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Working Party on Pollution and Energy

Eighty-third session
Geneva, 1–4 June 2021

Report of the Working Party on Pollution and Energy (GRPE) on its eighty-third session

Contents

I. Attendance

1. The Working Party on Pollution and Energy (GRPE) held its eighty-third session from 1 to 4 June 2021, 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, Canada, China, France, Germany, Hungary, India, Italy, Japan, Netherlands, Norway, Republic of Korea, Russian Federation, 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), European Tyres and Rubber Manufacturers Association (ETRMA), Fédération Internationale de l'Automobile (FIA), 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/2021/9
Informal documents GRPE-83-01, GRPE-83-02-Rev.1, GRPE-83-03-Rev.4 and GRPE-83-05

2. Mr. Rijnders, Chair of GRPE, opened the meeting, held as hybrid session, with all participants attending virtually because of the sanitary situation, and welcomed the participants. The Chair of the Informal Working Group (IWG) on Particle Measurement Programme (PMP) requested to remove ECE/TRANS/WP.29/GRPE/2021/17 from the agenda as the IWG on PMP could not finalize the proposal in time for a consideration by GRPE. The Chair of the IWG on Electric Vehicles and the Environment (EVE) requested to remove ECE/TRANS/WP.29/GRPE/2021/18 from the agenda as the IWG on EVE could not finalize the proposal in time for a consideration by GRPE.

3. GRPE acknowledged both requests by the IWGs on PMP and EVE and adopted the provisional agenda of the eighty-third session (ECE/TRANS/WP.29/GRPE/2021/9), as updated and consolidated in GRPE-83-03-Rev.4, and GRPE-83-02-Rev.1 as a tentative running order. GRPE took note of GRPE-83-01 on the organization of GRPE Informal Working Group (IWG) meetings held during the weeks prior to this meeting.

4. 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. The secretariat called GRPE to make sure not to breach copyrights when submitting documents to be uploaded on UNECE website submissions.

5. The secretariat introduced GRPE-83-05, announcing that the next GRPE session would tentatively take place on 12 November 2021 as a complimentary session and the next full session was expected to take place from 11 to 14 January 2022 and recalling the corresponding deadlines (20 August and 19 October 2021 respectively) for the submission of official documents.

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

Documentation: ECE/TRANS/WP.29/1157
Informal documents GRPE-83-04

6. The secretariat introduced GRPE-83-04 and reported on relevant items discussed during the 183rd sessions of the World Forum for Harmonization of Vehicle Regulations (WP.29). He referred to ECE/TRANS/WP.29/1157 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_1 and N_1 vehicles), 101 (CO_2 emissions/fuel consumption), 103 (Replacement pollution control devices) and [154] (Worldwide Light duty Test Procedure (WLTP))

Documentation: ECE/TRANS/WP.29/GRPE/2021/10,
ECE/TRANS/WP.29/GRPE/2021/11,
ECE/TRANS/WP.29/GRPE/2021/12,
Informal documents GRPE-83-07, GRPE-83-08, GRPE-83-12, GRPE-83-13, GRPE-83-15, GRPE-83-16, GRPE-83-18, GRPE-83-19 and GRPE-83-33

7. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2021/10 and GRPE-83-15 extending the acceptable reference fuels and road load determination methodologies and clarifying crankcase pressure measurement and four-wheel drive vehicles tests in the 05, 06 and 07 series of amendments to UN Regulation No. 83. The representative from the UK requested further details on the road load determination proposal. The representative from OICA explained it would reduce testing burden to be able to use road load determination approaches used for UN GTR No. 15 and UN Regulation No. 154. The representative from Spain raised concerns about formulation in ECE/TRANS/WP.29/GRPE/2021/10 and GRPE-83-15 which were corrected during the session, as reflected in Annexes IV, V and VI.

8. GRPE requested the secretariat to submit Annexes IV, V and VI to WP.29 and AC.1 for consideration and vote at their November 2021 sessions as draft Supplement 15, 17 and 14 to the 05, 06 and 07 series of amendments to UN Regulation No. 83 respectively.

9. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2021/11 proposing a shortened test procedure for Pure Electric Vehicles (PEVs) as well as an update of the CoP test procedure in order to align UN Regulation No. 101 with proceedings and procedures described in UN Regulation No. 154. It also proposed an option for manufacturers to determine road load values for Pure Electric Vehicles according to the requirements of UN Regulation No. 83. Some minor editorial corrections had been proposed during the session, as reflected in Annex VII.

10. GRPE requested the secretariat to submit Annex VII to WP.29 and AC.1 for consideration and vote at their November 2021 sessions as draft Supplement 11 to the 01 series of amendments to UN Regulation No. 101.

11. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2021/12 as a proposal for amendment to UN Regulation No. 154. GRPE welcomed the proposal and agreed with the content of the proposal, following an edit during the session. The Chair proposed other related informal documents, also proposing amendments to UN Regulation No. 154, to be introduced to GRPE.

12. The representative of the European Commission (EC) introduced GRPE-83-07 and GRPE-83-08, and the representatives from OICA introduced GRPE-83-12, GRPE-83-13,

GRPE-83-18 and GRPE-83-19 proposing amendments to the original and 01 series of amendments to UN Regulation No. 154.

13. The Chair proposed to take all proposals to amend UN Regulation No. 154 together and proposed different options (GRPE-83-33) also considering the extra GRPE session in November 2021. GRPE agreed to have preparatory meetings with all interested parties and to attempt preparing working documents to be considered during the November 2021 session of GRPE.

14. Given time constraints, the Chair proposed to receive GRPE-83-16 under agenda item 16 if time allows.

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: Informal documents GRPE-83-17

15. The representative from OICA introduced GRPE-83-17 amending UN GTR No. 15 with respect to peak power in NOVC-HEVs. Considering other forthcoming amendments to UN GTR No. 15 expected soon, GRPE agreed to postpone consideration of this document to forthcoming sessions of GRPE.

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

Documentation: Informal documents GRPE-83-31 and GRPE-83-32

16. The representative from the EC, Chair of the IWG on RDE, introduced updated terms of reference and rules of procedure for the IWG on RDE (GRPE-83-31 as revised during the session) detailing expected activities in the months and years to come. The representative from the US supported the updated approach and highlighted opportunities for alignment. GRPE endorsed the updated document and encouraged the IWG on the ambitious harmonization activities.

17. Consequently, the Chair of the IWG on RDE introduced a revised authorization to develop a new UN GTR on RDE (GRPE-83-32 amended during the session as reflected in Annex VIII). She detailed that the expected UN GTR would go directly into a more comprehensive phase 2, with wider engagement from all parties. The representative from the USA commended the GRPE process and he added that the USA were working on a rule making that was expecting to use the outcomes from the IWG on RDE and the draft phase 2 UN GTR.

18. GRPE requested the secretariat to submit Annex VIII to WP.29 and AC.3 for consideration and vote at their November 2021 sessions as draft revised authorization to develop a new UN GTR on RDE.

V. Heavy duty vehicles (agenda item 4)

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

Documentation: ECE/TRANS/WP.29/GRPE/2021/13 and
ECE/TRANS/WP.29/GRPE/2021/14
Informal document GRPE-83-22

19. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2021/13 and ECE/TRANS/WP.29/GRPE/2021/14 proposing to amend the 05 and 06 series of amendments to UN Regulation No. 49 respectively correcting and improving some provisions with respect to humidity and hydrocarbons measurements. GRPE further modified

ECE/TRANS/WP.29/GRPE/2021/13 and ECE/TRANS/WP.29/GRPE/2021/14 during the session as reflected in Annexes IX and X respectively.

20. The representative from the Netherlands raised two questions on referencing ISO standards in UN texts and some clarifications about the use of helium in flame ionization detectors (FID).

21. The secretariat described the existing collaboration with the ISO secretariat and clarified how ISO standards might be referenced in UN documents. The representative from OICA further explained that helium is now difficult and expensive to acquire as the main reason to request for an alternative option to measure hydrocarbons. The representative from the EC supported this proposal.

22. GRPE requested the secretariat to submit Annexes IX and X to WP.29 and AC.1 for consideration and vote at their November 2021 sessions as draft Supplement 11 and 7 to the 05 and 06 series of amendments to UN Regulation No. 49 respectively.

23. The representative from the UK introduced GRPE-83-22 introducing updated communication forms to be filled for type approval authorities. The representative from OICA required some time to assess the impact of such requests on the test procedure and administrative process, and requested GRPE to consider this document as a working document at the January 2022 session of GRPE.

24. GRPE agreed to consider this proposal from the UK at forthcoming sessions of GRPE.

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))

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

C. Worldwide provisions for Heavy Duty vehicles Fuel Economy

26. GRPE had not received any new proposals for discussion under 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/2021/15 and ECE/TRANS/WP.29/GRPE/2021/16

27. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2021/15, exempting modern vehicle from opacity tests. The representative from EC highlighted the need to update the reference K value used, with particulate filter removal remaining undetected due to high this reference value. The representatives from Switzerland and from CITA agreed that the existing 0.5 reference value was no longer adequate and that a much lower value would be desirable. The representative from EC suggested a reference K value of around 0.05 could be a good compromise to improve the failure/tampering detection levels.

28. GRPE agreed to keep discussing a more appropriate K value during forthcoming GRPE sessions, and invited participants to submit proposals on this matter.

29. GRPE adopted ECE/TRANS/WP.29/GRPE/2021/15 and requested the secretariat to submit it to WP.29 and AC.1 for consideration and vote at their November 2021 sessions as draft Supplement 7 to the 03 series of amendments to UN Regulation No. 24 (Visible pollutants, measurement of power of C.I. engines (Diesel smoke)).

30. The representative from the Russian Federation introduced ECE/TRANS/WP.29/GRPE/2021/16 to clarify provisions in UN Regulation No. 133. The representative from the Netherlands proposed an alternative wording to simplify the proposal, as reflected in Annex XI. The representative from the Russian Federation thanked and supported the alternate proposal from the Netherlands.

31. GRPE adopted Annex XI and requested the secretariat to submit it to WP.29 and AC.1 for consideration and vote at their November 2021 sessions as draft Supplement 1 to UN Regulation No. 133 (Recyclability of motor vehicles).

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)

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

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

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

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

Documentation: ECE/TRANS/WP.29/GRPE/2021/17
Informal documents GRPE-83-11, GRPE-83-20 and GRPE-83-21

34. The representative from the EC, Chair of the IWG on PMP, introduced GRPE-83-21 giving a status report of the activities of the IWG on PMP. He explained the reasons for requesting to remove ECE/TRANS/WP.29/GRPE/2021/17 from the agenda. He detailed such request was due to diverging views on the possibility of sampling directly from raw exhaust, requiring additional tests to be performed over the 2021 summer.

35. The representatives from Japan, the UK and the EC introduced GRPE-83-11 as a request for authorization to develop a new UN GTR No. [XX] on brake PM and PN emissions. The representative from the US asked, given the ambitious timeline, if a PM/PN measurement procedure was already close to finalization. The representative from EC, leading the activities on non-exhaust emissions, clarified that rig test procedure was well advanced and added some issues such as regenerative braking, extreme brake events, were still being considered by the group.

36. GRPE requested the secretariat to submit GRPE-83-11, as reproduced in Annex XII to WP.29 and AC.3 for consideration and vote at their November 2021 sessions as request for authorization to develop a new UN GTR No. [XX] on brake PM and PN emissions.

