up</i>
1	(Secretariat) Informal meetings in conjunction with the GRPE (proper) session: schedule and links to virtual meetings	A
2r3	(Secretariat) Provisional annotated agenda	A
3	(Secretariat) Draft running order	A
4	(Secretariat) Guidelines for virtual meeting participation	A
5	(Chair) Proceedings of the 81st GRPE session	A
6r1	(Chair) GRPE priority list using latest AC.2 template	B
7r1	(Secretariat) Highlights of the WP.29 Sessions of March 2020	A
8	(VIAQ) IWG on VIAQ status report	A
9r1	(VIAQ) Terms of reference and rules of procedure for IWG on VIAQ for the 3rd stage	B
10	(PMP) Revisions to ECE/TRANS/WP.29/GRPE/2020/14: sub 23nm PN measurements	B
11	(PMP) Explanatory note for GRPE-81-10 (included in GRPE-81-15)	A
12	(PMP) Brake emissions protocol - part 1	A
13	(PMP) Amendments to the terms of reference and rules of procedure for IWG on PMP	B
14	(WLTP) Revisions to ECE/TRANS/WP.29/GRPE/2020/14: improvements to Amendment 6 to UN GTR No. 15	B
15	(WLTP) Technical report for Amendment 6 to UN GTR No. 15	B
16	(RDE) Revisions to ECE/TRANS/WP.29/GRPE/2020/15	B
17	(RDE) IWG on RDE status report	A
18	(CITA) Proposed amendments to UN Regulation No. 24: reference values for PN emissions	C
19	(CITA) Proposed amendments to UN Regulation No. 83: reference values for PN emissions	C
20r1	(WLTP) IWG on WLTP status report	A
21	(OICA) Revisions to ECE/TRANS/WP.29/GRPE/2020/10	B
22	(EPPR) IWG on EPPR status report	A
23r1	(EPPR) Amendments to the terms of reference and rules of procedure for IWG on EPPR	B
24r2	(EPPR) Revisions to ECE/TRANS/WP.29/GRPE/2020/17	B
25	(Secretariat) General information, 82nd session of GRPE	A
26	(RDE) Template for UN Regulation on RDE reporting file	B
27	(EVE) Revisions to ECE/TRANS/WP.29/GRPE/2020/12	B
28	(OICA) Proposal for UN Regulation No. 24	C
29r1	(WLTP) Clarification of points regarding “UN Regulation WLTP”	B
30	(OICA) Additions to GRPE-81-29: clarification of points regarding “UN Regulation WLTP”	A
31	(PMP) IWG on PMP status report	A
32	(EVE) IWG on EVE status report	A
33	(EVE) Introduction to new UN GTR on DEVP	A
34	(EC) EC Comments to GRPE-81-06	A
35	(OICA) Proposal to amend GRPE-81-29	A
36	(Secretariat) Options for clarifications/guidelines documents	A
37	(Italy) Revisions to ECE/TRANS/WP.29/GRPE/2020/11	B

*Notes:*

- A Consideration by GRPE completed or to be superseded;
- B Adopted;
- C Further consideration on the basis of a revised proposal;
- D Distribute at the January 2021 session with an official symbol.

## **Annex II**

### **Informal meetings held in conjunction with the GRPE session**

Virtual meetings had been held in the weeks prior to GRPE in order to accommodate the different time zones.



## Annex III

### List of GRPE informal working groups, task forces and subgroups

<i>Name (Acronym) (Status)</i>	<i>Chair or Co-chairs</i>	<i>Secretaries</i>	<i>End of mandate</i>
Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR) (group)	Adolfo Perujo, Adolfo.PERUJO@ec.europa.eu  Mr. H. Suzuki suzuki@ntsel.go.jp	Daniela Leveratto, d.leveratto@immamotorcycles.org	December 2025
Electric Vehicles and the Environment (EVE) (group)	Michael Olechiw, Olechiw.Michael@epamail.epa.gov  Chen Chunmei (vice-Chair), chencm@miit.gov.cn  Hajime Ishii (vice-Chair), ishii@ntsel.go.jp	Andrew Giallonardo, Andrew.Giallonardo@canada.ca	June 2021
Particle Measurement Programme (PMP) (group)	Giorgio Martini, giorgio.martini@ec.europa.eu	Rainer Vogt rvogt@ford.com	June 2021
Vehicle Interior Air Quality (VIAQ) (group)	Andrey Kozlov, a.kozlov@nami.ru  Jong Soon Lim (vice-Chair), jongsoon@ts2020.kr	Andreas Wehrmeier Andreas.Wehrmeier@bmw.de	November 2025
Worldwide harmonized Light vehicles Test Procedure (WLTP) – Phase 2 (group)	Robertus Cuelenaere, rob.cuelenaere@tno.nl  Daisuke Kawano (vice-Chair), kawano@ntsel.go.jp	Noriyuki Ichikawa (co-Technical Secretary), noriyuki_ichikawa@mail.toyota.co.jp Markus Bergmann (co-Technical Secretary), markus.bergmann@audi.de	June 2020
Global Real Driving Emissions (RDE) (group)	Panagiota Dilara, Panagiota.DILARA@ec.europa.eu  Mr. Yamamura (vice-Chair), yamamura-s2zh@mlit.go.jp  Junhong Park (vice-Chair) pjhy98@korea.kr	Noriyuki Ichikawa (co-Technical Secretary), noriyuki_ichikawa@mail.toyota.co.jp Giustino Manzo (co-Technical Secretary), giustino.manzo@cnhind.com	January 2021

## Annex IV

[English only]

### Adopted amendments to ECE/TRANS/WP.29/GRPE/2020/10

Adopted on the basis of GRPE-81-21 (see para. 0)

### A new Supplement to the 05, 06 and 07 series of amendments to UN Regulation No. 83

## I. Proposal

*In the 05, 06 and 07 series of amendments, Annex 4A, Appendix 3, Paragraph 2., amend to read:*

"2. Calibration procedures

**For test and measurement equipment that is compliant with the technical requirements of UN GTR No. 15, the maintenance and calibration requirements described in that UN GTR may be followed, in all other cases the following requirements shall apply:"**

*In the 07 series of amendments, Annex 11, Paragraph 4.4. amend to read:*

"4.4. Prior to or at the time of type approval, no deficiency shall be granted in respect of the requirements of paragraph 6.5., except paragraph ~~6.5.3.4.~~ **6.5.3.5.**, of Appendix 1 to this annex."

## II. Justification

1. UN GTR No. 15 has brought all maintenance and calibration requirements up to date reflecting the capabilities of state-of-the-art equipment.

2. Most laboratories have been or will be updated to be capable of testing to UN GTR No. 15 but will still be used for testing to NEDC for the foreseeable future.

3. In order to remove the risk that equipment has to be calibrated more often than necessary, UN Regulation No. 83 should be updated to recognise the equipment in WLTP capable laboratories.

**4. In the 07 series of amendments (with amendment 1), paragraphs were renumbered because of a newly inserted paragraph. So the reference above should read now 6.5.3.5.**

"6.5.3.4. Basic diagnostic data, (as specified in paragraph 6.5.1.) and bi-directional control information shall be provided using the format and units described in the standard listed in paragraph 6.5.3.2.(a) of this appendix 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.

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 the standard listed in paragraph 6.5.3.2.(a) of this Regulation but related to this Regulation.

**6.5.3.5.** When a fault is registered, the manufacturer shall identify the fault using an appropriate ISO/SAE controlled fault code specified in one of the standards listed in paragraph 6.5.3.2.(d) of this appendix 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 the same standard. The fault codes shall be fully accessible by standardised diagnostic equipment complying with the provisions of paragraph 6.5.3.3. of this appendix."

## Annex V

[English only]

### Technical Report to Amendment 6 to UN GTR No. 15

Adopted on the basis of GRPE-81-15 (see para. 0)

### Technical report on the development of Amendment 6 to UN GTR No. 15 on the Worldwide harmonized Light vehicles Test Procedure (WLTP)

#### I. Mandate

1. Amendment 6 to global technical regulation (GTR) No. 15 was developed by the Informal Working Group (IWG) on Worldwide harmonized Light vehicles Test Procedures (WLTP) in the framework of Phase 2 of the development of UN GTR No. 15. The Executive Committee (AC.3) of the 1998 Agreement adopted the authorisation to develop Phase 2 of GTR No. 15 at its June 2016 session (ECE/TRANS/WP.29/AC.3/44).

#### II. Objectives

2. New definitions added for "Engine capacity" and "Engine displacement".
3. New definitions added to accompany the introduction of dual-axis dynamometer requirements in paragraph 2.4.2.4. of Annex 6.
4. New definition added for "Coasting" in association with an amendment to paragraph 2.4.2. of Annex 6.
5. New definitions added for NOVC-FCHVs and OVC-FCHVs to accompany the introduction of requirements for OVC-FCHVs which add to the requirements for NOVC-FCHVs which were already included in UN GTR No. 15.
6. Introduction of definitions for flex-fuel and mono-fuel vehicles to align with the UN Regulation on WLTP and amendments included in UN GTR No. 19 Amendment 3.
7. Update to the definition for "defeat device", accompanied by new text in paragraph 5.5.5. of the GTR. to align with the definition and supporting paragraph included in UN Regulation on WLTP.
8. Introduction of a new definition for "Configurable start mode" to support amendments to the requirements of the GTR in paragraph 2.6.6. of Annex 6.
9. Introduction of new definitions on the topic of On-Board Diagnostics (OBD) to support the new annex for OBD (Annex 11).
10. Introduction of new family definitions to cover the amendments and additions introduced in UN GTR No. 15 Amendment 6, covering OVC-FCHV and NOVC-FCHV interpolation families; Gas Fuelled Vehicles (GFV) family; Exhaust after-treatment system using reagent (ER) family; OBD family; Durability family; Low temperature family; and  $K_{CO_2}$  correction factor family for OVC-HEVs and NOVC-HEVs.
11. The annexes concerning the WLTC (Annex 1), and gear selection and shift point determination for vehicles equipped with manual transmissions (Annex 2) were updated to resolve issues which were encountered through the implementation of regional WLTP legislation and to introduce machine code versions of the calculation tool, which will be available on the UNECE website.
12. Annex 3 was updated to introduce new reference fuel specifications for the new Type 6 Low Temperature test that was added to UN GTR No. 15 in a new optional Annex 13. These were introduced in Part II of Annex 3, with a new Part I having been created for the Type 1 test reference fuels.

In addition to the new reference fuels for the Type 6 test, a new Type 1 test reference fuel was introduced to align with the harmonised diesel (B5H) reference fuel which were included in Level 2 of UN Regulation on WLTP (the most stringent level). Relevant sections of Annex 6 and Annex 7 were also updated to introduce this new fuel.

13. To align with UN Regulation on WLTP new requirements were added in relation to the testing of 4WD vehicles, which are required to be tested on a dual-axis dynamometer. These requirements were introduced in a new paragraph 2.4.2.4. of Annex 6 (Allocation of dynamometer type to test vehicle), with other related amendments being made in paragraph 3. (definitions), and Annex 4 (paragraph 2.5.3. and 7.3.3.), Annex 5 (paragraph 2.3.) and Annex 6 (paragraphs 2.4.2.4. and 2.6.3.2.).

As a result of the discussions in the Dual-Axis Dyno Task Force and the main Informal Working Group the requirements of paragraph 7.3.3. of Annex 4 relating to the placement of the vehicle on the dynamometer were updated in relation to vehicle restraint during testing, to ensure that there can be no vertical force applied.

The provisions of paragraph 2.4.2.4. of Annex 6 require 4WD vehicles to be tested on a dual-axis dyno unless equivalency between a dynamometer in 2WD operation and a dynamometer in 4WD operation can be demonstrated to the responsible authority – based on a set of conditions specified in paragraph 2.4.2.5.1. of Annex 6.

14. Interpolation method and minimum deltas - paragraph 4.2.1.1.2. of Annex 4.

The interpolation method contains a minimum delta of 5 mg/km CO<sub>2</sub> in order to avoid perverse effects due to test to test variability but it has been noticed that similar effects can occur when the individual coefficients  $f_0$ ,  $f_1$  and  $f_2$  lie too close together and are then extrapolated. New rules have been developed to eliminate this effect.

15. Clarification that for vehicles supplied with an additional set of snow tyres (with or without wheels) these shall not be considered as optional equipment when determining the cycle energy demand. This clarification has been provided in paragraph 4.2.1.1.2. of Annex 4 and also in several paragraphs of Annex 7.

16. Amendments were made to the provisions in Annex 4 for flat belt measurement (paragraph 6.5.2. of Annex 4) to introduce an option for cases where the air drag coefficient of a vehicle is not constant over speed.

17. A new paragraph 2.3.2. of Annex 5 was added to provide the requirements relating to the vehicle restraint system for single roller chassis dynamometers.