37. The Chair of the IWG on PMP introduced GRPE-83-20 as updated terms of reference and rules of procedure for the IWG on PMP, detailing all the expected activities until June 2023. The Chair requested for information about expected completion for ultra-fine particulate under 23nm measurement procedure for light duty vehicles on the road. The Chair of the IWG on PMP informed this procedure was expected to be completed by June 2022.

38. He finally announced that, after more than 15 years as Chair of the IWG on PMP, other activities would prevent him for carrying on being a Chair of the IWG on PMP. The IWG on PMP nominated Barouch Giechaskiel, from the European Commission Joint Research Centre, as a new Chair of the IWG on PMP.

39. GRPE endorsed GRPE-83-20 and recognized the great work and achievements from Giorgio Martini as outgoing Chair of the IWG on PMP and congratulated Barouch Giechaskiel as the new Chair for the IWG on PMP.

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)

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

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) and [XX] (Durability)

Documentation: Informal documents GRPE-83-10 and GRPE-83-26-Rev.1

41. The Chair of the IWG on EPPR invited GRPE to review the latest draft for Amendment 5 to UN GTR No. 2, enlarging the scope to include more vehicle types (higher-powered three-wheeled vehicles) and accepting more fuel types to be included in the test procedure. He added the document was expected to be submitted to GRPE consideration at forthcoming sessions of GRPE.

42. He also invited GRPE to review the first draft of the new UN GTR on Durability that was expected to be submit for GRPE consideration at forthcoming sessions of GRPE.

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

Documentation: Informal document GRPE-83-28

43. The Chair of IWG on EPPR presented a status report (GRPE-83-28). He announced he would retire at the end of August 2021, and consequently the IWG on EPPR was looking for a new Chair which had not been identified. He further invited all potential interested parties to contact him for any potential application.

44. GRPE recognized the added value of the Chair of the IWG on EPPR over the years and commended the outstanding achievements of the IWG on EPPR under his leadership, and wished him all the best for his retirement.

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

A. UN GTRs No. 21 on the Determination of Electrified Vehicle Power (DEVP) and No. [XX] on In-vehicle Battery Durability

Documentation: ECE/TRANS/WP.29/GRPE/2021/18
Informal document GRPE-83-09

45. The Chair of the IWG on EVE detailed the reasons ECE/TRANS/WP.29/GRPE/2021/18 had been withdrawn from the agenda and invited GRPE to review the latest draft of the UN GTR on In-vehicle Battery Durability (GRPE-83-09).

B. Other activities of IWG on EVE

Documentation: Informal documents GRPE-83-29 and GRPE-83-30.

46. The Chair of IWG on EVE presented the status report introducing the latest activities of the group (GRPE-83-29). He detailed the latest activities with respect to in-vehicle battery durability as reflected in the latest draft of the UN GTR (see para 0).

47. The representative from OICA supported the extensive efforts done to finalize the draft UN GTR and agreed to leave some provisions still open (such Part A and B family definitions) even though some common agreements had been reached in recent meetings.

48. Given the importance and urgency to deliver on this new UN GTR, the Chair proposed GRPE to hold an additional GRPE session in the fall of 2021 so that the draft UN GTR could be considered and voted upon during the March 2022 session of WP.29. Following some interactions with the secretariat, the dates of 12 or 22 November 2021 afternoon were proposed.

49. The representatives from Canada, France, South Africa, Sweden, UK, USA and EC supported the proposal for an additional GRPE session and opted for the 12 November 2021.

50. The Chair of the IWG on EVE introduced draft updated terms of reference and rules of procedure for the IWG on EVE (GRPE-83-30) and announced GRPE a final version would be presented to GRPE at the additional November 2021 session.

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

Documentation: ECE/TRANS/WP.29/GRPE/2021/19

51. The representative from OICA introduced ECE/TRANS/WP.29/GRPE/2021/19 amending M.R.2. to align it with the latest definitions used in the latest amendments to UN GTR No. 15.

52. GRPE adopted ECE/TRANS/WP.29/GRPE/2021/19 and requested the secretariat to submit it to WP.29, AC.1 and AC.3 for consideration and vote at their November 2021 sessions as a proposal for an amendment to Mutual Resolution No. 2 (M.R.2).

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

Documentation: Informal documents GRPE-83-06 and GRPE-83-14

53. The GRPE ambassador to the IWG on IWVTA introduced GRPE-83-06 on the feedback from the IWG on IWVTA after the ambassador requested removal of UN Regulation No.154 and forthcoming UN Regulation No. [XXX] on RDE from the list of candidates for IWVTA Phase 2, as requested by GRPE during its last session in January 2021 (ECE/TRANS/WP.29/GRPE/82, para. 59). He emphasized the IWG on IWVTA did not understand the reasons for the request and asked GRPE to re-confirm their request for removal.

54. The representative from OICA introduced GRPE-83-14 also calling GRPE to include UN Regulation No. 154 into the candidate list as a useful tool for OICA to reduce the administrative burden into some regions where IWVTA is expected to be used more broadly.

55. The representative from Japan also considered there was a benefit in including UN Regulation No. 154 and forthcoming UN Regulation No. [XXX] on RDE in IWVTA and requested to include it.

56. The representative from the EU stated they no longer had reservations not to include UN Regulation No. 154 from the list of candidates for IWVTA Phase 2, to benefit countries and regions where IWVTA would reduce the administrative burden.

57. GRPE agreed to keep UN Regulation No.154 and forthcoming UN Regulation No. [XXX] on RDE in the list of candidates for IWVTA Phase 2 and requested the GRPE ambassador to the IWG on IWVTA to communicate this updated information To the IWG on IWVTA during their next meeting in June 2021.

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

Documentation: Informal document GRPE-83-23

58. The Chair of IWG on Vehicles Interior Air Quality (VIAQ) presented a status report on the ongoing activities of the group (GRPE-83-23). He informed GRPE about the latest progress and the items agreed during the last IWG meetings.

59. GRPE acknowledged the good progress made by IWG on VIAQ and the robust approach with which they are developing their activities.

XIV. Lifetime compliance (agenda item 13)

Documentation: Informal documents GRPE-83-24, GRPE-83-25 and GRPE-83-27

60. The representative from the Netherlands, co-chair of the IWG on Periodic Technical Inspection (PTI), introduced GRPE-83-24 introducing a new PTI particle test for Diesel Particulate Filters (DPFs) in the Netherlands from 1 July 2022. The representative from Norway asked if such test would also be appropriate for heavy-duty vehicles. The co-chair of the IWG on PTI clarified that the test procedure would also be appropriate for heavy duty vehicles, but that a different limit value would need to be determined. He added that, to date, the issue of DPF removal for trucks was much more limited than for light duty vehicles.

61. The representative from Spain asked whether the limit value was determined at low or high idle. The co-chair of IWG on PTI replied that the limit value was determined at low idle, but high idle values were expected to be at similar levels. He directed to the background report[1] detailing the procedure that was available on the New Periodic Technical Inspection (NPTI) website.

62. The representative from CITA underlined a similar program was on-going with 500 vehicles (among which 50 heavy duty vehicles) to be finalized in Jan 2023. The representative from the EC said the EC was closely looking at the issue and asked GRPE to keep this topic on the agenda for the January 2022 session of GRPE for further updates. The Chair suggested such a test could be included into the Rule 1 to the 97 Agreement as an optional procedure.

63. GRPE agreed to keep this topic on the agenda for forthcoming sessions of GRPE, and to reflect where such procedures could be inserted.

64. The Secretary from GRVA introduced GRPE-83-27 on an introduction to RxSWIN to inform GRPE about application to UN Regulation No. 156 into other UN Regulations. The Chair thanked the secretariat for introducing the topic to GRPE and proposed GRPE to reflect on potential applications in GRPE-related legal texts.

65. The representative from the Netherlands introduced GRPE-83-25 introducing an excerpt from the Dutch contribution to future regulatory process in Europe and how life compliance was a shared responsibility between car manufacturers, owners and legislators. The representative from OICA stated that On-Board Monitoring was not technically feasible today, as that remained a vision for the future.

[1] More information can be found in: https://www.tno.nl/en/focus-areas/traffic-transport/roadmaps/sustainable-traffic-and-transport/sustainable-mobility-and-logistics/improving-air-quality-by-monitoring-real-world-emissions/emissions-of-particulate-matter-from-diesel-cars/

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

Documentation: Informal documents GRPE-83-34 and GRPE-83-35

66. The Vice-Chair introduced GRPE-83-34 as notes from the "low- and zero-tailpipe emissions Heavy duty vehicles and associated regulatory needs" workshop held by GRPE during the GRPE week[2].

67. The representative from OICA thanked the secretariat for organizing the workshop and clarified there are on-going discussions at OICA on amending UN Regulation No. 49 to include hydrogen as a fuel for internal combustion engines.

68. The representative from the US, chair of the IWG on EVE, agreed considering heavy duty in the activities related to in-vehicle battery durability would be highly relevant.

69. The Chair introduced GRPE-83-35 as revised list of priorities to be shared with WP.29. The representative from the EC called for prior consultation within GRPE before including new element in the priority list.

70. The representative from Japan stated that carbon neutrality was now a crucial issue in the country and required the issue of life cycle analysis to be considered by GRPE as candidate to be included in the priority list, as was already the case in the GRPE emission items list (GRPE-80-04-Rev.1). the Chair agreed to consider this at the next session of GRPE in November 2021.

XVI. Election of officers (agenda item 15)

71. Given GRPE agreed to hold an additional session in November 2021, and according to Rule 37 of Terms of Reference and Rules of Procedure of the World Forum for Harmonization of Vehicle Regulations and its subsidiary bodies, GRPE agreed to postpone the election of officers to the November 2021 session of GRPE.

XVII. Any other business (agenda item 16)

Documentation: Informal document GRPE-83-13

72. As the time allowed for the meeting had expired, the Chair proposed to receive the presentation from the expert from OICA on GRPE-83-16 during the January 2022 session of GRPE. GRPE agreed to this proposal.

XVIII. Provisional agenda for the next session

A. Next GRPE session

73. The next GRPE session, including IWG meetings, is scheduled to be held as a hybrid meeting, with physical and remote participation, on Friday, 12 November 2021, from 12.30 p.m. to 3.30 p.m. (to be confired by the Conference Services). Interpretation services would be provided.

B. Provisional agenda for the next proper GRPE session

74. GRPE agreed on the following provisional agenda for its next session:

1. Adoption of the agenda.

[2] More information on the workshop can be found in: https://unece.org/transport/events/grpe-workshop-low-and-zero-emissions-heavy-duty-vehicles

2. Report on the last sessions of the World Forum for Harmonization of Vehicle Regulations (WP.29).

3. Electric Vehicles and the Environment (EVE):

   (a) UN GTR No. [XX] on in-vehicle battery durability;

   (b) Updated Terms of Reference and Rules of Procedures.

4. Light vehicles: UN Regulations No. 154 (WLTP);

5. Motorcycles and mopeds: Update on officers for the IWG on EPPR;

6. Priority topics for GRPE activities.

7. Election of officers.

8. Any other business.

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

75. The informal meetings in conjunction with the next GRPE sessions are expected to be virtual and held in the days prior to GRPE, if need be.

76. 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-83-) distributed without an official symbol before and during the session

No.	*(Author) Title*	*Follow-up*
1	(Secretariat) Informal meetings in conjunction with the GRPE (proper) session: schedule and links to virtual meetings	A
2r1	(Secretariat) Draft running order	A
3r4	(Secretariat) Provisional annotated agenda	A
4	(Secretariat) Highlights of the WP.29 session of March 2021	A
5	(Secretariat) General Information, 83rd and 84th sessions of GRPE	A
6	(IWVTA) Update from GRPE Ambassador to IWVTA	A
7	(Japan, EC) Proposal for a new Supplement to the original version to UN Regulation No. 154	C
8	(Japan and EC) Proposal for a new Supplement to 01 series of amendments to UN Regulation No. 154	C
9	(EVE) Proposal for amendments to ECE/TRANS/WP.29/GRPE/2021/18	C
10	(EPPR) latest draft of new UN GTR on the measurement procedure for two- or three-wheeled vehicles equipped with a combustion engine with regard to durability of pollution-control devices	C
11	(Japan, UK, EC) Request for authorization to develop a new UN GTR on brake PM and PN emissions	B
12	(OICA) Proposal for amendments to the Original and 01 series of amendments to UN Regulation No. 154	C
13	(OICA) Proposal for amendments to the Original series of amendments to UN Regulation No. 154	C
14	(OICA) Contribution to IWVTA Discussion	A
15	(OICA) Proposal to amend ECE/TRANS/WP.29/GRPE/2021/10	B
16	(OICA) Special Purpose Vehicles	C
17	(OICA) Proposal to amend UN GTR No. 15	C
18	(OICA) Proposal for amendments to the Original and 01 series of amendments to UN Regulation No. 154	C
19	(OICA) Proposal for amendments to the Original and 01 series of amendments to UN Regulation No. 154	C
20	(PMP) Updated terms of reference and rules of procedure for the IWG on PMP	B
21	(PMP) IWG on PMP status report	A
22	(UK) Proposal for a new supplement to the 07 series of amendments to UN Regulation No. 49	C
23	(VIAQ) IWG on VIAQ status report	A
24	(Netherlands) Introduction in the Netherlands of the new PTI particle test for DPFs	A
25	(Netherlands) Importance of lifetime compliance	A
26r1	(EPPR) Latest draft proposal for a new Amendment 5 to UN GTR No. 2	C
27	(Secretariat) Short Introduction to RxSWIN	A
28	(EPPR) IWG on EPPR status report	A
29	(EVE) IWG on EVE status report	A
30	(EVE) Updated terms of reference for the IWG on EVE	C
31	(RDE) Updated terms of reference and rules of procedure for the IWG on RDE	B
32	(RDE) Revised request for authorization to develop UN GTR on RDE, phase 2	B

No.	*(Author) Title*	*Follow-up*
33	(Chair) Options to consider UN Regulation No. 154 amendments	A
34	(Vice-Chair) Vice Chair's note on HDV workshop	A
35	(Chair) Updated List of priorities	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 November 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. The planning can be shown on the IWG wiki calendar available in:

https://wiki.unece.org/pages/viewpage.action?pageId=917779

Annex III

List of GRPE informal working groups, task forces and subgroups

Name (Acronym) (Status)	*Chair or Co-chairs*	*Secretaries*	*End of mandate*
Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR) (group)	Adolfo Perujo, Adolfo.PERUJO@ec.europa.eu (until 31 August 2021) Shinya Yamamura yamamura-s2zh@mlit.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	[November 2021]
Particle Measurement Programme (PMP) (group)	Barouch Giechaskiel, barouch.giechaskiel@ec.europa.eu	Rainer Vogt rvogt@ford.com	June 2023
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
Global Real Driving Emissions (RDE) (group)	Panagiota Dilara, Panagiota.DILARA@ec.europa.eu Shinya 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	June 2023

Annex IV

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/10

Adopted on the basis of GRPE-83-15, as amended during the session (see para. 8)

A new Supplement to the 05 series of amendments to UN Regulation No. 83

I. Proposal

Annex 6, paragraph 5.2.; amend to read:

"5.2. The pressure in the crankcase shall be measured at an appropriate location. ~~It shall be measured at the dip-stick hole with an inclined-tube manometer.~~ **It is recommended to measure the pressure at the dip-stick hole, if feasible.**"

Annex 7, paragraph 3.2.1., amend to read:

"3.2.1. The appropriate reference fuel shall be used, as defined in Annex 10 to this Regulation.

As an alternative at the choice of the manufacturer, the appropriate reference fuel as defined in Annex 10 to the 06 or 07 series of amendments to this Regulation may be used."

Annex 8, paragraph 5.2.11.; amend to read:

"5.2.11. A four-wheel drive vehicle shall be tested in a two-wheel drive mode of operation. The determination of the total road force for dynamometer setting is performed while operating the vehicle in its primary designed driving mode. **At the request of the manufacturer a four-wheel drive vehicle shall be tested in its primary drive mode of operation.**"

II. Justification

1. The reference to an inclined-tube manometer for the determination of crankcase pressure in general is not a technically neutral description. Thus, proposal is to delete this reference. Dip-stick hole might be not available for all engine types.

2. Testing a four-wheel vehicle under Type VI conditions should not be limited to a two-wheel drive mode as it also not required under Type I conditions and a two-wheel mode may not be available.

3. The reference fuels used for EU5 or EU6 testing are a higher volatility and higher ethanol content than those described in the 05 series of amendments. This results in them demonstrating a worst case situation for evaporative emissions in comparison.

4. The 06 series of amendments permits free choice between E5 and E10 fuels. It is worth clarifying that if E5 is selected for the type I test, E10 may still be used as worst case for the Type IV test.

Annex V

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/10

Adopted on the basis of GRPE-83-15, as amended during the session (see para. 8)

A new Supplement to the 06 series of amendments to UN Regulation No. 83

I. Proposal

Annex 4a, paragraph 5.1., amend to read:

"5.1. Test procedure

The procedure for measuring the vehicle road load is described in Appendix 7a to this annex.

As an alternative to this, the following measures may be used.

(a) In the case where the vehicle road load has already been determined according to WLTP procedures as defined in UN GTR No. 15, the methodology~~,~~ described in Appendix 7b may alternatively be used.

(b) In the case where a vehicle road load has already been determined according to Appendix 7a to this annex, simulation of the other configurations of the vehicle which have same body shape or same transmission may be used ~~and~~ under the condition that the type approval authority approves the simulation methodology proposed by the manufacturer.

~~This procedure is~~ **These procedures are** not required if the chassis dynamometer load is to be set according to the reference mass of the vehicle."

Annex 6, paragraph 5.2.; amend to read:

"5.2. The pressure in the crankcase shall be measured at an appropriate location. ~~It shall be measured at the dip-stick hole with an inclined-tube manometer.~~ **It is recommended to measure the pressure at the dip-stick hole, if feasible.**"

Annex 7, paragraph 3.2.1., amend to read:

"3.2.1. The appropriate reference fuel shall be used, as defined in Annex 10 to this Regulation.

As an alternative at the choice of the manufacturer, in the case that E5 fuel has been used for the Type I test, E10 fuel may be used for the Type IV test."

Annex 8, paragraph 5.2.11.; amend to read:

"5.2.11. A four-wheel drive vehicle shall be tested in a two-wheel drive mode of operation. The determination of the total road force for dynamometer setting is performed while operating the vehicle in its primary designed driving mode. **At the request of the manufacturer a four-wheel drive vehicle shall be tested in its primary drive mode of operation.**"

II. Justification

1. The reference to an inclined-tube manometer for the determination of crankcase pressure in general is not a technically neutral description. Thus, proposal is to delete this reference. Dip-stick hole might be not available for all engine types.

2. Testing a four-wheel vehicle under Type VI conditions should not be limited to a two-wheel drive mode as it also not required under Type I conditions and a two-wheel mode may not be available.

3. The reference fuels used for EU5 or EU6 testing are a higher volatility and higher ethanol content than those described in the 05 series of amendments. This results in them demonstrating a worst case situation for evaporative emissions in comparison.

4. The 06 series of amendments permits free choice between E5 and E10 fuels. It is worth clarifying that if E5 is selected for the type I test, E10 may still be used as worst case for the Type IV test.

5. During the 80th session of GRPE, the alternative methodology converting WLTP road load to NEDC was adopted. In the case where NEDC road load has been already determined, the conversion from such data to the other version considered to be equivalent.

Annex VI

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/10

Adopted on the basis of GRPE-83-15, as amended during the session (see para. 08)

A new Supplement to the 07 series of amendments to UN Regulation No. 83

I. Proposal

Annex 4a, paragraph 5.1., amend to read:

"5.1. Test procedure

The procedure for measuring the vehicle road load is described in Appendix 7a to this annex.

As an alternative to this, the following measures may be used.

(a) In the case where the vehicle road load has already been determined according to WLTP procedures as defined in UN GTR No. 15, the methodology~~,~~ described in Appendix 7b may alternatively be used.

(b) In the case where a vehicle road load has already been determined according to Appendix 7a to this annex, simulation of the other configurations of the vehicle which have same body shape or same transmission may be used ~~and~~ under the condition that the type approval authority approves the simulation methodology proposed by the manufacturer.

~~This procedure is~~ **These procedures are** not required if the chassis dynamometer load is to be set according to the reference mass of the vehicle."

Annex 6, paragraph 5.2.; amend to read:

"5.2. The pressure in the crankcase shall be measured at an appropriate location. ~~It shall be measured at the dip-stick hole with an inclined-tube manometer.~~ **It is recommended to measure the pressure at the dip-stick hole, if feasible.**"

Annex 8, paragraph 5.2.11.; amend to read:

"5.2.11. A four-wheel drive vehicle shall be tested in a two-wheel drive mode of operation. The determination of the total road force for dynamometer setting is performed while operating the vehicle in its primary designed driving mode. **At the request of the manufacturer a four-wheel drive vehicle shall be tested in its primary drive mode of operation.**"

II. Justification

1. The reference to an inclined-tube manometer for the determination of crankcase pressure in general is not a technically neutral description. Thus, proposal is to delete this reference. Dip-stick hole might be not available for all engine types.

2. Testing a four-wheel vehicle under Type VI conditions should not be limited to a two-wheel drive mode as it also not required under Type I conditions and a two-wheel mode may not be available.

3. The reference fuels used for EU5 or EU6 testing are a higher volatility and higher ethanol content than those described in the 05 series of amendments. This results in them demonstrating a worst case situation for evaporative emissions in comparison.

4. The 06 series of amendments permits free choice between E5 and E10 fuels. It is worth clarifying that if E5 is selected for the type I test, E10 may still be used as worst case for the Type IV test.

5. During the 80th session of GRPE, the alternative methodology converting WLTP road load to NEDC was adopted. In the case where NEDC road load has been already determined, the conversion from such data to the other version considered to be equivalent.

Annex VII

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/11

Amended during the session (see para. 10)

A new Supplement to the 01 series of amendments to UN Regulation No. 101

I. Proposal

Paragraph 2.18., amend to read:

"2.18. "*Electric range*", for vehicles powered by an electric power train only or by a hybrid electric power train with off-vehicle charging, means distance that can be driven electrically on one fully charged battery (or other electric energy storage device) as measured according to the procedure described in **Annex 7 and** Annex 9 to this Regulation."

Paragraph 5.3.1., amend to read:

"5.3.1. The Technical Service in charge of the tests conducts the measurement of the electric energy consumption **and electric range** according to the method and test cycle described in Annex 7 to this Regulation."

Paragraph 5.3.2., delete first subparagraph and amend second subparagraph to read:

"5.3.2. ~~The Technical Service in charge of the tests conducts the measurement of the electric range of the vehicle according to the method described in Annex 9 to this Regulation.~~

The **pure** electric range $\mathbf{D_e}$ measured by this method is the only one which may be included in sales promotional material."