18. The requirements for measuring Particle Number (PN) have been updated by the work of the PMP Informal Working Group, introducing new test equipment requirements for a solid particle number measurement procedure with a cut-off size of approximately 10 nm (SPN10) and also updating the existing requirements for measurement with a cut-off size of 23nm (SPN23), in particular allowing the use of a catalyzed evaporation device in volatile particle remover (VPR). These amendments, along with the technical rationale are provided in Appendix 1 to this Technical Report.

19. Additional provisions relating to Type 1 testing of vehicles fuelled with LPG or NG/biomethane have been introduced in paragraph 1.1.2. of Annex 6. These reflect the requirements introduced in UN Regulation on WLTP, which were themselves based on the provisions of Annex 12 of UN Regulation No 83.

20. GTR No. 15 has been updated in multiple locations to align with UN Regulation on WLTP in relation to the addition of a Contracting Party option for the calculation and declaration of 'fuel efficiency' (km/l) as an alternative to fuel consumption (l/100km) and CO<sub>2</sub>. In many areas of the GTR, the first instance being paragraph 1.2.3.3. of Annex 6, two options for the requirements are provided. Option A relates to the 4-phase WLTP, as required by Level 1A of UN Regulation on WLTP, whilst Option B covers the results after the first 3 phases of a WLTP test, as required by Level 1B of UN Regulation on WLTP.

The introduction of the fuel efficiency metric has resulted in updates throughout Annex 6, Annex 7 and Annex 8, as well as in the new Annex 14 covering Conformity of Production.

21. The introduction of optional requirements relating to OVC-FCHV, in Level 1A of UN Regulation on WLTP, has also resulted in multiple changes in the GTR. Whilst the majority of these are included in Annex 8 and its appendices, there are other areas of the GTR where requirements relating to OVC-FCHV are included, e.g. an additional element in Table A6/2.

The procedure described and defined for OVC-FCHV is following the procedure from OVC-HEVs, but adjusting it to the requirements from OVC-FCHVs (e.g. replacing fuel consumption by hydrogen consumption). Besides the procedure for OVC-FCHVs, the interpolation approach for those vehicles has been introduced (along with a family definition). Interpolation approach was also added for NOVC-FCHVs.

22. Paragraph 2.3.2.4. of Annex 6 and paragraph 4.5.1.1.5. of paragraph 8. have been updated to clarify how to verify the linearity of CO<sub>2</sub> mass emissions for vehicle M, both for a 4-phase calculation and a 3-phase calculation.

23. Paragraph 2.4.2. of Annex 6 has been updated to provide a Contracting Party option relating to vehicles fitted with a coasting functionality. This option requires that the functionality shall be deactivated during chassis dynamometer testing. The introduction of this modification was supported by the introduction of a new definition for "coasting" in paragraph 3 of the GTR.

24. Paragraph 2.6.6. of Annex 6 (Driver selectable modes) has been updated to provide clarification. This update introduces the new term "configurable start mode" which has been introduced as a new definition in paragraph 3 of the GTR. This covers the situation where some modes are retained after a "key off" but others default back to a mode similar to a predominant concept.

25. Paragraph 2.6.8.3. of Annex 6 (Speed trace tolerances) has been updated and restructured to include requirements for IWR and RMSSE which were previously included in paragraph 7. of Annex 7.

Amendments throughout paragraph 7. of Annex 7 have been made in order to align with the changes made in paragraph 2.6.8.3. of Annex 6.

26. Paragraph 3. of Appendix 2 to Annex 6 (REESS energy change-based correction procedure) has been updated. Paragraphs 3.4.2., 3.4.3. and 3.4.4. have been replaced by a new paragraph 3.4.2. This aligns the requirements for conventional (ICE) vehicles more closely with those for electrified vehicles and simplifies the text considerably by eliminating the need to calculate the coefficient 'c'.

In addition Table A6.App2/1 Energy content of fuel has been updated to introduce heat values for LPG and CNG, as well as to introduce the B5H harmonised diesel reference fuel.

27. The post-processing tables in Annex 7 and Annex 8 have been updated to align with the tables finalised for UN Regulation on WLTP, with some additional modifications and corrections to those UN Regulation tables, and new tables have been added to cover the introduction of requirements for OVC-FCHVs into the GTR (Tables A8/9a and A8/9b).

In addition, underneath the table captions clarification is provided to explain that in order to calculate the results for 3-phases and 4-phases the tables must be worked through twice, once for the 3-phase and once for 4-phase.

28. In relation to Table A7/1 (Procedure for calculating final test results), at the 30th WLTP IWG a discussion was held on the provisions for the calculation of phase specific fuel consumption.

The calculation of the phase specific fuel consumption in the WLTP is based on the phase specific CO<sub>2</sub> result, while for CO and HC the total test results are used. It was explained that the reason for this is that when having a regenerating exhaust aftertreatment system the K<sub>i</sub> factors will be applied. K<sub>i</sub> factors are only available for the whole test results. Therefore in

order to avoid too much test burden it was accepted as a technical compromise. The effect might be only a few tenths of a percent.

29. Paragraph 3.2.1.1.4. of Annex 7 (Flow-weighted arithmetic average concentration calculation) was updated to correct an anomaly which had been uncovered in the GTR which is confusing and can also adversely affect the accuracy of the mass calculations for continuous dilute measurements from the constant volume sampler (CVS).

30. Through the work of the CFD Task Force the requirements of paragraph 3.2.3.2.2.3.2. of Annex 7 (Alternative method for determination of aerodynamic influence of optional equipment) was updated. This includes CFD simulation as a Contracting Party option.

The method allows the use CFD simulation software to determine the  $\Delta C_{d,A_f}$  of aerodynamic optional equipment instead of using the windtunnel method. There are restrictions specified with respect to the scope (in terms of applicable vehicles and type of optional equipment), the accuracy of the simulation software and the maximum allowed  $\Delta C_{d,A_f}$ . Before the CFD simulation software may be used, the manufacturer shall demonstrate the equivalency of the method by a validation test programme in a windtunnel for at least two types of optional equipment, and may then only be applied for those types of optional equipment (e.g. wheels, cooling air control systems, spoilers, etc.).

31. Annex 8 of the GTR has been amended in multiple locations to introduce the requirements for fuel efficiency (see paragraph 20 of this Technical Report) and OVC-FCHVs (see paragraph 21).

32. Topics related to the Annex 8 vehicles (covered by Annex 8 of the GTR) have been amended in multiple locations as follows:

Interpolation family criteria of OVC-HEVs and PEVs (Main Body of GTR) for all levels: Updated regarding charge electric energy converter, type of traction REESS.

Added CO<sub>2</sub> correction factor family (Main Body of GTR) for UN Regulation on WLTP Level 1A equivalent: Required for application of CO<sub>2</sub> correction factor family.

Exempt humidity requirements for PEVs and FCHVs (paragraph 3.1.3.) for all levels: Not necessary for PEVs and FCHVs.

Calculation schemes in Annex 8, Chapter 4 for all levels: Change of input parameters for calculation schemes of  $M_{CO_2,weighted}$ ,  $FC_{weighted}$ ,  $EC_{AC,weighted}$ , EAER from measured values (partially) to declared values (completely). Further clarification and adjustments were identified.

Post Processing Tables in Annex 8, Chapter 4 for all levels: Error correction of errors identified by lessons learned.

Option to decrease EAER and EAER<sub>p</sub> as a manufacturers option (Annex 8, Chapter 4): Manufacturer is allowed to decrease the range values of EAER and EAER<sub>p</sub>.

33. CO<sub>2</sub> correction (Annex 8, Appendix 2):

- Clarification of its application in paragraph 1. for all levels
- CO<sub>2</sub> correction factor family application in paragraph 2.1. for level 1A: The correction factor determined for one interpolation family can be applied to other interpolation families when meeting the requirements of the CO<sub>2</sub> correction factor family.
- Generic approach application in paragraph 4. for all levels: A new paragraph 4 has been added to Appendix 2 to Annex 8 which introduces a manufacturer's option for an alternative test procedure for rechargeable electric energy storage system monitoring.

34. Paragraph 3. of Appendix 3 to Annex 8 ("REESS voltage application") for all levels: Paragraph 3 was reworked due to the nominal voltage application.

35. Charging of OVC-HEVs and PEVs in Annex 8, Appendix 4 for all levels: In paragraph 3.1.2., information was added regarding the soaking and application of the normal charge.

36. In Appendix 6 to Annex 8, the concept of configurable start mode has been added for all vehicle types described in Annex 8 and for all levels.

37. In addition, a new Appendix 8 has been added to Annex 8 relating to the calculation of additional values required for checking the Conformity of Production of electric energy consumption of PEVs and OVC-HEVs. This has been moved from the calculation part in the context of CoP to this annex as the calculation of these specific value already need to be performed during type approval for vehicle high and vehicle low. Furthermore, the interpolation of these CoP values is described in Appendix 8.

38. Amendment 6 of UN GTR No. 15 introduces a new Annex 10 covering the requirements for vehicles that use a reagent for the exhaust after-treatment system.

These requirements have been copied from UN Regulation on WLTP, which in turn had been copied from Appendix 6 to UN Regulation No 83.

For UN GTR No. 15 the requirement in paragraph 8.3.4. of Annex 10, relating to a 'performance restriction' approach to restrict the speed of the vehicle after the inducement system activates has been made a Contracting Party option to align with Level 1B of UN Regulation on WLTP.

39. Amendment 6 of UN GTR No. 15 introduces a new Annex 11 covering provisions relating to On-Board Diagnostics (OBD).

The OBD procedure from Annex 11 of UN Regulation No. 83 07 series was updated for inclusion in the new UN Regulation on WLTP, introducing the WLTC in place of NEDC and also incorporating Japan's OBD provisions (for example the use of a 3-phase versus 4-phase WLTC). There was also some clarification of provisions including additional definitions.

For UN GTR No. 15 Amendment 6 the text describing the OBD procedure in UN Regulation on WLTP has been further refined by some restructuring of the provisions and the inclusion of some additional definitions to those in UN Regulation on WLTP.

40. Amendment 6 of UN GTR No. 15 introduces a new optional Annex 12 covering provisions relating to the Type 5 test (Description of the endurance test for verifying the durability of pollution control devices).

Annex 12 introduces the new provisions around the UN Regulation No. 83 07 series Type 5 test requiring emissions testing on WLTC which were developed for inclusion in UN Regulation on WLTP and including the specific regional requirements of the EU and Japan as Contracting Party options.

Option A is based on the EU provisions in terms of useful life (160,000 km), assigned DFs and acceptable mileage accumulation procedures, allowing the use of component bench ageing.

Option B is based on the Japan provisions in terms of useful life (80,000 or 60,000 km), assigned DFs and acceptable mileage accumulation procedures, but excluding the use of component bench ageing.

41. Amendment 6 of UN GTR No. 15 introduces a new optional Annex 13 covering provisions relating to the Type 6 test (Low temperature test)



Unlike the other new annexes introduced in UN GTR No. 15 Amendment 6 the Type 6 test is not included in UN Regulation on WLTP.

The WLTP based Type 6 test included in Annex 13 differs in many areas from the NEDC based Type VI test included in Annex 8 of UN Regulation No. 83 07 series of amendments, including the scope of vehicles covered and the test requirements. Appendix 2 of this Technical Report provides a detailed explanation.

42. Amendment 6 of UN GTR No. 15 introduces a new optional Annex 14 covering provisions relating to Conformity of Production (CoP).

The CoP provisions were developed by the Conformity of Production Task Force for inclusion in UN Regulation on WLTP and have now been copied into the GTR, as appropriate. These integrate the EU and Japan CoP provisions, with Contracting Party options providing the alternative provisions.

Appendix 3 to this Technical Report provides details of the CoP provisions.

### **III. Meetings held by Task Forces**

23. The proposed changes in Amendment 6 to UN GTR No. 15 listed in section II above were discussed at length and agreed upon by all participants during the following Informal Working Group (IWG) meetings:

- (a) 26th IWG, April 2019 (Zagreb);
- (b) 27th IWG, May 2019 (Geneva);
- (c) 28th IWG, September 2019 (Bern);
- (d) 29th IWG, January 2020 (Geneva);
- (e) Intermediate IWG, February 2020 (Brussels);
- (f) 30th IWG, April 2020 (Remote WebEx).

Numerous face-to-face or audio/web meetings of the following task forces were held: EV (electric vehicle); Gearshift; CFD (Computational Fluid Dynamics); Drive Trace Indices; Dual Axis Dyno; Low Temperature; Drafting Subgroup; Durability; Conformity of Production; and OBD.

## Appendix 1 – Technical Report from PMP IWG

24. This informal document is submitted by the Informal Working Group (IWG) Particle Measurement Programme (PMP) to inform and update the GRPE of the work of the IWG on the amendment of UN GTR No. 15 Annexes 5, 6 and 7 to:

- Modify the existing solid PN measurement methodology having a 50% cut-off size at 23 nm (SPN23) in order to allow the use of catalyzed evaporation device in volatile particle remover (VPR) and introduce minor improvements
- Include as a second alternative option a solid PN measurement methodology with a 65% cut-off size at 10 nm (SPN10).