Paragraph 5.3.3., amend to read:

"5.3.3. The result of the electric energy consumption **C** must be expressed in Watt hours per kilometre (Wh/km) and the range in km, both rounded to the nearest whole number."

Paragraph 9.4.1.5., amend to read:

"9.4.1.5. Make sure that for each type of vehicle**, the electric energy consumption testing** prescribed in Annex 7 to this Regulation is carried out; notwithstanding the requirements of paragraph **5.1.1.6.** of Annex 7 to this Regulation, at the request of the manufacturer, the tests will be carried out on vehicles which have not travelled any distance; **as an alternative at the choice of the manufacturer, the electric energy consumption may be confirmed by testing according to the procedure that is described in paragraph 9.4.3. below.**

~~Make sure that for each type of vehicle tests prescribed in Annex 7 to this Regulation is carried out; notwithstanding the requirements of paragraph 2.3.1.6. of Annex 7 to this Regulation, at the request of the manufacturer, the tests will be carried out on vehicles which have not travelled any distance.~~"

Add Paragraph 9.4.3. and subparagraphs 9.4.3.1. up to 9.4.3.5.:

"**9.4.3. Alternative at the choice of the manufacturer for electric energy consumption verification for conformity of production**

9.4.3.1. **During the conformity of production procedure, the break-off criterion for the Type 1 test procedure according to paragraph 5.2.3.1. to Annex 7 of this Regulation (consecutive cycle procedure) and paragraph 5.2.3.2. to Annex 7 of this Regulation (Shortened Test Procedure) shall be replaced with the following:**

The break-off criterion for the conformity of production procedure shall be reached with having finished the first two NEDC test cycles according to paragraph 2. to Annex 7 of this Regulation.

9.4.3.2. **During ~~this~~ these first two NEDC test cycles, the DC energy from the REESS(s) shall be measured according to the method described in Appendix ~~2~~3 to Annex 7 of this Regulation and divided by the driven distance in this two NEDC test cycles.**

9.4.3.3. **The value determined according to paragraph 9.4.3.2. shall be compared to the value determined according to paragraph 9.4.3.5..**

9.4.3.4. **Conformity for electric energy consumption shall be checked using the statistical procedures described in Section 9.3.. For the purposes of this conformity check, the term CO_2 shall be replaced by electric energy consumption.**

9.4.3.5. **Electric energy consumption for vehicles powered by an electric power train only**

The following value shall be declared and used for verifying the conformity of production with respect to the electric consumption:

$$EC_{DC,COP} = EC_{DC,first\ two\ NEDC} \times AF_{EC}$$

where:

$EC_{DC,COP}$ **is the value for electric energy consumption that has to be confirmed during the conformity of production test procedure within the first two NEDC test cycles, in Wh/km;**

$EC_{DC,first\ two\ NEDC}$ **is the electric energy consumption of the first two NEDC test cycles calculated according to paragraph 5.2.5.1. to Annex 7 for type approval purposes, in Wh/km;**

AF_{EC} **is the adjustment factor that adjusts the electric energy consumption that has to be confirmed in COP based on the difference between calculated and declared electric energy consumption for type approval purposes.**

and:

$$AF_{EC} = \frac{C_{dec}}{C}$$

where:

C_{dec} **is the declared electric energy consumption according to Section 5.5. in Wh/km;**

C **is the electric energy consumption according to paragraph 5.2.5.3. to Annex 7, in Wh/km.**"

Annex 7, amend the title to read.:

"Method of measuring the electric energy consumption **and the pure electric range** of vehicles powered by an electric power train only"

Annex 7, insert new paragraphs 1., 1.1. and 1.2. to read:

"**1. Measurement of electric energy consumption and pure electric range**

The test method described hereafter permits to measure the electric energy consumption, expressed in Wh/km, and the pure electric range, expressed in km, of vehicles powered by an electric power train only.

1.1. The test procedure to determine the pure electric range and electric energy consumption shall be selected in accordance with the estimated pure electric range of the test vehicle from the following table.

If the estimated pure electric range is	Applicable test procedure
…less than the length of 6 NEDC test cycles.	Consecutive cycle test procedure in accordance with paragraph 5.2.3.1. of this Annex.
…equal to or greater than the length of 6 NEDC test cycles.	Shortened test procedure in accordance with paragraph 5.2.3.2. of this Annex.

The manufacturer shall give evidence to the approval authority concerning the estimated pure electric range prior to the test. The pure electric range determined by the applied test procedure shall confirm that the correct test procedure was applied.

1.2. Parameters, units and accuracy of measurements

Parameter	*Units*	*Accuracy*	*Resolution*
Time	**s**	**±0.1 s**	**0.1 s**
Distance	**m**	**±0.1 per cent**	**1 m**
Temperature	**°C**	**±1 °C**	**1 °C**
Speed	**km/h**	**±1 per cent**	**0.2 km/h**
Mass	**kg**	**±0.5 per cent**	**1 kg**
Electric Energy [(a)]	**Wh**	**±1 per cent**	**0.001 kWh [(b)]**
Electric current	**A**	**±0.3 per cent FSD or ±1 per cent of reading [(c,d)]**	**0.1 A**
Electric voltage	**V**	**±0.3 per cent FSD or ±1 per cent of reading [(c)]**	**0.1 V**

(a) Equipment: static meter for active energy.
(b) AC watt-hour meter, Class 1 according to IEC 62053-21 or equivalent.
(c) Whichever is greater.
(d) Current integration frequency 20 Hz or more."

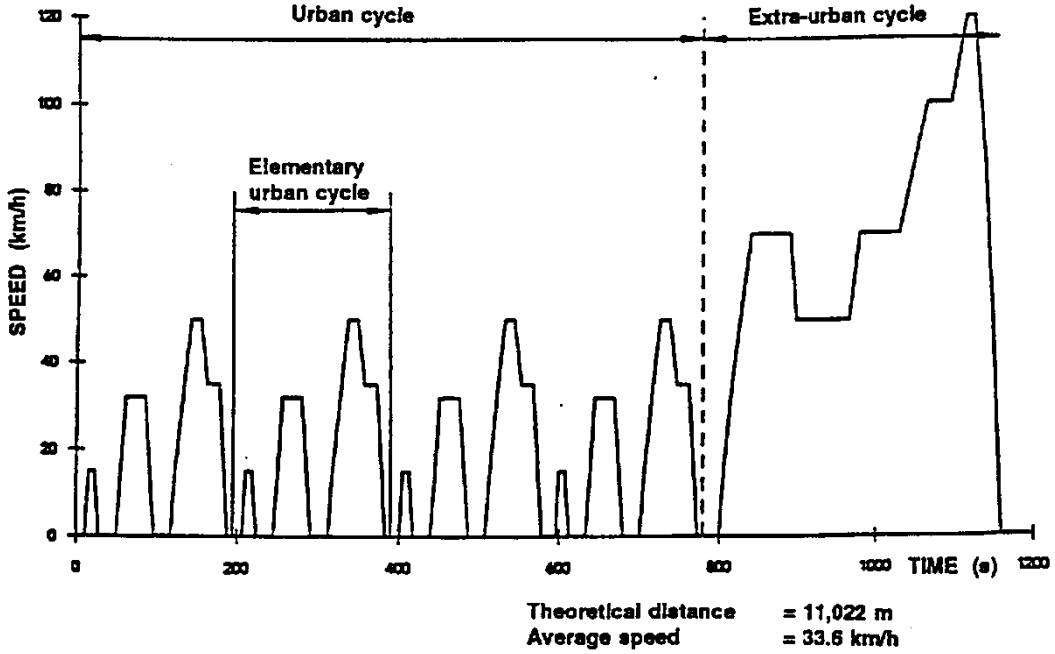
Annex 7, renumber paragraphs 1. to 1.3. as 2. to 2.3. and amend to read:

"**2.**~~**1.**~~ **NEDC test cycle** ~~Test sequence~~

2.1.~~**1.1.**~~ Composition

The **NEDC test cycle** ~~test sequence~~ is composed of two parts (see Figure 1):

Figure 1
NEDC test cycle ~~Text sequence~~



2.2. ~~1.2.~~ Urban cycle

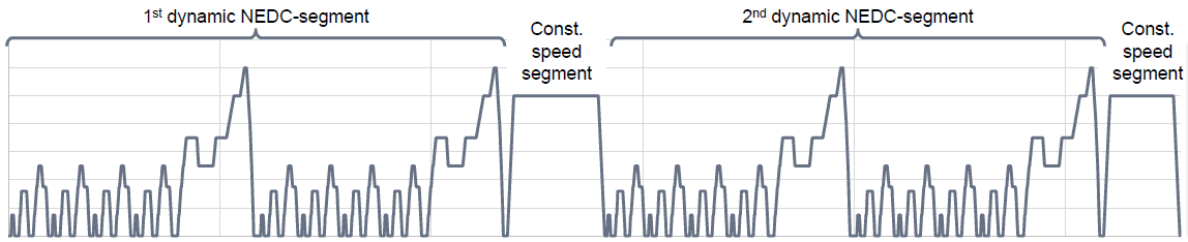
2.3. ~~1.3.~~ Extra-urban cycle"

Annex 7, insert new paragraph 3:

"**3. Shortened NEDC test sequence**

The shortened NEDC test sequence consists of two dynamic NEDC-segments (DS_1 and DS_2) combined with two constant speed segments (CSS_M and CSS_E) as shown in the following figure.

Figure 3a
Shortened NEDC test sequence



The dynamic NEDC segments DS_1 and DS_2 are used to calculate the electric energy consumption. The constant speed segments CSS_M and CSS_E are intended to reduce test duration by depleting the REESS more rapidly than driving consecutively NEDC test cycles.

3.1. Dynamic NEDC segments

Each dynamic NEDC segment DS_1 and DS_2 consists of two NEDC test cycles in accordance with paragraph 2. of this Annex.

3.2. Constant speed segment

The constant speeds during segments CSS_M and CSS_E shall be identical.

(a) Speed specification

The minimum speed of the constant speed segments shall be 100 km/h. At the request of manufacturer and with approval of the approval authority, a higher constant speed in the constant speed segments may be selected.

The acceleration to the constant speed level shall be smooth and accomplished within 1 minute after completion of the dynamic segments and, in the case of a break in accordance with paragraph 5.2.~~53~~.2.1. of this Annex, after initiating the powertrain start procedure.

If the maximum speed of the vehicle is lower than the required minimum speed for the constant speed segments according to the speed specification of this paragraph, the required speed in the constant speed segments shall be equal to the maximum speed of the vehicle.

(b) Distance determination of CSS_E and CSS_M

The length of the constant speed segment CSS_E shall be determined based on the percentage of the usable REESS energy UBE_{STP} according to paragraph 5.2.5.2.2. of this Annex. The remaining energy in the traction REESS after dynamic NEDC segment DS_2 shall be equal to or less than 10 per cent of UBE_{STP}. The manufacturer shall provide evidence to the approval authority after the test that this requirement is fulfilled.

The length of the constant speed segment CSS_M may be calculated using the following equation:

$$d_{CSSM} = D_{e,est} - d_{DS1} - d_{DS2} - d_{CSSE}$$

where:

$D_{e,est}$ **is the estimated pure electric range of the considered vehicle, km;**

d_{DS1} **is the length of dynamic NEDC segment 1, km;**

d_{DS2} **is the length of dynamic NEDC segment 2, km;**

d_{CSSE} **is the length of constant speed segment CSS_E, km.**"

Annex 7, renumber paragraph 1.4. as 4. and amend to read:

"**4.~~1.4.~~** Tolerance

~~Tolerances are given in Figure 4.~~"

Annex 7, add new paragraph 4.1. and 4.2.:

"**4.1. Tolerances for driving the NEDC test cycle**

Tolerances are given in Figure 4.