25. This is an explanatory note accompanying the consolidated document addressing the changes to the current methodology and the proposed changes for the second alternative option to extend the particle size detection range to 10 nm particles.

### Purpose and summary of the modifications

26. This proposed amendment to UN GTR No. 15 aims mainly at introducing as an alternative option a solid particle number measurement procedure with a cut-off size of approximately 10 nm (SPN10) differing in this from the existing procedure which has a 50% cut-off size at 23 nm (SPN23).

27. This amendment stems from the evidence that specific technologies like PFI and CNG engines may exhibit, in some cases, particle emissions close to the existing emission limit and at the same time a significantly high fraction of sub-23 nm particles. In view of a possible extension of the particle number limit to all combustion engines, the European Commission and other Contracting Parties had expressed the interest in a test procedure with a lower cut-off size in order to improve the control of particle emissions whatever the average size of the particles emitted. The PMP IWG concluded that it would be extremely challenging to develop a reliable particle counting methodology with a d<sub>50</sub> below 10 nm while a 65% cut-off size at 10 nm would be achievable by properly adapting the existing methodology.

28. For this reason the PMP IWG has worked to identify the necessary changes which would allow an increase to the size range of the particles counted, whilst maintaining an appropriate level of repeatability/reproducibility, and at the same time trying to reduce as much as possible the impact on the testing burden and the measuring equipment required. The new proposed procedure has been assessed by means of an inter-laboratory exercise that has involved several laboratories located in Europe and Asia. This exercise has shown that the variability level of SPN10 results is at the same level as the SPN23 values.

29. Since a few Contracting Parties have asked to maintain the existing methodology with the 50% cut-off size at 23 nm in the UN GTR No. 15, in agreement with the GRPE Secretariat, it is proposed to keep the existing methodology with some modifications and introduce the new procedure with the cut-off size at about 10 nm as an additional option. Both the changes to the existing methodology and the changes to extend the particle size detection range to 10 nm are summarized and explained in the table 1.

30. One of the more debated points in the PMP IWG concerned the volatile particle remover and more specifically whether for SPN10 this should be based on a catalytic stripper or whether also the usual evaporation tube should be allowed. The results of the validation exercise have not provided clear evidence that one solution is definitely better than the other, but there is large consensus among the experts that the catalytic stripper minimizes the risk of artefacts due to too low dilution ratios. Moreover, losses are more critical for particles below 23 nm and if not properly measured and modelled, allowing both systems could result in an increased variability among instruments based on different sample treatment approaches. For these reasons it has been decided to allow only the use of the catalytic stripper for SPN 10. However, in order to maintain the possibility of using sampling systems designed for SPN10 also for SPN23 measurement, the IWG proposes to modify also the existing procedure by removing the restriction that the sampling system parts shall not react with the exhaust gas components. In this way a sampling system with a catalytic stripper

fitted with a condensation particle counter with the proper calibration can be used for the SPN23 measurement. As supported by several experimental data, the different losses between catalytic stripper and evaporation tube become important only below 23 nm and therefore, allowing the use of both devices for SPN23, should not result in an increased variability of the measurements.

Table 1

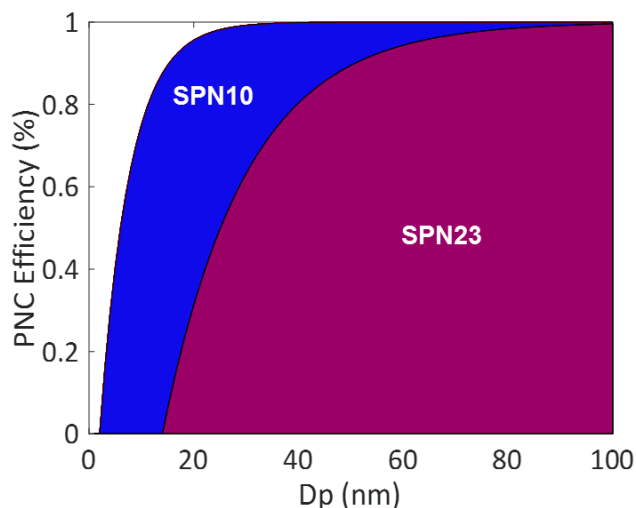
**Main changes to SPN23 and changes/additions for SPN10**

<i>Subject</i>	<i>UN GTR No. 15, Annex 5 – Original requirements</i>	<i>Proposed changes for SPN23</i>	<i>Proposed changes for SPN10</i>	<i>Reasoning</i>
PNC efficiency	50±12 % @ 23 nm, >90% @ 41nm	None	65±15 % @ 10 nm, >90% @ 15nm	Typical PNC-efficiency, well tested in the field.
Maximum VPR-loss requirement	@ 30nm 30% and @ 50 nm 20% higher than @ 100 nm	None	Addition @15 nm 100 % higher than at 100 nm	No additional requirement below 15 nm since generation of particles < 15 nm challenging, uncertainties high
Polydisperse validation of VPR	a polydisperse 50 nm aerosol may be used for validation	None	Removed	Uncertainties @ 15 nm or below high → test serves no purpose
VPR validation	> 99.0 % vaporization of 30 nm tetracontane particles, with an inlet concentration of ≥ 10,000 per cm <sup>3</sup> (Monodisperse)	None	> 99.9 % removal efficiency of tetracontane particles with count median diameter > 50 nm and mass > 1 mg/m <sup>3</sup> . (Polydisperse)	Secure the functioning of VPR also for PNC with 65±15 % @ 10 nm, >90% @ 15nm
Volatile Particle Remover (VPR)	All parts (of SPN-system) -- shall not react with exhaust gas components	-- VPR may be catalyzed (both heated evaporation tube and catalytic stripper allowed)	- the VPR shall be catalyzed (use of catalytic stripper only)	Minimize the risk of artefacts for SPN10. Comparability of PNC10 and PNC23 and possibility of using new sampling systems with CS also for SPN23 by fitting a PNC with a D50 @ 23 nm.

31. A specific technical issue stemmed from the concern that to certify a vehicle for two different regions applying different PN limits (i.e. PN10 and PN23) either two different instruments or double testing might be required. This would lead in any case to increased

testing costs and burden. Both those situations might be avoided if a test performed using the SPN 10 measurement procedure could also cover the SPN23 nm test.

32. In principle measuring SPN10 should result in higher PN values and therefore if the PN23 limit is met it can be concluded that the same limit would be more easily met when using the SPN23 procedure (see picture below). The PMP IWG believes that this option is acceptable if any party would like to implement it.



33. As explained above, the proposed amendment does not just contain a second option for SPN10 measurement, but also includes a number of corrections/improvements to the existing and the proposed methodology. The following table describes in detail only the changes to the existing, SPN23 methodology. When in the “New text” column the marking “SPN23” does not appear, the changes also apply to the SPN10 procedure.

Annex 5	Original text	New text	Justification
4.3. PN measurement equipment (if applicable)	None	<p>This Regulation allows for two optional settings for the measurement of PN, differentiated by the particle electrical mobility diameter at which the PNC’s detection efficiency is stated. The two values included are 23 nm and 10 nm.</p> <p>While most of the paragraphs and sub-paragraphs are common to the two different settings and have to be applied for both 23 nm and 10 nm PN measurement, some contain two different options starting respectively with the markings “SPN23” and “SPN10”.</p> <p>Where such options exist, a Contracting Party wishing to apply the 23 nm value should select the requirements starting with the marking “SPN23” whereas a Contracting Party wishing to apply the 10 nm value should select the</p>	<p>The text explains how to read the annex in the context of having common text, SPN10 specific text and SP23 specific text- as introduced by the new and the amended test procedure.</p>

Annex 5	Original text	New text	Justification
		requirements starting with the marking "SPN10".	
4.3.1.2.3.	All parts of the dilution system and the sampling system from the exhaust pipe up to the PNC, which are in contact with raw and diluted exhaust gas, shall be designed to minimize deposition of the particles. All parts shall be made of electrically conductive materials that do not react with exhaust gas components, and shall be electrically grounded to prevent electrostatic effects.	All parts of the dilution system and the sampling system from the exhaust pipe up to the PNC, which are in contact with raw and diluted exhaust gas, shall be made of electrically conductive materials, shall be electrically grounded to prevent electrostatic effects and designed to minimize deposition of the particles.	This change allows the use of a catalytic stripper in the sampling system used for SPN23 measurement
4.3.1.3.3.	The sample preconditioning unit shall: (a) Be capable of diluting the sample in one or more stages to achieve a particle number concentration below the upper threshold of the single particle count mode of the PNC and a gas temperature below 35 °C at the inlet to the PNC;	The sample preconditioning unit shall: (a) Be capable of diluting the sample in one or more stages to achieve a particle number concentration below the upper threshold of the single particle count mode of the PNC; (b) Have a gas temperature at the inlet to the PNC below the maximum allowed inlet temperature specified by the PNC manufacturer;	Permits the use of systems that can control the inlet temperature
4.3.1.3.3.	The sample preconditioning unit shall: (e) Be designed to achieve a solid particle penetration efficiency of at least 70 per cent for particles of 100 nm electrical mobility diameter;	The sample preconditioning unit shall: (f) Achieve a solid particle penetration efficiency of at least 70 per cent for particles of 100 nm electrical mobility diameter;	Only editorial change
4.3.1.3.3.	The sample preconditioning unit shall: (h) Also achieve more than 99.0 per cent vaporization of 30 nm tetracontane (CH <sub>3</sub> (CH <sub>2</sub> ) <sub>38</sub> CH <sub>3</sub> ) particles, with an inlet concentration of ≥ 10,000 per cm <sup>3</sup> , by means of heating and reduction of partial pressures of the tetracontane.	The sample preconditioning unit shall: (h) SPN23: Achieve more than 99.0 per cent vaporization of 30 nm tetracontane (CH <sub>3</sub> (CH <sub>2</sub> ) <sub>38</sub> CH <sub>3</sub> ) particles, with an inlet concentration of ≥ 10,000 per cm <sup>3</sup> , by means of heating and reduction of partial pressures of the tetracontane.	Only editorial change
New 4.3.1.3.3.1.	None	The solid particle penetration $P_r(d_i)$ at a particle size, $d_i$ , shall be calculated using the following equation: $P_r(d_i) = DF \cdot N_{out}(d_i)/N_{in}(d_i)$ Where	Definition of penetration. It was not defined

Annex 5	Original text	New text	Justification
		<p><math>N_{in}(d_i)</math> is the upstream particle number concentration for particles of diameter <math>d_i</math>;</p> <p><math>N_{out}(d_i)</math> is the downstream particle number concentration for particles of diameter <math>d_i</math>;</p> <p><math>d_i</math> is the particle electrical mobility diameter</p> <p>DF is the dilution factor between measurement positions of <math>N_{in}(d_i)</math> and <math>N_{out}(d_i)</math> determined either with trace gases, or flow measurements.</p>	
4.3.1.3.4.	The PNC shall: (d) Have a linear response to particle number concentrations over the full measurement range in single particle count mode;	The PNC shall: (d) Operate under single counting mode only and have a linear response to particle number concentrations within the instrument's specified measurement range;	Clarification of the already existing requirement of single counting mode
4.3.1.3.4.	The PNC shall: (g) Incorporate a coincidence correction function up to a maximum 10 per cent correction, and may make use of an internal calibration factor as determined in paragraph 5.7.1.3. of this annex but shall not make use of any other algorithm to correct for or define the counting efficiency;	The PNC shall: (g) Introduce a correction with an internal calibration factor as determined in paragraph 5.7.1.3.	The coincidence correction is outdated. New counters have more sophisticated algorithms
4.3.1.3.4.	None	The PNC shall: (i) SPN23: The PNC calibration factor from the linearity calibration against a traceable reference shall be applied to determine PNC counting efficiency. The counting efficiency shall be reported including the calibration factor from the linearity calibration against a traceable reference.	Clarification that the calibration factor has to be applied when checking the efficiencies at the cut-off curve sizes
4.3.1.3.4.	None	The PNC shall: (j) If the PNC applies some other working liquid besides n-butyl alcohol or isopropyl alcohol, the counting efficiency of the PNC shall be demonstrated with 4cSt polyalphaolefin and soot-like particles.	To confirm that PNC working fluid does not behave differently with soot particles, i.e. soot is somewhat hydrophobic and PNCs applying water as working fluid should be avoided