4.2. Tolerances for driving with constant speed in a constant speed segment

Tolerances on the constant speed are ±2 km/h.

Deviations beyond this tolerance are permitted up to five times per hour for a duration less than 4 seconds each."

Annex 7, renumber paragraph 2. as 5.:

"**5.~~2.~~** Test method"

Annex 7, delete paragraph 2.1. and 2.2.:

"~~2.1. Principle~~

~~The test method described hereafter allows the electric energy consumption, expressed in Wh/km, to be measured:~~

~~2.2. Parameters, units and accuracy of measurements~~

~~*Parameter*~~	~~*Units*~~	~~*Accuracy*~~	~~*Resolution*~~
~~Time~~	~~s~~	~~±0.1 s~~	~~0.1 s~~
~~Distance~~	~~m~~	~~±0.1 per cent~~	~~1 m~~
~~Temperature~~	~~°C~~	~~±1 °C~~	~~1 °C~~
~~Speed~~	~~km/h~~	~~±1 per cent~~	~~0.2 km/h~~

~~Mass~~ ~~Energy~~	~~kg~~ ~~Wh~~	~~±0.5 per cent~~ ~~±0.2 per cent~~	~~1 kg~~ ~~Class 0.2 s according to IEC 687~~

~~IEC = International Electrotechnical Commission~~"

Annex 7, renumber paragraph 2.3. to 2.3.1.6. as 5.1. to 5.1.1.6. and amend paragraph 5.1.1.6. to read:

"**5.1.**~~2.3.~~ Vehicle

5.1.1.~~2.3.1.~~ Condition of the vehicle

5.1.1.1.~~2.3.1.1.~~ The vehicle tyres shall be inflated to the pressure specified by the vehicle manufacturer when the tyres are at the ambient temperature.

5.1.1.2.~~2.3.1.2.~~ The viscosity of the oils for the mechanical moving parts shall conform to the specification of the vehicle manufacturer.

5.1.1.3.~~2.3.1.3.~~ The lighting and light-signalling and auxiliary devices shall be off, except those required for testing and usual day-time operation of the vehicle.

5.1.1.4.~~2.3.1.4.~~ All energy storage systems available for other than traction purposes (electric, hydraulic, pneumatic, etc.) shall be charged up to their maximum level specified by the manufacturer.

5.1.1.5.~~2.3.1.5.~~ If the batteries are operated above the ambient temperature, the operator shall follow the procedure recommended by the car manufacturer in order to keep the temperature of the battery in the normal operating range.

The manufacturer's agent shall be in a position to attest that the thermal management system of the battery is neither disabled nor reduced.

5.1.1.6.~~2.3.1.6.~~ The vehicle must have undergone at least 300 km **or one full charge distance, whichever is longer,** before the test with those batteries that are installed in the test vehicle."

Annex 7, renumber paragraph 2.4. as 5.2. and amend to read:

"**5.2.**~~2.4.~~ Operation mode

All the tests are conducted at a temperature of between 20 °C and 30 °C.

The **general** test method includes the ~~four~~ following steps:

(a) Discharging the battery in accordance with paragraph 5.2.1. of this Annex;

(b) Application of a normal charge in accordance with paragraph 5.2.2. of this Annex;

(c) Application of either the consecutive cycle test procedure or the shortened test procedure in accordance with paragraph 1.1. of this Annex;

(d) Application of a normal charge in accordance with paragraph 5.2.2. of this Annex;

(e) Determination of the electric energy consumption and the pure electric range.

~~(a) Initial charge of the battery;~~

~~(b) Application twice of the cycle made of four elementary urban cycles and an extra-urban cycle;~~

~~(c) Charging the battery;~~

~~(d) Calculation of the electric energy consumption.~~

Between the steps, if the vehicle shall move, it is pushed to the following test area (without regenerative recharging).

The chassis dynamometer shall be set with the method described in Appendix 1 to this Annex."

Annex 7 delete paragraph 2.4.1.:

"~~2.4.1. Initial charge of the battery~~

~~Charging the battery consists of the following procedures:~~"

Annex 7 renumber paragraph 2.4.1.1. to 2.4.1.2.2. as 5.2.1. to 5.2.2.2. and amend to read:

"**5.2.1.**~~2.4.1.1.~~Discharge of the battery

The discharge procedure shall be performed according to the manufacturer's recommendation. The manufacturer shall guarantee that the REESS is as fully depleted as is possible by the discharge procedure.

~~The procedure starts with the discharge of the battery of the vehicle while driving (on the test track, on a chassis dynamometer, etc.) at a steady speed of 70 per cent ± 5 per cent from the maximum thirty minutes speed of the vehicle.~~

~~Stopping the discharge occurs:~~

~~(a) When the vehicle is not able to run at 65 per cent of the maximum thirty minutes speed;~~

~~(b) Or when an indication to stop the vehicle is given to the driver by the standard on-board instrumentation, or~~

~~(c) After covering the distance of 100 km.~~

5.2.2.~~2.4.1.2.~~ Application of a normal ~~overnight~~ charge

Normal charging is the transfer of electricity to an electrified vehicle with a power of less than or equal to 22 kW.

Where there are several possible methods to perform a normal AC charge (e.g. cable, induction, etc.), the charging procedure via cable shall be used.

Where there are several AC charging power levels available, the highest normal charging power shall be used. An AC charging power lower than the highest normal AC charging power may be selected if recommended by the manufacturer and by approval of the responsible authority.
~~The battery shall be charged according to the following procedure.~~

5.2.2.1.~~2.4.1.2.1.~~ **Charging procedure** ~~Normal overnight charge procedure~~

The REESS shall be charged at an ambient temperature compromised between 20°C and 30°C with the on-board charger if fitted.

In the following cases, a charger recommended by the manufacturer and using the charging pattern prescribed for normal charging shall be used if:

(a) No on-board charger is fitted, or

(b) Charging time exceeds maximum time defined in paragraph 5.2.2.2.

The procedures in this paragraph exclude all types of special charges that could be automatically or manually initiated, e.g. equalization charges or servicing charges.

~~The charge is carried out:~~

~~(a) With the on-board charger if fitted,~~

~~(b) With an external charger recommended by the manufacturer, using the charging pattern prescribed for normal charging,~~

~~(c) In an ambient temperature comprised between 20 °C and 30 °C.~~

~~This procedure excludes all types of special charges that could be automatically or manually initiated like, for instance, the equalisation charges or the servicing charges.~~

The car manufacturer shall declare that during the test, a special charge procedure has not occurred.

5.2.2.2.~~2.4.1.2.2.~~ End of charge criteria

The end of charge criteria corresponds to a charging time of 12 hours except if a clear indication is given to the driver by the standard instrumentation that the battery is not yet fully charged.

In this case,

$$\text{the maximum time is} = \frac{3 \cdot \text{claimed battery capacity (Wh)}}{\text{mains power supply (W)}}$$ „

Annex 7, delete paragraph 2.4.1.2.3.:

“~~2.4.1.2.3. Fully charged battery~~

~~Battery having been charged according to overnight charge procedure until the end of charge criteria.~~”

Annex 7, renumber paragraph 2.4.2. as 5.2.3. and amend to read:

“**5.2.3.**~~2.4.2.~~ Application of the cycle **test procedure to determine the pure electric range and the electric energy consumption** ~~measurement of the distance~~

The end of charging time t_0 (plug off) is reported.

~~The chassis dynamometer shall be set with the method described in Appendix 1 to this annex.~~

~~Starting within 4 hours from t_0, the cycle made of four elementary urban cycles and an extra-urban cycle is run twice on a chassis dynamometer (test distance: 22 km, test duration: 40 minutes).~~

~~At the end, the measure D_{test} of the covered distance in km is recorded.~~”

Annex 7, insert new paragraphs 5.2.3.1. to 5.2.3.2.3.:

“**5.2.3.1. Consecutive cycle test procedure**

5.2.3.1.1. Speed trace and breaks

The test shall be performed by driving consecutive NEDC test cycles until the break-off criterion according to paragraph 5.2.3.1.3. of this Annex is reached.

To respect human needs, up to three interruptions are permitted between NEDC test cycles, of no more than fifteen minutes in total.

Breaks for the driver and/or operator are permitted only between test cycles and with a maximum total break time of 10 minutes. During the break, the powertrain shall be switched off.

5.2.3.1.2. REESS current and voltage measurement

From the beginning of the test until the break-off criterion according to 5.2.3.1.3. is reached, the electric current of all REESSs and the electric voltage of all REESSs shall be determined according to Appendix ~~2~~3 to this Annex.

5.2.3.1.3. Break-off criterion

The break-off criterion is reached when the vehicle is not able to meet the target curve up to 50 km/h, or when an indication from the standard on-board instrumentation is given to the driver to stop the vehicle.

The accelerator control shall be deactivated. The vehicle shall be braked to standstill within 60 seconds.

At a speed over 50 km/h, when the vehicle does not reach the required acceleration or speed of the test cycle, the accelerator pedal shall remain fully depressed until the reference curve has been reached again.

5.2.3.2. Shortened test procedure

5.2.3.2.1. Speed trace and breaks

The test shall be performed by driving the shortened NEDC test sequence according to paragraph 3. of this Annex until the break-off criterion according to paragraph 5.2.3.2.3. of this Annex is reached.

Breaks for the driver and/or operator are permitted only in the constant speed segments as prescribed in the following table.

Breaks for the driver and/or test operator

Distance driven in constant speed segment CSS_M (km)	**Maximum total break (min)**
Up to 100	**10**
Up to 150	**20**
Up to 200	**30**
Up to 300	**60**
More than 300	**Shall be based on the manufacturer's recommendation**

5.2.3.2.2. REESS current and voltage measurement

From the beginning of the test until the break-off criterion according to paragraph 5.2.3.2.3. to this Annex is reached, the electric current of all REESSs and the electric voltage of all REESSs shall be determined according to Appendix ~~2~~3 to this Annex.

5.2.3.2.3. Break-off criterion

The break-off criterion is reached when the vehicle exceeds the prescribed speed trace tolerance as specified in paragraph 4.2. of this Annex for 4 consecutive seconds or more in the second constant speed segment CSS_E. The accelerator control shall be deactivated. The vehicle shall be braked to a standstill within 60 seconds."

Annex 7, renumber paragraph 2.4.3. as 5.2.4. and amend to read:

"**5.2.4.**~~2.4.3.~~ Charge of the battery

The vehicle shall be connected to the mains within the 30 minutes after the **break-off criterion in accordance with paragraph 5.2.3.1.3. or 5.2.3.2.3. respectively** ~~conclusion of the cycle made of four elementary urban cycles and an extra-urban cycle, carried out twice~~.

The vehicle shall be charged according to normal overnight charge procedure **in accordance with paragraph 5.2.2. of this Annex** ~~(see paragraph 2.4.1.2. of this annex)~~.

The energy measurement equipment, placed between the mains socket and the vehicle charger, measures the charge energy E delivered from the mains, as well as its duration.

The determination of recharged electric energy shall be stopped if the end of charge criterion in accordance with 5.2.2.2. is reached.

~~Charging is stopped after 24 hours from the previous end of charging time (t_0).~~

~~*Note:* In case of a mains power cut, the 24 hours period will be extended accordingly to the cut duration. Validity of the charge will be discussed between the Technical Services of the approval laboratory and the vehicle's manufacturer.~~"

Annex 7, delete paragraph 2.4.4. and insert new paragraphs 5.2.5. to 5.2.5.3.:

"~~2.4.4. Electric energy consumption calculation~~

~~Energy E in Wh and charging time measurements are recorded in the test report.~~

~~The electric energy consumption c is defined by the formula:~~

~~$c = \frac{E}{D_{test}}$ (expressed in Wh/km and rounded to the nearest whole number)~~

~~Where D_{test} is the distance covered during the test (km).~~

5.2.5. Determination of pure electric range and electric energy consumption

5.2.5.1. Calculation of electric energy consumption

For the determination of the electric energy consumption based on the current and voltage determined according to Appendix ~~2~~3 of this Annex, the following equations shall be used:

$$EC_{DC,j} = \frac{\Delta E_{REESS,j}}{d_j}$$

where:

$EC_{DC,j}$ **is the electric energy consumption over the considered period j based on the REESS depletion, Wh/km;**

$\Delta E_{REESS,j}$ **is the electric energy change of all REESSs during the considered period j, Wh;**

d_j **is the distance driven in the considered period j, km;**

and

$$\Delta E_{REESS,j} = \sum_{j=1}^{n} \Delta E_{REESS,j,i}$$

where:

$\Delta E_{REESS,j,i}$ **is the electric energy change of REESS i during the considered period j, Wh;**

and

$$\Delta E_{REESS,j,i} = \frac{1}{3600} \times \int_{t_0}^{t_{end}} U(t)_{REESS,j,i} \times I(t)_{REESS,j,i}\, dt$$

where:

$U(t)_{REESS,j,i}$ **is the voltage of REESS i during the considered period j determined according to Appendix ~~2~~3 to this Annex, V;**

t_0 **is the time at the beginning of the considered period j, s;**

t_{end} **is the time at the end of the considered period j, s;**

$I(t)_{REESS,j,i}$ **is the electric current of REESS i during the considered period j determined according to Appendix ~~2~~3 to this Annex, A;**

i **is the index number of the considered REESS;**

n **is the total number of REESS;**

j **is the index for the considered period, where a period can be any combination of phases or cycles;**

$\frac{1}{3600}$ **is the conversion factor from Ws to Wh.**

5.2.5.2. Calculation of the pure electric range

5.2.5.2.1. Determination of the pure electric range when the consecutive cycle test procedure according to paragraph 5.2.3.1. of this Annex is applied

The final pure electric range D_e shall rounded to the nearest whole number in km and shall be calculated using the following equations:

$$D_e = \frac{UBE_{CCP}}{EC_{DC}}$$

where:

UBE_{CCP} **is the usable REESS energy determined from the beginning of the consecutive cycle test procedure until the break-off criterion according to paragraph 5.2.3.1.3. of this Annex is reached, Wh;**

EC_{DC} **is the electric energy consumption determined from completely driven NEDC test cycles of the consecutive cycle Type 1 test procedure, Wh/km;**

and

$$UBE_{CCP} = \sum_{j=1}^{k} \Delta E_{REESS,j}$$

where:

$\Delta E_{REESS,j}$ **is the electric energy change of all REESSs during NEDC test cycle j of the consecutive cycle test procedure, Wh;**

j **is the index number of the NEDC test cycle considered;**

k **is the number of NEDC test cycles driven from the beginning up to and including the phase where the break-off criterion is reached;**

and

$$EC_{DC} = \sum_{j=1}^{n} EC_{DC,j} \times k_j$$

where:

$EC_{DC,j}$ **is the electric energy consumption for NEDC test cycle j of the consecutive cycle test procedure according to paragraph 5.2.5.1. of this Annex, Wh/km;**

k_j **is the weighting factor for the NEDC test cycle j of the consecutive cycle test procedure;**

j **is the index number of the NEDC test cycle;**

n **is the whole number of complete NEDC test cycles driven;**

and

in case of two complete NEDC test cycles driven:

$k_1 = \frac{\Delta E_{REESS,1}}{UBE_{CCP}}$, $k_2 = \frac{\Delta E_{REESS,2}}{UBE_{CCP}}$

in case of at least three NEDC test cycles driven:

$k_1 = \frac{\Delta E_{REESS,1}}{UBE_{CCP}}$, $k_2 = \frac{\Delta E_{REESS,2}}{UBE_{CCP}}$ **and** $k_j = \frac{1-k_1-k_2}{n-2}$ **for** $j = 3 \ldots n$

where:

$\Delta E_{REESS,1}$ **is the electric energy change of all REESSs during the first NEDC test cycle of the consecutive test cycle procedure, Wh;**

$\Delta E_{REESS,2}$ **is the electric energy change of all REESSs during the second NEDC test cycle of the consecutive test cycle procedure, Wh.**

5.2.5.2.2. Determination of the pure electric range when the shortened test procedure according to paragraph 5.2.3.2. of this Annex is applied

The final pure electric range D_e shall rounded to the nearest whole number in km and shall be calculated using the following equations:

$$D_e = \frac{UBE_{STP}}{EC_{DC}}$$

where:

UBE_{STP} **is the usable REESS energy determined from the beginning of the shortened test procedure until the break-off criterion as defined in paragraph 5.2.3.2.3. of this Annex is reached, Wh;**

EC_{DC} **is the weighted electric energy consumption of DS_1 and DS_2 of the shortened test procedure, Wh/km;**

and

$$UBE_{STP} = \Delta E_{REESS,DS_1} + \Delta E_{REESS,DS_2} + \Delta E_{REESS,CSS_M} + \Delta E_{REESS,CSS_E}$$

where:

$\Delta E_{REESS,DS_1}$ **is the electric energy change of all REESSs during DS_1 of the shortened test procedure, Wh;**

$\Delta E_{REESS,DS_2}$ **is the electric energy change of all REESSs during DS_2 of the shortened test procedure, Wh;**

$\Delta E_{REESS,CSS_M}$ **is the electric energy change of all REESSs during CSS_M of the shortened test procedure, Wh;**

$\Delta E_{REESS,CSS_E}$ **is the electric energy change of all REESSs during CSS_E of the shortened test procedure, Wh;**

and

$$EC_{DC} = \sum_{j=1}^{2} EC_{DC,j} \times k_j$$

where:

$EC_{DC,j}$ **is the electric energy consumption of DS_j of the shortened test procedure according to paragraph 5.2.5.1. of this Annex, Wh/km;**

k_j **is the weighting factor of DS_j of the shortened test procedure;**

and

$k_1 = \frac{\Delta E_{REESS,DS_1}}{UBE_{STP}}$ **and** $k_2 = 1 - k_1$

where:

k_1 **is the weighting factor of DS_1 of the shortened test procedure;**

k_2 **is the weighting factor of DS_2 of the shortened test procedure;**

$\Delta E_{REESS,DS_1}$ **is the electric energy change of all REESSs during DS_1 of the shortened test procedure, Wh;**

5.2.5.3. Calculation of electric energy consumption

The electric energy consumption based on the recharged electric energy from the mains and the pure electric range shall be calculated using the following equation:

$$C = \frac{E_{AC}}{D_e}$$

where:

C **the electric energy consumption rounded to the nearest whole number based on the recharged electric energy from the mains and the non-rounded pure electric range, Wh/km;**

E_{AC} **is the recharged electric energy from the mains according to paragraph 5.2.4. of this Annex, Wh;**

D_e **is the non-rounded pure electric range as calculated according to paragraph 5.2.5.2.1. or paragraph 5.2.5.2.2. of this Annex, depending on the PEV test procedure that must be used according to paragraph 1.1. of this Annex, km.**"

Annex 7, Appendix 1, paragraph 1.; amend to read:

"1. Introduction

The purpose of this appendix is to define the method of measuring the total road load power of a vehicle with a statistical accuracy of ±4 per cent at a constant speed and to reproduce this measured road load power on a dynamometer with an accuracy of ±5 per cent.

As an alternative at the choice of the manufacturer, the road load may be determined according to the process described in Appendix 7 to Annex 4a of the latest version of UN Regulation No. 83 at the time of approval."

Add new Annex 7, Appendix 3:

"Annex 7 - Appendix 3

Determination of REESS current and REESS voltage PEVs

1. Introduction

1.1. This Appendix defines the method and required instrumentation to determine the REESS current and the REESS voltage of PEVs.

1.2. Measurement of REESS current and REESS voltage shall start at the same time as the test starts and shall end immediately after the vehicle has finished the test.

1.3. A list of the instrumentation used by the manufacturer to measure REESS voltage and current (including instrument manufacturer, model number, serial number, last calibration dates (where applicable)) shall be provided to the approval authority.

2. REESS current

REESS depletion is considered as a negative current.

2.1. External REESS current measurement

2.1.1. The REESS current(s) shall be measured during the tests using a clamp-on or closed type current transducer. The current measurement system shall fulfil the requirements specified in paragraph 1.2. of this Annex. The current transducer(s) shall be capable of handling the peak currents and temperature conditions at the point of measurement.

In order to have an accurate measurement, zero adjustment and degaussing shall be performed before the test in accordance with the instrument manufacturer's instructions.

2.1.2. Current transducers shall be fitted to any of the REESS on one of the cables connected directly to the REESS and shall include the total REESS current.

In case of shielded wires, appropriate methods shall be applied in accordance with the approval authority.

In order to easily measure the REESS current using external measuring equipment, the manufacturer should provide appropriate, safe and accessible connection points in the vehicle. If that is not feasible, the manufacturer is obliged to support the approval authority in connecting a current transducer to one of the cables directly connected to the REESS in the manner described above in this paragraph.

2.1.3. The current transducer output shall be sampled with a minimum frequency of 20 Hz. The measured current shall be integrated over time, yielding the measured value of Q, expressed in ampere-hours Ah. The integration may be done in the current measurement system.

2.2. Vehicle on-board REESS current data

As an alternative to paragraph 2.1. of this Appendix, the manufacturer may use the on-board current measurement data. The accuracy of these data shall be demonstrated to the approval authority.

3. REESS voltage

3.1. External REESS voltage measurement

The REESS voltage(s) shall be measured during the tests. The voltage measurement equipment shall fulfil the requirements specified in paragraph 1.2. of this Annex. To measure the REESS voltage using external measuring equipment, the manufacturers shall support the approval authority by providing REESS voltage measurement points.

3.2. Vehicle on-board REESS voltage data

As an alternative to paragraph 3.1. of this Appendix, the manufacturer may use the on-board voltage measurement data. The accuracy of these data shall be demonstrated to the approval authority."

Annex 9, title amend to read:

"Annex 9

Method of measuring the electric range of vehicles powered ~~by an electric power train only or~~ by a hybrid electric power train and the OVC range of vehicles powered by a hybrid electric powertrain"

Annex 9, Paragraph 1.; amend to read:

"1. Measurement of the electric range

The test method described hereafter permits to measure ~~the electric range, expressed in km, of vehicles powered by an electric power train only or~~ the electric range and OVC range of vehicles powered by a hybrid electric power

train with off-vehicle charging (OVC-HEV as defined in paragraph 2. of Annex 8 to this Regulation)."

Annex 9, Paragraph 3.1.6.; amend to read:

"3.1.6. The vehicle must have undergone at least 300 km **or one full charge distances, whichever is longer** ~~during the seven days before the test~~ with those batteries that are installed in the test vehicle."