Annex 5	Original text	New text	Justification
Table A5/2a PNC counting efficiency	23±1 41±1	23 41	Reference to “nominal” particle size
4.3.1.3.6.	Where not held at a known constant level at the point at which PNC flow rate is controlled, the pressure and/or temperature at the PNC inlet shall be measured for the purposes of correcting particle number concentration measurements to standard conditions	Where not held at a known constant level at the point at which PNC flow rate is controlled, the pressure and/or temperature at the PNC inlet shall be measured for the purposes of correcting particle number concentration measurements to standard conditions. The standard conditions are 101.325 kPa pressure and 0°C temperature.	Standard conditions defined to avoid ambiguity.
4.3.1.4.1.3.	The sampling probe or sampling point for the test gas flow shall be arranged within the dilution tunnel so that a representative sample gas flow is taken from a homogeneous diluent/exhaust mixture.	Becomes 4.3.1.4.1.4 and a new provision is inserted in 4.3.1.4.1.3.	Change on indexing
New 4.3.1.4.1.3.	None	SPN23: The evaporation tube, ET, may be catalytically active.	Clarification that catalytically active evaporation tube is permitted
5.7.1.1.	The responsible authority shall ensure the existence of a calibration certificate for the PNC demonstrating compliance with a traceable standard within a 13-month period prior to the emissions test. Between calibrations either the counting efficiency of the PNC shall be monitored for deterioration or the PNC wick shall be routinely changed every 6. See Figures A5/16 and A5/17. PNC counting efficiency may be monitored against a reference PNC or against at least two other measurement PNCs. If the PNC reports particle number concentrations within ±10 per cent of the arithmetic average of the concentrations from the reference PNC, or a group of two or more PNCs, the PNC shall subsequently be considered stable, otherwise maintenance of the PNC is required. Where the PNC is monitored against two or	The responsible authority shall ensure the existence of a calibration certificate for the PNC demonstrating compliance with a traceable standard within a 13-month period prior to the emissions test. Between calibrations either the counting efficiency of the PNC shall be monitored for deterioration or the PNC wick shall be routinely changed every 6 months if recommended by the instrument manufacturer. See Figures A5/16 and A5/17. PNC counting efficiency may be monitored against a reference PNC or against at least two other measurement PNCs. If the PNC reports particle number concentrations within ±10 per cent of the arithmetic average of the concentrations from the reference PNC, or a group of two or more PNCs, the PNC shall subsequently be considered stable, otherwise maintenance of the PNC is required. Where the PNC is monitored against two or more other measurement PNCs, it is permitted to use a reference vehicle running sequentially in different test cells	This is obsolete for some instrument on the market as they have an integrated quality check option (e.g. pulse-height determination)

Annex 5	Original text	New text	Justification
	more other measurement PNCs, it is permitted to use a reference vehicle running sequentially in different test cells		
5.7.1.3.	Calibration shall be traceable to a national or international standard calibration method by comparing the response of the PNC under calibration with that of:	Calibration shall be undertaken according to ISO 27891:2015 and traceable to a national or international standard by comparing the response of the PNC under calibration with that of:	Requirement that PNC calibration should follow the recently released ISO 27891:2015.
5.7.1.3.	(b) A second PNC that has been directly calibrated by the method described above.	(b) SPN23: A second full flow PNC with counting efficiency above 90 per cent for 23 nm equivalent electrical mobility diameter particles that has been calibrated by the method described above. The second PNC counting efficiency shall be taken into account in the calibration.	Requirement that facilitates the PNC calibration with a reference PNC different to that required in ISO 27891:2015.
5.7.1.3.1.	For the requirements of paragraph 5.7.1.3.(a), calibration shall be undertaken using at least six standard concentrations spaced as uniformly as possible across the PNC's measurement range.	For the requirements of paragraphs 5.7.1.3.(a) and 5.7.1.3.(b), calibration shall be undertaken using at least six standard concentrations across the PNC's measurement range. These standard concentrations shall be as uniformly spaced as possible between the standard concentration of 2,000 particles per cm <sup>3</sup> or below and the maximum of the PNC's range in single particle count mode.	Paragraphs 5.7.1.3.1. and 5.7.1.3.2. combined together and clarified
5.7.1.3.2.	For the requirements of paragraph 5.7.1.3.(b), calibration shall be undertaken using at least six standard concentrations across the PNC's measurement range. At least 3 points shall be at concentrations below 1,000 per cm <sup>3</sup> , the remaining concentrations shall be linearly spaced between 1,000 per cm <sup>3</sup> and the maximum of the PNC's range in single particle count mode.	Deleted	Paragraphs 5.7.1.3.1. and 5.7.1.3.2. combined together and clarified
Old 5.7.1.3.3. becomes new 5.7.1.3.2.	For the requirements of paragraphs 5.7.1.3.(a) and 5.7.1.3.(b), the selected points shall include a nominal zero concentration point produced by attaching HEPA filters of at least	For the requirements of paragraphs 5.7.1.3.(a) and 5.7.1.3.(b), the selected points shall include a nominal zero concentration point produced by attaching HEPA filters of at least Class H13 of EN 1822:2008, or equivalent	Stricter requirement for the linearity (instead of +/-10%, reduced to +/-5%) from the slope. Additionally, linearity is no more compared



Annex 5	Original text	New text	Justification
	<p>Class H13 of EN 1822:2008, or equivalent performance, to the inlet of each instrument. With no calibration factor applied to the PNC under calibration, measured concentrations shall be within <math>\pm 10</math> per cent of the standard concentration for each concentration, with the exception of the zero point, otherwise the PNC under calibration shall be rejected. The gradient from a linear least squares regression of the two data sets shall be calculated and recorded. A calibration factor equal to the reciprocal of the gradient shall be applied to the PNC under calibration. Linearity of response is calculated as the square of the Pearson product moment correlation coefficient (<math>r</math>) of the two data sets and shall be equal to or greater than 0.97. In calculating both the gradient and <math>r^2</math>, the linear regression shall be forced through the origin (zero concentration on both instruments).</p>	<p>performance, to the inlet of each instrument. The gradient from a linear least squares regression of the two data sets shall be calculated and recorded. A calibration factor equal to the reciprocal of the gradient shall be applied to the PNC under calibration. Linearity of response is calculated as the square of the Pearson product moment correlation coefficient (<math>r</math>) of the two data sets and shall be equal to or greater than 0.97. In calculating both the gradient and <math>r^2</math>, the linear regression shall be forced through the origin (zero concentration on both instruments). The calibration factor shall be between 0.9 and 1.1 or otherwise the PNC shall be rejected. Each concentration measured with the PNC under calibration, shall be within <math>\pm 5</math> per cent of the measured reference concentrations multiplied with the gradient, with the exception of the zero point, otherwise the PNC under calibration shall be rejected.</p>	<p>on absolute, measured reference concentrations, but on forecasted reference concentration.</p>
5.7.2.1.	<p>Calibration of the VPR's particle concentration reduction factors across its full range of dilution settings, at the instrument's fixed nominal operating temperatures, shall be required when the unit is new and following any major maintenance. The periodic validation requirement for the VPR's particle concentration reduction factor is limited to a check at a single setting, typical of that used for measurement on particulate filter-equipped vehicles. The responsible authority shall ensure the existence of a calibration or validation certificate for the VPR within a 6-month period prior to the emissions test. If the VPR incorporates</p>	<p>Calibration of the VPR's particle concentration reduction factors across its full range of dilution settings, at the instrument's fixed nominal operating temperatures, shall be required when the unit is new and following any major maintenance. The periodic validation requirement for the VPR's particle concentration reduction factor is limited to a check at a single setting, typical of that used for measurement on particulate filter-equipped vehicles. The responsible authority shall ensure the existence of a calibration or validation certificate for the VPR within a 6-month period prior to the emissions test. If the VPR incorporates temperature monitoring alarms, a 13-month validation interval is permitted.</p>	<p>"Primary calibration" replaced "with latest complete calibration". Primary is ambiguous and unrealistic if interpreted as the first calibration of the instrument.</p>

Annex 5	Original text	New text	Justification
	<p>temperature monitoring alarms, a 13-month validation interval is permitted.</p> <p>It is recommended that the VPR is calibrated and validated as a complete unit.</p> <p>The VPR shall be characterised for particle concentration reduction factor with solid particles of 30, 50 and 100 nm electrical mobility diameter. Particle concentration reduction factors <math>f_r(d)</math> for particles of 30 nm and 50 nm electrical mobility diameters shall be no more than 30 per cent and 20 per cent higher respectively, and no more than 5 per cent lower than that for particles of 100 nm electrical mobility diameter.</p> <p>For the purposes of validation, the arithmetic average of the particle concentration reduction factor shall be within <math>\pm 10</math> per cent of the arithmetic average particle concentration reduction factor <math>\bar{f}_r</math> determined during the primary calibration of the VPR.</p>	<p>It is recommended that the VPR is calibrated and validated as a complete unit.</p> <p>The VPR shall be characterised for particle concentration reduction factor with solid particles of 30, 50 and 100 nm electrical mobility diameter. Particle concentration reduction factors <math>f_r(d)</math> for particles of 30 nm and 50 nm electrical mobility diameters shall be no more than 30 per cent and 20 per cent higher respectively, and no more than 5 per cent lower than that for particles of 100 nm electrical mobility diameter. For the purposes of validation, the arithmetic average of the particle concentration reduction factor calculated for particles of 30 nm, 50 nm and 100 nm electrical mobility diameters shall be within <math>\pm 10</math> per cent of the arithmetic average particle concentration reduction factor <math>\bar{f}_r</math> determined during the latest complete primary calibration of the VPR.</p>	
New 5.7.2.4.	None	The instrument manufacturer must provide the maintenance or replacement interval that ensures that the removal efficiency of the VPR does not drop below the technical requirements. If such information is not provided, the volatile removal efficiency has to be checked yearly for each instrument.	Require the instrument manufacturer to recommend the maintenance interval to ensure proper functioning of the VPR
New 5.7.2.5.	None	The instrument manufacturer shall prove the solid particle penetration $P_r(d_i)$ by testing one unit for each PN-system model. A PN-system model here covers all PN-systems with the same hardware, i.e. same geometry, conduit materials, flows and temperature profiles in the aerosol path. The solid particle penetration $P_r(d_i)$ at a particle size, $d_i$ , shall be calculated using the following equation:	Definition of penetration. It was not defined.

Annex 5	Original text	New text	Justification
		$P_r(d_i) = DF \cdot N_{out}(d_i) / N_{in}(d_i)$ Where $N_{in}(d_i)$ is the upstream particle number concentration for particles of diameter $d_i$ ; $N_{out}(d_i)$ is the downstream particle number concentration for particles of diameter $d_i$ ; $d_i$ is the particle electrical mobility diameter DF is the dilution factor between measurement positions of $N_{in}(d_i)$ and $N_{out}(d_i)$ determined either with trace gases, or flow measurements.	
5.7.3. PN measurement system check procedures	On a monthly basis, the flow into the PNC shall have a measured value within 5 per cent of the PNC nominal flow rate when checked with a calibrated flow meter.	On a monthly basis, the flow into the PNC shall have a measured value within 5 per cent of the PNC nominal flow rate when checked with a calibrated flow meter. Here the term 'nominal flow rate' refers to the flow rate stated in the most recent calibration for the PNC by the instrument manufacturer.	Clarification of what nominal flow rate means.
Annex 6			
2.11.1.2.2.	Each day, a zero check on the PNC, using a filter of appropriate performance at the PNC inlet, shall report a concentration of $\leq 0.2$ particles per $\text{cm}^3$ . Upon removal of the filter, the PNC shall show an increase in measured concentration to at least 100 particles per $\text{cm}^3$ when sampling ambient air and a return to $\leq 0.2$ particles per $\text{cm}^3$ on replacement of the filter.	Each day, a zero check on the PNC, using a filter of appropriate performance at the PNC inlet, shall report a concentration of $\leq 0.2$ particles per $\text{cm}^3$ . Upon removal of the filter, the PNC shall show an increase in measured concentration and a return to $\leq 0.2$ particles per $\text{cm}^3$ on replacement of the filter. The PNC shall not report any error.	The 100 particles/ $\text{cm}^3$ was removed because it was a random number that does not confirm the proper operation of the PNC and sometime too restrictive for low-ambient backgrounds
Annex 7			
4. Determination of PN (if applicable)	$C_b$ is either the dilution air or the dilution tunnel background particle number concentration, as permitted by the responsible authority, in particles per cubic centimetre, corrected for coincidence and to standard conditions (273.15 K (0 °C) and 101.325 kPa);	$C_b$ is either the dilution air or the dilution tunnel background particle number concentration, as permitted by the responsible authority, in particles per cubic centimetre, corrected to standard conditions (273.15 K (0 °C) and 101.325 kPa);	Coincidence correction eliminated
	$C_i$ is a discrete measurement of particle number concentration in the diluted gas exhaust from the PNC; particles per $\text{cm}^3$ and corrected for coincidence;	$C_i$ is a discrete measurement of particle number concentration in the diluted gas exhaust from the PNC; particles per $\text{cm}^3$ ;	Coincidence correction eliminated

## **Appendix 2 – Technical Report on the development of a new procedure at low temperature, during WLTP phase 2 and a new optional annex, WLTP Low Temperature Type 6 test in the global technical regulation (GTR No. 15 Amendment 6) for the Worldwide harmonized Light vehicles Test Procedure (WLTP Low Temp)**

### **Preface**

34. The WLTP 16th session in The Hague Oct 2016 took place right after the conclusion of WLTP phase 1. It was then launched a new task force aiming to develop a new procedure at low temperature, during WLTP phase 2.<sup>[1]</sup> During that meeting, it was also decided that the Low and Realistic winter temperature Task Force (hereinafter LowT TF) should be chaired by the European Commission and open to all experts, stakeholders and CP representatives that have an interest in WLTP.

35. Soon after, it was described in the “Mandate and Terms of Reference” that “The purpose of the low temperature test is to check the level of specific pollutant emissions, CO<sub>2</sub>, and range of vehicles in conditions that may easily be encountered during the winter season”. 2020<sup>[2]</sup>

36. Having asked the Contracting Parties (CPs) about the “the need to improve the current regulation” they expressed a number of needs that have been considered in the process of preparation of the informal document amending the working document for GTR No. 15 Amendment#6 which is presented here. Main concerns mentioned at the time were the effects on air quality, the environment, health, customer information and protection. Some of them are considered critical whereas others should be referred for information. According to the consultation to CPs, the GTR No. 15 should be used, as a basis for the work of this task force. The items which were specifically mentioned for discussion the low / realistic winter temperature, the cycle, the vehicle category to be included and parameters to be measured.

### **Background**

37. Europe introduced in 1998 a type-approval test that allows to measure emissions at low temperatures from vehicles with positive-ignition engines. The Directive 98/69/EC of the European Parliament and of the Council<sup>[3]</sup> was a measure against air pollution by emissions from motor vehicles. This test was carried out on vehicles with petrol engines (M<sub>1</sub> and N<sub>1</sub> Class I) on a chassis dynamometer at -7 ±3 °C only over the Urban Driving Cycle (first part of the New European Driving Cycle, NEDC). The diluted exhaust gases should be analysed for CO and HC. Road-load can be either determined at -7 °C or adjusting the driving resistance for a 10% decrease of the coast-down time at 20°C. Regulation (EC) 715/2007<sup>[4]</sup> and its amendment EC 692/2008<sup>[5]</sup> brought some modifications, including the eligibility of vehicles with positive ignition engines (namely petrol hybrids, bi-fuel and flex-fuel), for the test, which is known as the Type 6 test from that moment. Most of the content found in this

<sup>1</sup> Reference Document WLTP-14-14e; ToR of the task force Low and Realistic Winter temperature; Meeting 9th January 2017 – Geneva. Consolidated version on the 25th of January 2017.

<sup>2</sup> All documents mentioned in this summary can be found at CIRCA BC under: EUROPA > European Commission > CIRCABC > GROW > wltP > P > Low and realistic winter temperature TF, as well as in the UNECE Wiki page: <https://wiki.unece.org/pages/viewpage.action?pageId=85295115>

<sup>3</sup> Directive 98/69/EC of the European Parliament and of the Council of 13 October 1998, “Relating to measures to be taken against air pollution by emissions from motor 59 vehicles and amending Council Directive 70/220/EEC”. Off. J. Eur. Un., L0069, pp1-65.

<sup>4</sup> Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and 61 commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information. Off. J. Eur. Communities L171/1; 2007.

<sup>5</sup> Commission regulation (EC) No 692/2008 of 18 July 2008 implementing and amending regulation (EC) No 715/2007 of the European Parliament and of the Council on type- approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information. Off. J. Eur. Communities L199/1; 2008.

last regulation (EC 692/2008) regarding Type 6 test is identical to what is present in the UNECE Regulation No. 83 07 series, where this test is referred as Type VI.<sup>[6]</sup>

38. Regulation EC 692/2008<sup>[5]</sup> includes the obligation of the manufacturers to present the type-approval authority with information showing that the NOx after-treatment device on diesel vehicles reaches a sufficiently high temperature for efficient operation within 400 seconds after a cold start at -7 °C and strategy of EGR systems used in diesel vehicles at low temperature. Similar procedures to the Type 6 test are applied in the USA (CFR 1066 Subpart H) where the test is also performed at -7 °C ( $\pm 1.7$  °C) and the determination of the road-load is done in the same way determined at -7 °C or adjusting the driving resistance for a 10% decrease of the coast-down time), there are important differences as well. In the USA the entire FTP testing procedure is used, while only the UDC is used in EU. The CFR 1066 procedure foresees the use of the vehicle's heater and defroster during the test, while the Type 6 test specifies that these auxiliaries should not be used.<sup>[7]</sup> Moreover, in the USA otto-cycle and diesel vehicles must be tested at low temperature.

### Introduction

39. After the establishment in the Global Registry as GTR No. 15 in March 2014, ECE/TRANS/WP.29/AC.3/39 on the authorization to further develop the work on Phase 1b was adopted to solve the remaining issues of WLTP Phase 1a. WLTP Phase 1b activities were completed and amendments to UN GTR No. 15 were submitted in October 2015 to be considered at the GRPE January 2016 session.

40. An extension of the mandate for the WLTP IWG, sponsored by the European Union and Japan was granted to tackle the development of the remaining issues. Phase 2 activities started immediately after the endorsement of this authorization by WP.29 and AC.3 at their November 2015 sessions.

41. The scope of work in Phase 2 covered, among other issues, the effect of Low ambient temperature on emissions and range.

42. With this premises and since January 2017, the LowT TF has been working regularly on a new Type 6 test to replace the Type VI test in UN Regulation No. 83. The work has been supported by a group of approximately 25 persons, including representatives from CP and stakeholders, which have been actively and regularly participating in the meetings and web-conferences. Along these years, the TF has hold forty-three encounters, either face-to-face meetings (usually twice per year) or via telco/ web conference. During the last year, the TF hold nineteen encounters, including a face-to-face meeting during the 28th WLTP meeting in Bern in September and the intermediate WLTP in February 2020. The work was also complemented by intense collaboration with SG EV, where from fall 2019 until mid-2020 alone, about twenty-two encounters, including web conference, face-to-face and drafting meetings were hold and specifications for the low temperature test procedure for electrified vehicles, amongst others, were developed.

43. Early discussions in the preparation of the Terms of Reference (ToR) resolved that, as far as conventional vehicles are concerned, the test procedure was meant to assess the impact of low temperature on the efficiency of after-treatment devices or other emission control technologies.

44. In order to properly reflect the conditions that are encountered in real world winter conditions, the road load should be representative of the increased resistance to progress at low temperatures due to the higher air density and other factors (viscosity of transmission lubricant,...). A proper procedure to define the road load and consequently the dyno settings was developed.

<sup>6</sup> <https://www.unece.org/fileadmin/DAM/trans/doc/2018/wp29grpe/GRPE-76-24e.pdf>

<sup>7</sup> US. EPA; <http://www.ecfr.gov/cgi-bin/text-idx?SID=ba447754d6f766672ab21e5aa4146283&mc=true&node=pt40.33.1066&rgn=div5#sp40.37.1066.h>

45. Another element to be addressed was whether the emissions should be predominantly measured during the cold start and immediately after or during the whole WLTC cycle.

46. Moreover, low temperatures largely affect the range of electrified vehicles as a consequence of a reduced efficiency of the battery, and also due to the additional energy consumption from auxiliaries (i.e. heating system). This aspect does not fall within the typical scope of the low temperature tests, especially due to the absence of exhaust emissions in the case of battery electric vehicles. However, this is an important element of the so-called 'range anxiety' which exists among potential EV consumers.

47. The mandate of the Low and realistic winter temperature TF

48. According to the ToR.<sup>[8]</sup> The low and realistic winter temperature Task Force was preordained to:

- Be open to all experts, stakeholders and CP representatives that have an interest in WLTP;
- Be chaired by the European Commission;
- Develop a harmonised low and realistic winter temperature test procedure (Type 6 test) for the assessment of the emissions (including CO<sub>2</sub>), vehicle fuel consumption and electric range, at low and/or realistic winter temperature;
- Propose a harmonised procedure to assess the impact of low temperatures on the range of electric vehicles for proper information of the consumers;
- Act as a platform for the exchange of information and contributions of stakeholders, to be discussed and agreed during the development process;
- Report to the WLTP-IWG on the progress;
- Deliver technical advice and make recommendations to the WLTP IWG on the document strategy, i.e. a new GTR or an annex of the GTR No. 15. Provide a draft text and contribute to the drafting process;
- Focus only on the technical issues regarding the procedure to be developed, while decisions are made at the WLTP IWG level;
- Develop a proposal for the handling of families for low temperature requirements;
- Promote interaction and exchange of information with other IWG Groups, sub-group and task forces, in particular with WLTP Sub-Group-EV and PMP IWG.

49. The Task Force worked intensively to define the temperature for the procedure in order to be representative of low and/or realistic winter temperatures.

- Define the driving cycle to be used for the procedure at low and/or realistic winter temperature and more specifically whether the whole WLTC cycle should be used or a reduced part of it.
- Define the procedure for the adjustment of the road load and consequently of the dyno settings.

50. The work needed specific studies or requests from the experts in the task force, specifically regarding a/ the procedure for assessing the pollutant emissions in conventional and electrified vehicles (LowTemp-Emissions); b/ the procedure for assessing the impact of the low temperature test on the range of electrified vehicles (LowTemp-Range):

#### **LowTemp-Emissions**

51. The scope was to develop a procedure to check specific emissions including CO<sub>2</sub>. The specific objectives were the following:

- Define the procedure to measure the distance specific emissions of the following compounds: total HC, CH<sub>4</sub> and NMHC, CO, NO<sub>x</sub>, CO<sub>2</sub> as well as PM and Particle

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<sup>8</sup> Reference Document WLTP-14-14e -; ToR of the task force Low and Realistic Winter temperature; Meeting 9th January 2017 – Geneva. Consolidated version on the 25th of January 2017

Number, paying attention to the measurement procedures for those compounds not currently regulated at low temperatures.

- Define specific provisions for the low temperature procedure for diesel and hybrid vehicles where necessary.

### LowTemp-Range

52. The scope was set to develop a procedure to determine the impact on the range of electrified vehicles at low temperature. The specific objectives were the following:

- Assess whether the shortened procedure for PEV and OVC-HEV range measurement was appropriate at low temperatures or otherwise agree on a new procedure for range determination;
- Develop a procedure to assess the impact of auxiliary systems (e.g. thermal comfort systems,...) on the energy consumption and the range of electrified vehicles.

53. To reach the scope of the task force which can be adapted to the specific purpose of each deliverable.

- Start with an analysis of the existing normative and literature on the method;
- Prepare a comparative analysis amongst the different regional procedures;
- Propose a way forward for the development of a harmonized procedure, including considerations on whether there is need for experimental activities and to what extent;
- Develop the harmonized method;
- Validate the method.

54. Under proposal of the LowT TF, to the WLTP, it was agreed to produce an optional annex to GTR No. 15.<sup>[9]</sup> Concerning the title of the GTR optional annex, it was agreed to name it "WLTP Low Temp";<sup>[10]</sup> The members of the Low T TF also agreed that the name of the test should be "Type 6"<sup>[11]</sup>

55. The scope of the text and the application should be the same as the GTR No. 15; it should be applicable to all vehicle although it was agreed to exempt FCHV for the first version of the optional annex.<sup>[12]</sup>

56. Key changes to the UN Regulation No. 83 Type VI test include:

- Drafting an **optional annex** to GTR No. 15 for low and realistic winter temperature
- Applicable to **all type of vehicles and fuels** (exempt FCHV for the first version of the optional annex)
- Purpose is to check compliance of pollutant emissions (THC, CH<sub>4</sub>, NMHC, CO, NO<sub>x</sub>, PM, PN) and provide information for CO<sub>2</sub>, FC, EC and range.

57. Considerations on family concept and the possibility of including simulation methods were the centre of intense and prolific discussions and were to be included in the optional annex. Nevertheless, a simulation method is currently not included.