Annex 9, Paragraph 4.1.1.1.; amend to read and delete Annex 9 subparagraphs 4.1.1.1.1. and 4.1.1.1.2.:

"**4.1.1.1. Reserved**

~~4.1.1.1. For pure electric vehicles:~~

~~4.1.1.1.1. The procedure starts with the discharge of the battery of the vehicle while driving (on the test track, on a chassis dynamometer, etc.) at a steady speed of 70 per cent +/-5 per cent from the maximum thirty minutes speed of the vehicle.~~

~~4.1.1.1.2. Stopping the discharge occurs:~~

~~(a) When the vehicle is not able to run at 65 per cent of the maximum thirty minutes speed;~~

~~(b) Or when an indication to stop the vehicle is given to the driver by the standard onboard instrumentation; or~~

~~(c) After covering the distance of 100 km.~~"

Annex 9, Paragraph 4.1.2.; amend to read:

"4.1.2. Application of a normal overnight charge

~~For a pure electric vehicle, the battery shall be charged according to the normal overnight charge procedure, as defined in paragraph 2.4.1.2. of Annex 7 to this Regulation, for a period not exceeding twelve hours.~~

For an OVC HEV, the battery shall be charged according to the normal overnight charge procedure as described in paragraph 3.2.2.5. of Annex 8 to this Regulation."

Annex 9, Paragraph 4.2.1.; amend to read and delete Annex 9 subparagraphs 4.2.1.1. to 4.2.1.5.:

"**4.2.1. Reserved**

~~4.2.1. For pure electric vehicle:~~

~~4.2.1.1. The test sequence as defined in paragraph 1.1. of Annex 7 to this Regulation is applied on a chassis dynamometer adjusted as described in Appendix 1 of Annex 7 to this Regulation, until the end of the test criteria is reached.~~

~~4.2.1.2. The end of the test criteria is reached when the vehicle is not able to meet the target curve up to 50 km/ h, or when an indication from the standard on board instrumentation is given to the driver to stop the vehicle.~~

~~Then the vehicle shall be slowed down to 5 km/h by releasing the accelerator pedal, without touching the brake pedal and then stopped by braking.~~

~~4.2.1.3. At a speed over 50 km/h, when the vehicle does not reach the required acceleration or speed of the test cycle, the accelerator pedal shall remain fully depressed until the reference curve has been reached again.~~

~~4.2.1.4. To respect human needs, up to three interruptions are permitted between test sequences, of no more than fifteen minutes in total.~~

~~4.2.1.5. At the end, the measure De of the covered distance in km is the electric range of the electric vehicle. It shall be rounded to the nearest whole number.~~"

II. Justification

1. UN GTR No. 15 (WLTP) has introduced a shortened Type 1 test procedure as well as a new conformity of production test procedure for pure electric vehicles.

2. These two introductions have been made to reduce on the one hand the testing time of the vehicles in lab and on the other hand to install robust procedures for the determination of electric energy consumption and range

3. This Amendment introduces both, shortened type 1 test procedure and the new COP procedure, also in the context of UN Regulation No. 101.

4. The new COP procedure has been added to the main body of this Regulation as an alternative, the shortened type 1 test procedure has been added to Annex 7 of this Regulation and can be applied if a PEV has more range than the defined threshold in paragraph 1. of Annex 7.

5. Required changes in the structure of the regulation had been that the method of measuring the range of electric range of vehicles powered by an electric powertrain only (means pure electric vehicles) has been deleted from Annex 9 and moved to Annex 7.

6. This concept has been adopted in the UN Regulation No. 154 and it is proposed to also include it in the x series which may be used in some markets.

7. As the processes for determination of road load in Regulation No. 83 and for Pure Electric Vehicles in Regulation 101 have diverged over the years, it would reduce approval burden to permit manufacturers to determine the road loads for PEVs according to the procedures for other vehicles described in Regulation No. 83.

Annex VIII

[English only]

Revised authorization to develop to develop a UN GTR on RDE

Adopted on the basis of GRPE-83-32, as amended in the session (see para. 0018)

I. Mandate and Objectives

1. In the framework of the 1998 Agreement the main objective of this proposal is to request a revision of the authorization to develop a UN GTR on Global RDE with the following objective:

- Continue development of the RDE GTR with a methodology for determining the real driving emissions of light duty vehicles appropriately adapted for broader areas of vehicle operation and additional pollutants.

II. Introduction

2. The draft GTR developed by the RDE Phase 1 group was largely informed by established RDE test procedures from both the European Commission and Japan. Many stakeholders participated in the development of the draft GTR and it met the immediate need of many Contracting Parties. However, it was generally recognized that the test procedure should be expanded to include a broader areas of vehicle operation and additional pollutants.

3. It is therefore appropriate to continue to develop the global technical regulation on RDE. The RDE Phase 2 GTR will consider extended conditions of driving, considering the varying conditions on driving patterns, traffic and ambient conditions which occur in the different areas in the world where cars are used. Furthermore, the RDE GTR structure should be developed in a way that it is possible for countries to implement the RDE GTR into their national legislation considering local normal driving, traffic and ambient conditions as well as variations in regulated pollutants and air toxics.

4. In order to develop the proposal a second phase of the IWG on Real Driving Emissions is necessary.

III. Areas of work

5. The group shall focus its work in the following areas:

(a) Create a consolidated list of goals of the real driving emissions (RDE) procedure- phase 2

Working within the IWG, stakeholders should identify and document an agreed upon list of goals for the Phase 2 project. This should include, but not limited to, expanded vehicle operation representative of real-world driving, a less prescriptive and more flexible test procedure, and consideration of additional pollutants, such as particle mass measurement (PM).

(b) Establish Consensus Goals

The consolidated version will be reviewed with the following objectives:

(i) Streamline the GTR text by focusing on the test procedure;

(ii) Identify areas for further technical improvements with particular focus in the evaluation methods;

(iii) Study the differences in conditions on normal driving patterns, traffic and ambient conditions in the different areas in the world where cars are used and review the regional needs;

(iv) Produce a draft GTR with the technical procedure for RDE.

(c) Finalizing a draft GTR on RDE

The draft GTR shall be edited by the group and proposed for acceptance to the June 2023 GRPE session.

IV. Existing regulations

6. UN Regulation No. 83 contains uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements. However this Regulation has no provisions for checking the real driving emissions of pollutants.

The IWG on RDE has in the meantime prepared and proposed for approval a new UN Regulation on RDE. The Regulation is pending approval following a decision on a technical element.

V. Timeline

7. The plan below is indicative only and will be regularly reviewed and updated to reflect progress and feasibility of the timeline.

(a) June 2021: Acceptance of the Terms of Reference by GRPE and request for new mandate;

(b) Sept. 2021-February 2023: technical research and meetings of IWG

(c) January 2023: Draft GTR available as informal document, guidance on any open issues by GRPE;

(d) January 2023-March 2023: Final drafting work on UN GTR text;

(e) March 2023: Transmission by RDE IWG of a draft UN GTR as a working document for consideration at the June 2023 GRPE session;

(f) April to May 2023: final corrections may be submitted as informal documents;

(g) June 2023: Final discussion and approval of the draft UN GTR by GRPE; consideration of the need to extend the mandate of the RDE IWG to work on additional items;

(h) Transmission of the draft UN GTR as a working document twelve weeks before the November 2023 session of AC.3 and aim for endorsement by AC.3 of the draft UN GTR based on a working document by GRPE at its November 2023 session.

Annex IX

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/13

Amended during the session (see para.22)

A new Supplement to the 05 series of amendments to UN Regulation No. 49

I. Proposal

Annex 4B, paragraph 8.2.; amend to read:

"8.2. NOx correction for humidity

As the NOx emission depends on ambient air conditions, the NOx concentration shall be corrected for humidity with the factors given in paragraph 8.2.1. or 8.2.2. The intake air humidity Ha may be derived from relative humidity measurement, dew point measurement, vapour pressure measurement or dry/wet bulb measurement using generally accepted equations.

For all humidity calculations (for example Ha, Hd) using generally accepted equations the saturation vapour pressure is required. For calculating the saturation vapour pressure which is in general a function of the temperature (at the humidity measurement point) the equation D.15 specified in Annex D to ISO Standard 8178-4:2020 should be used."

Annex 4B - Scope, paragraph 9.2.; amend to read:

"9.2. Linearity requirements

…..

Table 7

Linearity requirements of instruments and measurement systems

"

Measurement system	$\chi min \times (a1 - 1) + a0$	Slope a1	Standard error SEE	*Coefficient of Determination* r^2
Engine speed	≤ 0.05 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Engine torque	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Fuel flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Airflow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Exhaust gas flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Diluent flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Diluted exhaust gas flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Sample flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Gas analyzers	≤ 0.5 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Gas dividers	≤ 0.5 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Temperatures	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998

Pressures	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
PM balance	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Humidity measurement device	**≤ 2 % max.**	**0.98 – 1.02**	**≤ 2 %**	**≥ 0.95**

”

Annex 4A, Appendix 1 paragraph 5.3.; amend to read:

“5.3. NOx correction for humidity and temperature

As the NOx emission depends on ambient air conditions, the NOx concentration shall be corrected for ambient air temperature and humidity with the factors given in the following formulae. The factors are valid in the range between 0 and 25 g/kg dry air.

(a) For compression ignition engines:

$$k_{h,D} = \frac{1}{1 - 0.0182 \times (H_a - 10.71) + 0.0045 \times (T_a - 298)}$$

With:

Ta = temperature of the intake air, K

Ha = humidity of the intake air, g water per kg dry air

Where:

Ha may be derived from relative humidity measurement, dewpoint measurement, vapour pressure measurement or dry/wet bulb measurement using the generally accepted formulae.

(b) For spark ignition engines

$k_{h,G} = 0.6272 + 44.030 \times 10^{-3} \times H_a - 0.862 \times 10^{-3} \times H_a^2$

Where:

Ha may be derived from relative humidity measurement, dew point measurement, vapour pressure measurement or dry/wet bulb measurement using the generally accepted formulae**.**

For all humidity calculations (for example Ha, Hd) using generally accepted equations the saturation vapour pressure is required. For calculating the saturation vapour pressure which is in general a function of the temperature (at the humidity measurement point) the equation D.15 specified in Annex D to ISO Standard 8178-4:2020 should be used.”

Annex 4A. Appendix 5

Paragraph 1.2.1., amend to read:

“1.2.1. Pure gas

……

Hydrogen~~-helium~~ mixture (FID burner fuel)

(40 ± 1 per cent hydrogen, balance helium **or alternatively nitrogen**)

(Contamination ≤ 1 ppm C1, ≤ 400 ppm CO2)”

Paragraph 1.7.2., amend to read:

“1.7.2. Calibration

The CLD and the HCLD shall be calibrated in the most common operating range following the manufacturer's specifications using zero and span gas (the NO content of which shall amount to about 80 per cent of the operating range and the NO2 concentration of the gas mixture to less than 5 per cent of the NO

concentration). **With the ozonator deactivated**, the NOx analyzer shall be in the NO mode so that the span gas does not pass through the converter. The indicated concentration has to be recorded."

Paragraph 1.7.8., amend to read:

"1.7.8. NO**x** mode

~~Switched to~~ **Keeping** NO**x** mode with the ozonator deactivated, the flow of oxygen or synthetic air is also shut off. The NOx reading of the analyzer shall not deviate by more than ±5 per cent from the value measured according to paragraph 1.7.2. (the analyzer is in the NO**x** mode)".