58. During the definition of the scope of the Type 6 test, Contracting Parties indicated that the focus of this test was on criteria emissions for vehicles using internal combustion engines and energy consumption and range from electrified vehicles. Hence, for vehicles equipped with internal combustion engines the family was defined using the same criteria implemented in the PEMS family of the European and Global RDE. A series of adjustments were included to assure that the vehicle selected for the Type 6 test was previously tested over the Type 1

<sup>9</sup> See comments in sheet 2019-05-16 and 2019-09-09:

<https://wiki.unece.org/pages/viewpage.action?pageId=85295115>

<sup>10</sup> <https://wiki.unece.org/pages/viewpage.action?pageId=85295115> (See comment in 2019-09-09)

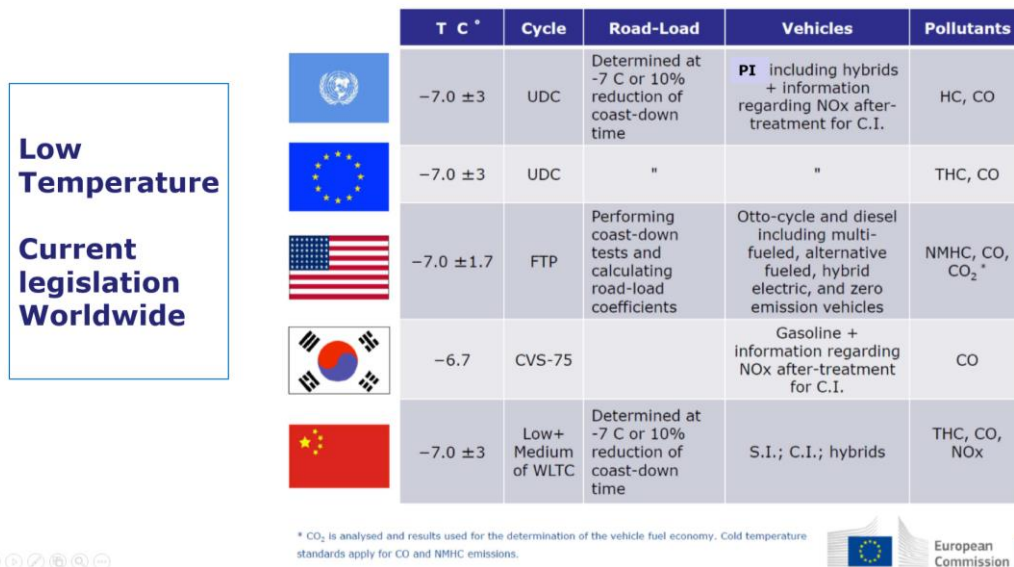
<sup>11</sup> <https://wiki.unece.org/pages/viewpage.action?pageId=85295115> (See comments in 2019-04-17)

<sup>12</sup> <https://wiki.unece.org/pages/viewpage.action?pageId=85295115> (See comments in 2019-09-09)

procedure. For pure electric vehicles new provisions that cover the main elements related to the impact of the temperature on energy consumption and range were defined.

**Analysis of the existing normative**

59. To reach the scope of the task force, there was an initial analysis of the existing normative and literature on the method and it was prepared a comparative analysis among the different regional procedures (See figure below).



60. The work in the LowT TF needed also some specific studies from the experts in the group, specifically regarding the procedure for assessing the pollutant emissions in conventional and electrified vehicles as well as the procedure for assessing the impact of the low temperature test on the range of electrified vehicles. Experts in the LowT TF have also worked in the assessment of the impact of auxiliary systems (e.g. thermal comfort systems) on the energy consumption and the range of electrified vehicles. Besides, the TF has been working in the development of a proposal for the handling of families for low temperature requirements. Therefore, the TF has been acting as a platform for the exchange of information and contributions of stakeholders to be discussed and agreed during the development process.

61. Moreover, from the Chair of the TF, there has been an intense work of promotion of interaction and exchange of information with other IWG Groups, sub-groups and task forces, in particular with WLTP Sub-Group EV. The Chair has also been reporting regularly to the WLTP-IWG on the progress and decisions. On this respect, the TF has focused only on the technical issues regarding the procedure to be developed and delivered technical advice and made recommendations to the WLTP IWG on the document strategy (an optional annex of the UN GTR No. 15) while decisions were made at the WLTP-IWG level. Finally, the Task Force was deeply committed to provide a draft text and contributed to the drafting process.

**The Outcome: an “optional annex” for a new Type 6 test.**

62. The outcome of the work of the LowT TF is a document, which provides test procedures to test conventional and electrified vehicles at cold ambient temperatures to be added as a new optional Low Temperature (Type 6) test to GTR No. 15.<sup>13</sup>

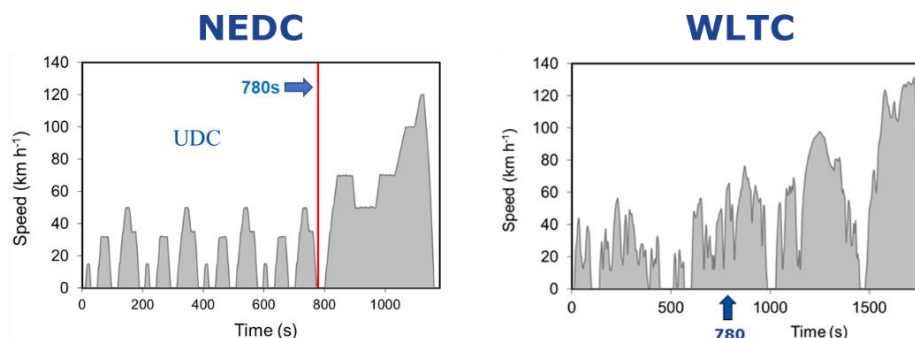
63. During the work and drafting of that document, the LowT TF has confirmed the set point temperature for the procedure (-7oC) and the requirements that the new procedure of the Type 6 test would have in a new optional annex. The procedure follows UN GTR No. 15 and the Type 1 test, therefore, the new test is performed following the WLTC, replacing the NEDC (shorter and less realistic).

<sup>13</sup> The document is based on the text of UN GTR No-15 Amendment 5 as submitted for vote at the June 2019 session of WP.29.



Figure 1

**Left panel: old test cycle for type approval in (NEDC) – Right panel: new test cycle (WLTC) for type approval**



64. The optional annex was presented as “a working document” for its consideration, and previously to the delivery of the Working Document, due on 20 March 2020 (200110 - Low Temp Annex based on ECE/TRANS/WP.29/2019/62)<sup>14</sup>.

65. The approach has been to leave the Type 1 test paragraphs of Annexes 1- 8 unaltered and to indicate in the optional annex where the Type 6 test would alter those requirements. However, there were some Type 6 related elements, which were expected to be incorporated into the current UN GTR No.15 sections. These included a definition of a Low Temperature Family in Section 5 of the GTR and specifications for Type 6 reference fuels in Annex 3.

66. The WLTP Low Temperature Type 6 test optional Annex 13 describes the procedure for undertaking the Type 6 test defined in paragraph 6.2.4. of the UN GTR No. 15 Amendment 6. At the option of the Contracting Party this annex may be omitted. Fuel cell hybrid vehicles are currently exempted from the Type 6 test.

67. Type 6 test requirements state that the Type 6 should be undertaken according to the definitions, requirements and tests set out in paragraphs 3. to 7. of the UN GTR No. 15. Application and amendments to the requirements of Annexes 1 to 8 inclusive of the UN GTR No. 15 are now specified in paragraphs 2.1. to 2.7. of the optional Annex 13.

68. Other premises in UN GTR No. 15 were identified to apply to the optional annex too, namely:

69. Worldwide light-duty test cycles (WLTC): The requirements of Annex 1 also apply for the purposes of the optional annex.

70. Gear selection and shift point determination for vehicles equipped with manual transmissions: The shifting procedures described in Annex 2 also apply with the following specific provision for Type 6 testing: It is allowed to set  $n_{min\_drive}$  and ASM values which are different than those used for Type 1 testing.

71. Reference Fuels: The reference fuels to be used for the Type 6 test are those specified in Part II of Annex 3, or Part I if a reference fuel is not provided in Part II (e.g., reference diesel). At the option of the manufacturer and approval of the responsible authority a reference fuel as specified in Part I of Annex 3 may be used.

72. Road load and dynamometer setting: For the vehicle to be tested, the chassis dynamometer load setting determined according to paragraph 8.1.4. or paragraph 8.2.3.3. of Annex 4 is to be applied.

73. The original idea was to take a similar approach as in UN Regulation No. 83, to either determine the road load at a temperature of  $-7\text{ }^{\circ}\text{C}$  or increase the road load by 10%. In both cases, the road load would be applied as a target chassis dynamometer setting for the Type 6

<sup>14</sup> On 6 January 2020, Standard UN GTR No. 15 text was deleted to just leave the Type 6 test relevant sections. Document loaded in: <https://wiki.unece.org/display/trans/Optional+annex+Low+T+-+Drafting>

test. During the discussions it was recognized that the method already included in the European Euro 6 legislation for the determination of the ATCT correction might also prove useful for the Type 6 test, refer to Regulation (EC) 2017/1151 and 2018/1832. In this approach the same chassis dynamometer setting is applied as for the Type 1 test, except for a correction to the f2 road-load coefficient which is corrected upwards to compensate for the increased air density at the lower temperature. In the case of the low temperature test, that compensation on f2 is 10%. Even though the same f0 road-load coefficient is used for the chassis dynamometer setting, the vehicle will experience a higher rolling resistance because of the lower tyre temperature during the test. The advantage of this method is that the chassis dynamometer setting procedure in the low temperature test cell can be eliminated. However, this is only allowed if the manufacturer has demonstrated equivalency between the chassis dynamometers of the Type 1 and the Type 6 test, and if the parasitic losses have been taken into account.

#### Main topics of the optional annex

N°	Discussion point	Conclusion
1	Test temperature	-7°C
2	Number of phases of the WLTC	EU 4 phases, Japan 3 phases.
3	Reference fuels	Specific provisions for gasoline, LPG and ethanol were added. In order to satisfy the specific requirements of bifuels testing and the switch from petrol to gas and the maximum allowed energy consumed by operation on petrol, it was indicated by OICA, and supported by Japan and EC to include these two elements using data provided after validation of the type 6 procedure, and including this point in the technical report.
4	Family definition	Based on PEMS family and Type 1 test. Focussed on pollutant emissions and electric range.
5	Use of auxiliary devices	<p>Currently introduce the use of thermal comfort systems, Passing-beam (dipped-beam) headlamps and electrical system(s) to defrost. Other systems such as radiant panels and heating seats will be addressed at a second stage.</p> <p>The work was divided in three steps:</p> <ol style="list-style-type: none"> <li>1. Assessment of auxiliaries to be included (Heating system for cabin, De-frosting/icing/fogging system, Thermal storage system, Battery Thermal Management system, Additional burners, Lighting, Infotainment equipment)</li> <li>2. Identify conditions to apply to a selected auxiliary in Assessment Matrix (preconditioning, soak, test)</li> <li>3. Procedure description for selected auxiliaries</li> </ol> <p>Initial orientations from Low Temp TF about the Test Procedure to include auxiliaries previewed:</p> <ol style="list-style-type: none"> <li>A. Auxiliary devices Test Procedure had to be as simple as possible to avoid test burden;</li> <li>B. Auxiliary devices should use the same procedure for different powertrains when/if possible;</li> <li>C. USA's procedure for auxiliary devices could be used as bases.</li> </ol>
6	Equipment	Make sure to avoid water condensation.
7	Soak	<ol style="list-style-type: none"> <li>1. A soak period prior to preconditioning was included. It was agreed to indicate that the soak before preconditioning may be omitted if the manufacturer can justify to the approval of the responsible authority that this soak will have negligible effects on the criteria emissions.</li> <li>2. A 12-36h soak period prior to test was agreed.</li> </ol>
	Soak before pre-conditioning	At the request of the manufacturer, and with the approval of the responsible authority, the soak before preconditioning may be omitted if the manufacturer can justify that this soak will have

		negligible effects on the criteria emissions. As an example, the effects on the criteria emissions may be non-negligible in the case that the vehicle has an aftertreatment system that uses a reagent. Japan supports new EC proposal as long as this option shall not be applied for PEV and CD test of OVC-HEV.
8	Road-load	Follow the approach of the Ambient Temperature Correction Test as used in the Euro 6 legislation.
9	Preconditioning	At -7°C.
10	Procedure for OVC-HEV	CD and CS testing was requested for OVC-HEV.
11	Calculation	Do not apply humidity correction.
12	Criteria for number of tests	Based on criteria emissions for vehicles with ICE, and on declared electric energy consumption and PER for PEVs.
13	HV battery charge	Starting within 1 hour after preconditioning.
14	Possible test sequence options for OVC-HEV testing	1. CD / 2. CS / 3. CD + CS / 4. CS + CD / 5. CS + CS / 6. CD + CD
15	Cycle for PEV	The PEV Type 6 test procedure consists of one dynamic segment (DS), followed by one constant speed segment (CSS), whereas the DS consists of (3) applicable WLTP test cycles (WLTC) in accordance with paragraph 1.4.2.1. of Annex 8 (Type 1).

74. During the development of a test procedure for PEV, applying the approach from Type 1 adapted for Type 6 conditions consecutive cycle test procedure/shorten test procedure (CCP/STP) was considered the best solution given the time constraints at this stage. The idea of a shortened or alternative STP was considered to be too premature for the implementation into a first working document. Furthermore, a shortened/alternative STP was recognized to have promising aspects to be discussed at a later stage, ideally for both, Type 1 and Type 6, in order to have the same procedure to be performed at both conditions.

75. Later in the development process and after scrutiny of test data by several stakeholders raising possible concerns with the original approach (see e.g. document WLTP-ITM-03e), guidance from WLTP IWG in the meeting on 20 February 2020 for SG EV was to focus on the development of an “alternative/shortened STP” (i.e. a specific PEV Type 6 test procedure).

76. Therefore, the PEV Type 6 test procedure was developed accordingly and now consists of one dynamic segment (DS), followed by one constant speed segment (CSS), whereas the DS consists of (3) applicable WLTP test cycles (WLTC) in accordance with paragraph 1.4.2.1. of Annex 8 (Type 1) of UN GTR No. 15.

#### **Traceability of the informal document and decision-making process**

77. The informal document for an optional annex on low temperature has been built-up following a dedicated file containing all open-closed issues discussed in the TF. The evolution and construction of the informal document for the new technical annex of the Type 6 test can be followed by considering the excel file where all changes have been registered and appear with the date of the modification/agreement.

**WLTP\_Low\_Temp\_TF\_Status\_list\_v2020-xx-xx.xlsx**<sup>[15] [16]</sup>

<sup>15</sup> This serial number was continued and updated by the chair of the TF. In order to track the evolution of the discussions and decisions inside the LowT TF, all excel files detailing the **Low T TF status list** were saved and made available in CIRCAC-BC and in UNECE Wiki page dedicated the LowT TF (<https://wiki.unece.org/pages/viewpage.action?pageId=85295115>)

<sup>16</sup> This document was periodically updated by the drafting coordinator or by any of the Chairs for the LowT TF or the SG EV and always following the discussions in the lowT TF, the SG EV and

<https://wiki.unece.org/display/trans/Optional+annex+Low+T+-+Drafting>

78. All main changes done in the text during the drafting of the informal document were indicated with margin notes and the latest are dated on the week previous to the delivery of the informal document to the secretariat of the GRPE in January 2020. Comments were provided at the relevant points of Annexes 1-8 which have been identified as being areas of UN GTR No. 15 which may need to be amended via the Optional Annex.

79. The informal document of the Low Temp optional annex was presented as a Working Document by the WLTP IWG to the Secretariat of the GRPE on 20 March 2020. From that moment, the work in the Task Force continued to solve the remaining issues in open square brackets and the document updated regularly was named:

**200xyy\_Status Square bracket topics\_Amd\_6 WD**

80. The new files following the discussions could be found in the same wiki page, <https://wiki.unece.org/display/trans/Optional+annex+Low+T+-+Drafting>

Final sessions (teleconference) for the drafting of the optional annex took place on 2-3 June and the new and latest version of the “200528\_Status Square bracket topics\_Amd\_6 WD\_20200604\_V4” was loaded in the folder: LowT TF final drafting sessions (teleconference).

81. The very final version of the WLTP Low Temperature Type 6 test (optional annex) was uploaded to the UN Wiki for latest version of the GTR No. 15 Amendment 6 text, along with the documents Sub-Annex 1 (Pure electric and hybrid electric vehicles) to Annex 13, the Appendix 1 (REESS state of charge profile) and the Appendix 2 (Vehicle preparation, preconditioning and soaking procedure for Type 6 testing of OVC-HEVs, NOVC-HEVs and PEVs): <https://wiki.unece.org/display/trans/GTR15+Amnd+6+Drafting>

**Further improvements in Annex 13 of the UN GTR No. 15**

82. In the development process of the WLTP Low Temperature Type 6 test (optional annex 13), several critical decisions had to be taken in order to deliver the final text of the test procedure to be integrated into UN GTR No. 15 Amendment 6 on time. It also appeared to the experts involved, that there is room for improvement of the current text. Therefore, a possible update of the WLTP Low Temperature Type 6 test procedure for pure ICE and electrified vehicles based on a validation exercise could further improve Annex 13, as well as Annex 13 Sub-Annex 1 of UN GTR No. 15 Amendment 6.

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corresponding drafting sub-groups. In order to track the evolution of the discussions and decisions, the files detailing the **progress in the drafting of the optional annex for lowT** were saved in a dedicated folder in UNECE Wiki page Low TF domain, created *ad-hoc* for this drafting process: <https://wiki.unece.org/display/trans/Optional+annex+Low+T+-+Drafting>

## Appendix 3 – Conformity of Production for Type 1 test and OBD

### Context

83. This technical report on the CoP provides a brief overview of the test procedure and the evaluation methods for OBD and Type 1 testing for CoP. The complete CoP procedure with all the details can be found in Annex 14. For this Technical Report the main focus is laid on the parts of the procedure that were added as new elements to the CoP procedures already in place in existing UN Regulations and regional legislation.

84. The CoP Taskforce took as a basis the existing CoP procedures in UN R83, UN R101, the European CoP procedure specified in Regulation (EU) 2017/1151 and the procedure which was under development at the time in Japan by the MLIT and JAMA. Where considered appropriate and necessary, these procedures were amended and improved in trying to achieve a harmonised approach for UN GTR 15.

85. During the process of developing the CoP test procedure by the CoP Taskforce, it proved difficult to satisfy the needs of the different Contracting Parties (CPs). It was impossible to reach consensus on a fully harmonised approach. With that conclusion in mind, the focus of the taskforce shifted towards establishing at least a harmonised test procedure for CoP, and allow the evaluation of the CoP test as a CP option. This approach enables to perform one and the same CoP test, but an evaluation according to the different needs of the CPs, thereby reducing the testing burden for manufacturers producing vehicles for different regions.

### CoP test for OBD

86. The CoP test procedure on OBD is largely based on the text in UN R83. A CoP test is triggered when the responsible authority finds that the quality of production is unsatisfactory. The CoP test itself is a repetition of the OBD test procedure as described in Appendix 1 to Annex 11, without any further amendments. If the tested vehicle does not fulfil the requirements, another vehicle is added to the sample, up to a maximum of 4 vehicles. At least 3 vehicles shall meet the requirements described in Appendix 1 to Annex 11. The OBD family for CoP is the same as the CoP family for Type 1 CoP tests.

### CoP test for Type 1 test

#### *Applicability*

87. The applicable Type-1 CoP requirements for the different types of vehicles are listed in Table A14/1. It was decided that NOVC-FCHV and OVC-FCHV are currently exempted from CoP testing.

#### *CoP family*

88. A CoP family is essentially the same as the interpolation family. Since the CoP is connected to the vehicle production, it was chosen to split the CoP family for different production facilities. As a consequence, one interpolation family can be present in different CoP families. Under the conditions specified in paragraph 1.3. and 1.3.1.2 of Annex 14, CoP families can be merged. The manufacturer also has the option to create smaller CoP families.

#### *Test frequency*

89. The test frequency is set at a minimum of one verification for each CoP family per 12 months. The manufacturer shall specify the planned production for each CoP family, and inform the responsible authority in case there are significant changes. For a planned production exceeding 7,500 vehicles per 12 months, at least one verification per 5,000 vehicles needs to take place (rounded to the nearest integer). As a CP option, the frequency is increased to one verification per 3 months for productions exceeding 17,500 vehicles per 12 months, respectively one verification per month for productions exceeding 5,000 vehicles per month.

*Type-1 CoP verification*

90. For a CoP verification, the Type 1 test is carried out on a minimum of three randomly selected vehicles from the production, selected across the interpolation families in the CoP family and/or different production facilities, if applicable. The verification process is shown in the Flowchart of Figure A14/1. The outcome is a 'pass' or a 'fail' decision. However, if a decision was not reached another test vehicle is added to the sample up to a maximum of 16 vehicles or, as an alternative CP option, a maximum of 32 vehicles for criteria emissions and 11 for fuel efficiency and electric energy consumption.

91. The fuel used during the CoP test is at the option of the CP, either a reference fuel in accordance with Annex 3, or a commercial fuel, with an alternative manufacturer option to use a reference fuel in accordance with Annex 3.

*Type-1 CoP verification for OVC-HEVs in Charge Depleting mode and PEVs*

92. For the evaluation of the CoP for PEVs and for OVC-HEVs in charge-depleting mode an alternative CoP evaluation procedure was developed. The electric energy consumption (EC) is only measured during the first applicable WLTP test cycle. This EC value is then evaluated against the charge-depleting EC of the first cycle at type-approval, corrected by an adjustment factor to observe the difference between the declared and measured EC. In this way, the significant test burden for the manufacturer for CoP testing can be reduced considerably, while it is still an effective method to check the CoP on EC. The determination of the EC values for CoP evaluation is described in Appendix 8 to Annex 8.

*Run-in factors*

93. Vehicles which are tested for CoP are relatively new, while a type approval vehicle has already been run in. This may potentially have an effect on the CO<sub>2</sub> emissions/fuel efficiency and criteria emissions. To take the difference of emission performance into account, run-in factors may be derived for the CoP verification. Depending on the CP they are applied for:

- (a) Criteria emissions, CO<sub>2</sub> emissions and/or electric energy consumption;
- (b) Fuel efficiency (FE) and/or electric energy consumption.

94. During the development of the run-in test procedure, the existing procedures were considered inadequate, particularly on the fact that they assume a linear evolution of the CO<sub>2</sub> emissions and fuel efficiency, and the actual odometer setting of the tested vehicles is not taken into consideration.

95. The newly developed run-in procedure fits the measured CO<sub>2</sub> emissions respectively FE and the corresponding odometer settings of the tested run-in vehicles to a natural logarithmic curve by a least square regression analysis and, as a CP option, corrects this downwards by the standard deviation of the difference between the measured and fitted CO<sub>2</sub> emissions. The run-in factor to be applied to the tested CoP vehicle will then be determined as a function of its actual odometer setting.

96. At the option of the CP the run-in factors may also be applied for criteria pollutants. In this case, the results are plotted on a linear regression line as a function of the actual odometer setting.

97. Another new element is that the mileage accumulation on the run-in vehicles may not exceed that of the type-approval vehicle to avoid any overcorrection.

98. As an alternative to the measured run-in factors, a default run-in factor may be applied of 0.98 for the CO<sub>2</sub> emissions respectively 1.02 for the fuel efficiency, depending on the CP option. There are no default run-in factors for criteria emissions and electric energy consumption.

*Statistical evaluation method*

99. Two separate evaluation procedures have been developed in parallel, both are included as a CP option. One is for the CoP evaluation of CO<sub>2</sub> emissions, electric energy consumption and criteria emissions, and the other for the CoP evaluation of fuel efficiency electric energy consumption and criteria emissions.

100. Evaluation of criteria emissions depends on the CP option, but in general the procedure is largely the same as in UN Regulation No. 83, respectively the CoP evaluation procedure in (EU) 2017/1151. In both cases an evaluation criterion is derived on the measured values of the sample, the limit value of the criteria emission component, the sample size and the variance in the measured results. The outcome of the evaluation can result in a 'pass', 'fail' or 'test another vehicle'.

101. For the evaluation of CO<sub>2</sub> respectively Fuel Efficiency, the Contracting Parties have developed their own individual evaluation procedures. The details can be found in Appendix 2 to Annex 14.

## Annex VI

[English only]

### Adopted amendments to ECE/TRANS/WP.29/GRPE/2020/11

Adopted on the basis of GRPE-81-37 (see para. 0.)

### A new Supplement to UN Regulation No. 115

## I. Proposal

*Add new paragraph 2.5.1.6.:*

**“2.5.1.6. The family relation shall be considered valid for Hybrid Electric Vehicles (HEVs), as defined in paragraph 2.21.2. of UN Regulation No. 83, with the following conditions:**

- (a) **If at least one Off-vehicle charging (OVC) vehicles is tested as parent vehicle according to this Regulation, the family relation can be considered valid for all OVC-HEV vehicles complying with paragraph 2.5.1.1. to paragraph 2.5.1.5. above.**
- (b) **If at least one Not-off-vehicle charging (NOVC) vehicles is tested as parent vehicle according to this Regulation, the family relation can be considered valid for all NOVC-HEV vehicles complying with paragraph 2.5.1.1. to paragraph 2.5.1.5. above.”**

*Add new paragraph 6.1.2.4.1.6.4.:*

**“6.1.2.4.1.6.4. Special provisions for Hybrid Electric Vehicles (HEVs)**

**In case of Hybrid Electric Vehicles, as defined in paragraph 2.21.2. of UN Regulation No. 83, the procedure described in UN Regulation No. 83 Annex 14 shall be applied during type I test.”**

*Paragraph 6.1.2.4.3.1., amend to read:*

**“6.1.2.4.3.1. The emissions of CO<sub>2</sub> are calculated according to UN Regulation No. 101 or to UN GTR No. 15 as applicable, for each parent vehicle, if applicable.**

**In case of HEVs, special provisions of Annex 8 to UN Regulation No. 101 or calculation of Annex 8 to UN GTR No. 15, as applicable, shall be applied.**

The mean of CO<sub>2</sub> emissions shall be calculated as follows:

....”

*Add new paragraph 6.2.2.4.1.6.4.:*

**“6.2.2.4.1.6.4. Special provisions for Hybrid Electric Vehicles (HEVs)**

**In case of Hybrid Electric Vehicles, as defined in paragraph 2.21.2. of UN Regulation No. 83, the procedure described in UN Regulation No. 83 Annex 14 or in Annex 8 to UN GTR No. 15, as applicable, shall be applied during type I test.”**



*Paragraph 6.2.2.4.3.1.*, amend to read:

“6.2.2.4.3.1. The emissions of CO<sub>2</sub> are calculated according to UN Regulation No. 101 or to UN GTR No. 15 as applicable, for each parent vehicle, if applicable.

**In case of HEVs, special provisions of Annex 8 to UN Regulation No. 101 or calculation of Annex 8 to UN GTR No. 15, as applicable, shall be applied.**

The mean of CO<sub>2</sub> emissions shall be calculated as follows:

....”

## II. Justification

1. Provisions for Hybrid Electric Vehicles (HEVs) are implicitly included in UN Regulation No. 115. Indeed, type I test refers to UN Regulation No. 83 which in turns defines special provisions for HEVs. This amendment clarifies that, for HEVs, the correct procedure for type I test shall take into account Annex 14 to UN Regulation No. 83.

2. In addition, regarding CO<sub>2</sub> measurement, Regulation No. 115 already refers to UN Regulation No. 101 or to UN GTR No. 15, as applicable. This amendment clarifies that for HEVs, the correct procedure shall take into account Annex 8 to UN Regulation No. 101 or Annex XX to UN GTR No. 15, as applicable.

3. Working document ECE/TRANS/WP.29/GRPE/2020/11 clarifies provisions applicable to LPG retrofit kits and hybrid vehicles (OVC and NOVC). The same provisions can be applied to CNG retrofit systems too.

4. In addition, new paragraph 6.1.2.4.1.6.3. introduced by ECE/TRANS/WP.29/GRPE/2020/11 is renumbered as 6.1.2.4.1.6.4.

## Annex VII

[English only]

### **Technical report on the development of a new UN GTR on the Determination of Electrified Vehicle Power (DEVP)**

Adopted on the basis of GRPE-81-27 (see para .0)

#### **A. Introduction**

1. Passenger vehicles are commonly assigned a vehicle power rating, which is useful for comparing the performance of different vehicles. Vehicle power rating has also been used for other purposes such as vehicle classification, customer information, insurance, and taxation.
2. Historically, almost every passenger vehicle produced for the consumer market has been powered exclusively by an internal combustion engine (ICE). The vehicle power rating assigned to these conventional vehicles has customarily been the same as the rated power of the engine, as determined by an engine bench test. This is a convenient way to assign a power rating to a vehicle, because the engine power rating may then be applied to any vehicle that uses the same engine.
3. As a measure of real-world vehicle performance, this traditional measure is imperfect, since it does not account for the power lost in the drivetrain between the engine and the road. However, it has become well established and is generally accepted as a useful metric, in part because conventional vehicles have only one engine, and its full rated power is typically available for propulsion.
4. Today, electrified vehicles such as hybrid electric vehicles (HEVs) and pure electric vehicles (PEVs) with multiple drive motors represent an increasing share of the market. A vehicle power rating is not as easy to assign to these vehicles because they combine more than one propulsion source, such as an engine and an electric machine, or multiple electric machines.
5. For these vehicles, the available power depends on how the control system combines the power of each propulsion source when the driver demands maximum power. While it may seem that this would simply be the sum of the rated power of each component, this is not necessarily valid in practice. It will result in an overestimate if, for example, the electric machine is limited by the available battery power, or if the control system limits or reassigns some of the nominal capacity, such as to maintain traction or charge the battery.
6. Owing to the pressing need to reduce emissions of greenhouse gases (GHG) and other air pollutants, the market share of electrified vehicles is expected to grow in the future. This intensifies the need for a standard method for assigning a vehicle power rating to electrified vehicles.
7. Electrified vehicles and conventional vehicles are likely to coexist in the market for some time. Many existing regulations and procedures, such as WLTP, apply to both conventional and electrified vehicles, and require a power rating as an input. In order to be used equitably for such purposes, a power rating for electrified vehicles should be qualitatively and quantitatively comparable with the traditional engine-based power ratings of conventional vehicles.

#### **B. Procedural background**

8. The IWG on EVE was set up in June 2012 following the approval by WP.29 of ECE/TRANS/WP.29/AC.3/32. This document established two distinct IWGs to examine environmental and safety issues related to EVs: the IWG on EVE, reporting to the Working Party on Pollution and Energy (GRPE), and the IWG on Electric Vehicle Safety (EVS),

reporting to the Working Party on Passive Safety (GRSP)). The proposal was supported by the European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), the National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) of the United States of America, the Ministry of Industry and Information Technology (MIIT) of China, and Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

9. A second mandate for the IWG on EVE, divided into Parts A and B was approved in November 2014 by AC.3 to conduct additional research to address several recommendations that grew out of the first mandate, and develop GTR(s), if appropriate. The second mandate was separate from the IWG on EVS.

10. The IWG on WLTP had stated a clear demand for an improved procedure for determining a power rating for electrified vehicles. The WLTP test procedure requires a vehicle power rating for the purpose of classifying vehicles into distinct Power-to-Mass ratio classes, and for application of the so-called "downscaling method" that enables the test reference cycles to be adapted for low-powered vehicles.

11. For purposes of rating the motive power of light vehicles, the UNECE currently provides a regulation under the 1958 Agreement, known as UN Regulation No. 85, that can be used for approval of ICEs and electric machines for M and N category vehicles. In many cases it is sufficient to fulfil the needs of WLTP.

12. However, UN Regulation No. 85 merely determines the bench power rating for either an ICE or a single electric machine. The regulation does not establish a method to determine the total vehicle power of a hybrid vehicle, nor for a pure electric vehicle propelled by more than one electric machine. This would call for a vehicle-level test that is able to determine the maximum power output of the system as a whole.

13. Accordingly, Part B of the second EVE mandate included a subtask to develop an amendment to Global Technical Regulation No. 15 to establish a procedure for determining the powertrain performance of electrified vehicles for use with the WLTP test procedure.

14. The EVE IWG therefore established the subgroup "Determination of electrified vehicle power" (DEVP). The goal was to clarify how an improved technical procedure for the determination of the system power of hybrid powertrains could be realized in an efficient and simple way.

15. The scope of the work covered light duty vehicles (passenger cars -M<sub>1</sub> and light duty vehicles -N<sub>1</sub>) and aimed to develop a recommendation or regulation for determination of hybrid vehicle system power. It was agreed that the procedure should cover all types of HEV (ordinary HEVs and plug-in HEVs) as well as PEVs with more than one electric machine for propulsion (for example, all-wheel drive configurations driven by an electric machine on each axle, or by wheel hub motors).

16. The EVE IWG recognized that several organizations, including the Society of Automotive Engineers (SAE), the International Organization for Standardization (ISO), and the Korea Automobile Testing & Research Institute (KATRI), were also studying the issue of hybrid system power determination. The EVE IWG was therefore able to consider several possible paths forward for which considerable research had already occurred. The IWG received presentations from experts with these organizations and discussed the merits and drawbacks of the methods proposed by each.

17. At the 22nd meeting of the IWG on EVE, the Contracting Parties reached consensus that the ISO approach presented the best option as a basis to fulfil the needs of the mandate. A drafting group was then formed to draft the amendment to UN GTR No. 15.

18. The drafting group initially focused on converting the draft ISO standard, which was nearing finalization, into an Annex to UN GTR No. 15. The group made substantial progress on converting the document into the proper format and harmonizing its technical details with UN GTR No. 15 where necessary. The IWG also initiated and completed a first phase of validation testing to further evaluate the harmonized procedure as it was developed.

19. During this effort, a clear demand emerged on the part of several Contracting Parties that the procedure should be developed as a standalone GTR, in part so that it could be more

easily utilized for purposes outside of the specific context of WLTP. In 2019, the mandate was therefore modified to specify development of a standalone GTR rather than an Annex to UN GTR No. 15.

20. Recognizing the need for a reasonable test burden, as well as the increasing diversity of electrified powertrain architectures, the EVE IWG originally considered the possibility of developing both a “reference” method and a “candidate” method. The reference method would determine system power by means of a vehicle-level test procedure, while the candidate method would derive system power from the results of component-level tests. Initial priority was placed on the reference method over the candidate method.

21. At this time, the test procedure described herein provides for a reference method but not a candidate method. Development of a candidate method remains a possibility for future attention of the EVE IWG.

### **C. Principle for developing the global technical regulation**

22. Discussions among the members of the EVE IWG identified a number of requirements for a hybrid system power rating:

- (a) The system power rating should be comparable to the traditional engine-based power rating of conventional vehicles;
- (b) Third-party verification of the power ratings developed by the method, and of any manufacturer-provided inputs to the procedure, should be readily possible;
- (c) The test burden imposed by the procedure should be reasonable, so that the cost and the amount of work necessary to certify the power of an electrified vehicle should not be prohibitive;
- (d) The procedure should be consistent and repeatable with little variation, to minimize the need for repeated tests and prevent opportunities for selective reporting (or “cherry picking”);
- (e) The procedure should be sufficiently robust to evaluate all architectures fairly, including those that currently exist in the market, and those that may reasonably be anticipated to emerge in the future.

23. Additional discussion as to how the EVE IWG considered these requirements in development of the UN GTR, and discussion of all of the technical approaches considered, can be found in the Technical Background section of this UN GTR.

## Annex VIII

[English only]

**Decisions adopted under silence procedure**

Remote informal meeting of the Working Party for Pollution and Energy (GRPE), 9-11 June 2020

The list of decisions had been circulated to Contracting Parties for a 10 days silence procedure on 12 June 2020. As silence had not been broken, the decisions were considered adopted on 22 June 2020.

Documentation referenced in the below draft decisions is available under:  
<http://www.unece.org/index.php?id=53539>

Decision No.	Agenda Item	Decision
1	3(a)	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/10 as amended by GRPE-81-21 on amendments to UN Regulation No. 83 and agreed to submit it for consideration and vote at the November 2020 session of WP.29/AC.1
2	3(b)	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/14 as amended by GRPE-81-10 and GRPE-81-14 on Amendment 6 to UN GTR No. 15 and agreed to submit it for consideration and vote at the November 2020 session of WP.29/AC.3
3	3(b)	GRPE adopted GRPE-81-15 on a technical report to Amendment 6 to UN GTR No. 15 and agreed to submit it for consideration and vote at the November 2020 session of WP.29/AC.3
4	3(c)	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/15 as amended by GRPE-81-16 and supplemented by GRPE-81-26 on a new UN Regulation on Global Real Driving Emissions (RDE) and agreed to submit it for consideration and vote at the November 2020 session of WP.29/AC.1
5	7	GRPE adopted GRPE-81-13 on amendments to the terms of reference and rules of procedure for Informal Working Group (IWG) on Particulate Measurement Protocol (PMP) and agreed to submit it for endorsement at the November 2020 session of WP.29
6	8(b)	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/17 as amended by GRPE-81-24-Rev.2 on Amendment 1 to UN GTR No. 18 and agreed to submit it for consideration and vote at the November 2020 session of WP.29/AC.3
7	8(c)	GRPE adopted GRPE-81-23-Rev.1 on amendments to the terms of reference and rules of procedure for IWG on Environmental and Propulsion Performance Requirements (EPPR) and agreed to submit it for endorsement at the November 2020 session of WP.29
8	9(a)	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/12 as amended by GRPE-81-27 on a new UN GTR on the Determination of Electrified Vehicle Power (DEVP) and its technical report and agreed to submit them for consideration and vote at the November 2020 session of WP.29/AC.3
9	12	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/16 on a revision to Mutual Resolution No. 3 and agreed to submit it for vote at the November 2020 sessions of WP.29/AC.1/AC.3
10	12	GRPE adopted GRPE-81-09-Rev.1 on amendments to the terms of reference and rules of procedure for IWG on Vehicles Interior Air Quality (VIAQ) and agreed to submit it for endorsement at the November 2020 session of WP.29
11	5	GRPE adopted ECE/TRANS/WP.29/GRPE/2020/11 as amended by GRPE-81-37 on amendments to UN Regulation No. 115 and agreed to submit it for consideration and vote at the November 2020 session of WP.29/AC.1
12	15	GRPE elected by consensus Mr. André Rijnders, from the Netherlands, as Chair, and M. Duncan Kay, from the United Kingdom of Great Britain and Northern Ireland, as Vice-Chair for the year 2021.