II. Justification

1. Annex 4B, paragraph 8.2.; amendments related to the NOx correction for humidity

The reasoning is derived from the experience, and the need for the amendment has been raised by technical service.

2. Annex 4B – Amendments to paragraph 9.2.

3. The reasoning for adding a row is the following.

Regulation 49 defines no linearity requirements for humidity sensors. As the humidity content of the intake air is an essential measure for the calculation of the specific exhaust emission, it is important to add requirement for humidity sensor (Reference: ISO 16183 the accuracy of the absolute humidity shall be +- 5%).

4. Annex 4B – Amendments to paragraph 9.3.3.1.

Helium is produced with high energy consumption by fractioning natural gas. It is already classified as a critical resource by the EU as well as USA. In the automotive industry Helium is used as so fuel gas for flame ionization detectors (FID) to measure Hydrocarbon emissions. In the FID fuel gas Helium is mixed with Hydrogen in a ratio of 40 % H2 and 60 % He. The annual fluctuations of the helium global market lead to an insufficient supply with FID fuel gas, like happened lately during summer 2018. In order to prevent the industry from the fluctuations of the global helium market, the US legislation reacted already in 2014 and allowed the usage of Nitrogen as batch gas for the FID fuel gas (§1065.750 (2i) [https://ecfr.io/Title-40/pt40.37.1065#se40.37.1065_1260].

5. Annex 4A. Appendix 5, Amendments to paragraph 1.2.1.

Same reasoning as previous for Annex 4B, paragraph 9.3.3.1.

6. Annex 4A, Appendix 5, Amendments to paragraph 1.7.2.

To clarify the operation procedure, make the text easier to be understood.

7. Annex 4A, Appendix 5, Amendments to paragraphs 1.7.7. and 1.7.8.

Typo error, the instrument should be now in NOx mode.

Annex X

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/14

Amended during the session (see para. 022)

A new Supplement to the 06 series of amendments to UN Regulation No. 49

I. Proposal

Part 1) - Amendments to Annex 4, in line with Working Document ECE/TRANS/WP.29/GRPE/2021/6 as modified by informal document GRPE-82-22

In Annex 4

Paragraph 8.4.2.3., Equation (36), amend to read:

"…

The following equation shall be applied:

~~$m_{gas} = u_{gas} \times \sum_{i=1}^{i=n} c_{gas,i} \times q_{mew,i} \times \frac{1}{f}$ (in g/test)~~

$$\boldsymbol{m_{gas} = u_{gas} \times \sum_{i=1}^{i=n} \left(c_{gas,i} \times q_{mew,i} \times \frac{1}{f} \right)} \quad \textbf{in (g/test)} \qquad (36)$$

Where:

…"

Paragraph 8.4.2.4., Equation (37), amend to read:

"…

The following equation shall be applied:

~~$m_{gas} = \sum_{i=1}^{i=n} u_{gas,i} \times c_{gas,i} \times q_{mew,i} \times \frac{1}{f}$ (in g/test)~~

$$\boldsymbol{m_{gas} = \sum_{i=1}^{i=n} \left(u_{gas,i} \times c_{gas,i} \times q_{mew,i} \times \frac{1}{f} \right)} \quad \textbf{in } \left(\frac{\mathbf{g}}{\mathbf{test}} \right) \qquad (37)$$

Where:

…"

Paragraph 8.5.1.4., Equation (54), amend to read:

"…

$$Q_{SSV} = \frac{A_0}{60} d_V^2 C_d p_p \sqrt{\left[\frac{1}{T} \left(r_p^{1.4286} - r_p^{1.7143} \right) \cdot \left(\frac{1}{1 - r_D^4 r_p^{1.4286}} \right) \right]} \qquad (54)$$

Where:

A_0 is ~~0.0061110~~**0.005692** in SI units of $\left(\frac{m^3}{\min} \right) \left(\frac{K^{\frac{1}{2}}}{kPa} \right) \left(\frac{1}{mm^2} \right)$

d_V is the diameter of the SSV throat, ~~m~~**mm**

…"

Paragraph 8.5.2.3.1., Equation (57), amend to read:

"…

$$u_{gas} = \frac{M_{gas}}{M_d \times \left(1 - \frac{1}{D}\right) + M_e \times \left(\frac{1}{D}\right)} \times \frac{\mathbf{1}}{\mathbf{1000}} \qquad (57)$$

…"

Paragraph 8.6.1., amend to read:

"…

Depending on the measurement system and calculation method used, the uncorrected emissions results shall be calculated with equations 36, 37, 56, ~~57~~**58** or 62, respectively. For calculation of the corrected emissions, c_{gas} in equations 36, 37, 56, ~~57~~**58** or 62, respectively, shall be replaced with c_{cor} of equation 66. If instantaneous concentration values $c_{gas,i}$ are used in the respective equation, the corrected value shall also be applied as instantaneous value $c_{cor,i}$. In equation**s** ~~57~~**58 and 62**, the correction shall be applied to both the measured and the background concentration.

…"

Paragraph 9.5.4.1., amend to read:

"9.5.4.1. Data analysis

…

$$C_d = \frac{Q_{ssv}}{\frac{\mathbf{A_0}}{\mathbf{60}} \times d_V^2 \times p_p \times \sqrt{\left[\frac{1}{T} \times \left(r_p^{1.4286} - r_p^{1.7143}\right) \times \left(\frac{1}{1 - r_D^4 \times r_p^{1.4286}}\right)\right]}} \qquad (89)$$

Where:

Q_{SSV} is the *airflow* rate at standard conditions (101.3 kPa, 273 K), m^3/s

T is the temperature at the venturi inlet, K

d_V is the diameter of the SSV throat, ~~m~~**mm**

…

$$\mathrm{Re} = A_1 \times \mathbf{60} \times \frac{Q_{SSV}}{d_V \times \mu} \qquad (90)$$

With

$$\mu = \frac{\mathrm{b} \times T^{1.5}}{\mathrm{S} + T} \qquad (91)$$

Where:

A_1 is ~~25.55152~~ **27.43831** in SI units of $\left(\frac{\boldsymbol{kg}}{m^3}\right)\left(\frac{min}{s}\right)\left(\frac{mm}{m}\right)$

Q_{SSV} is the airflow *rate* at standard conditions (101.3 kPa, 273 K), m^3/s

d_V is the *diameter* of the SSV throat, ~~m~~**mm**

…"

Annex 4 Appendix 2

Paragraph A.2.1.3., amend to read:

"A.2.1.3. Components of Figures 9 and 10

EP Exhaust pipe

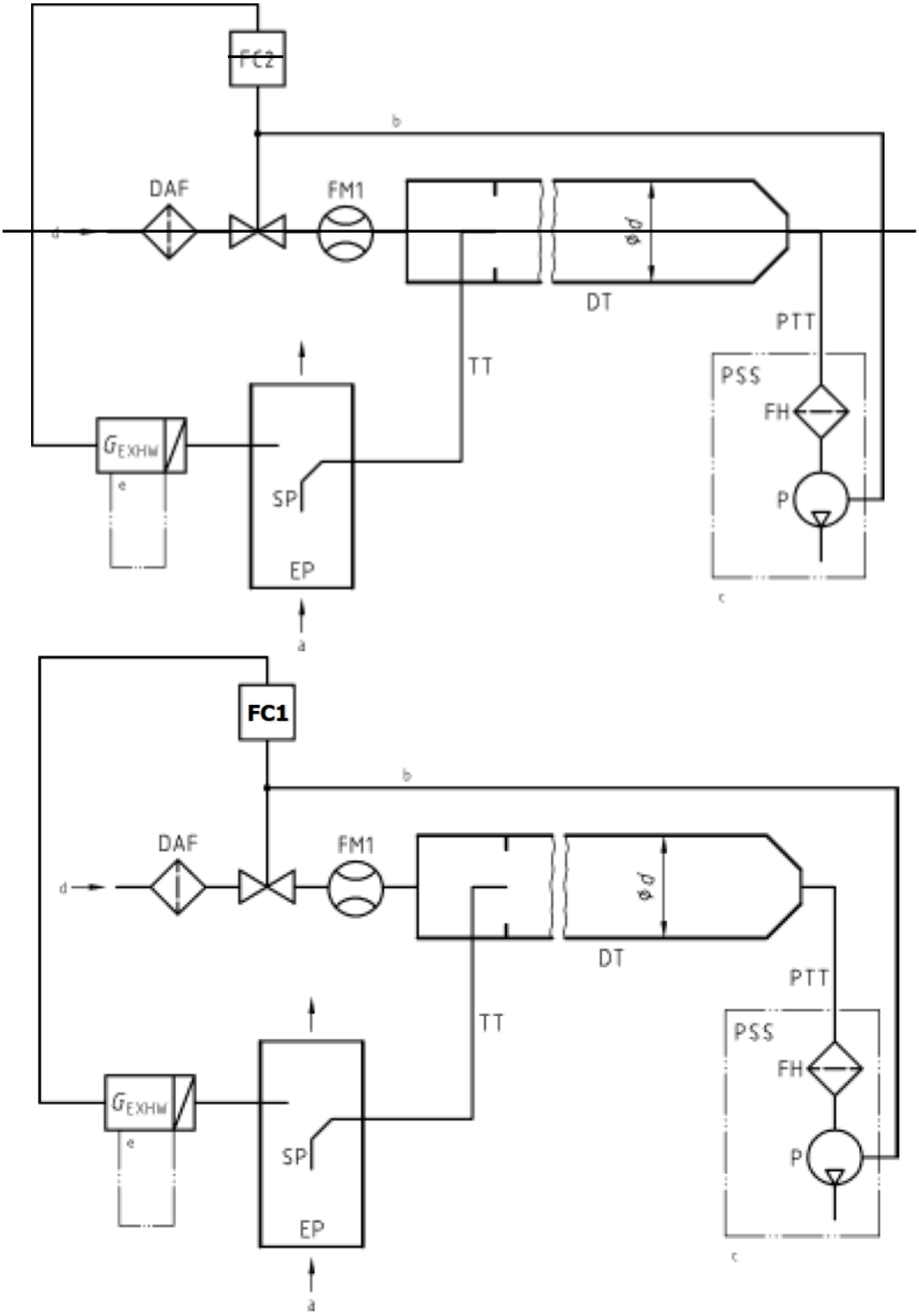
~~SP~~**SP1** Raw exhaust gas sampling probe (Figure 9 only)

…"

Paragraph A.2.2.1., amend to read:

"…

Figure 12
Scheme of partial flow dilution system (total sampling type)



a = exhaust b = optional c = details see Figure 16

…"

Paragraph A.2.2.5., amend to read:

"…

For a partial flow dilution system, a sample of the diluted exhaust gas is taken from the dilution tunnel DT through the particulate sampling probe PSP and the particulate transfer tube PTT by means of the sampling pump P, as shown in Figure 16. The sample is passed through the filter holder(s) FH that contain the particulate sampling filters. The sample flow rate is controlled by the flow controller ~~FC3~~**FC2**.

For of full flow dilution system, a double dilution particulate sampling system shall be used, as shown in Figure 17. A sample of the diluted exhaust gas is transferred from the dilution tunnel DT through the particulate sampling probe PSP and the particulate transfer tube PTT to the secondary dilution tunnel SDT, where it is diluted once more. The sample is then passed through the filter holder(s) FH that contain the particulate sampling filters. The diluent flow rate is usually constant whereas the sample flow rate is controlled by the flow controller ~~FC3~~**FC2**. If electronic flow compensation EFC (see Figure 15) is used, the total diluted exhaust gas flow is used as command signal for ~~FC3~~**FC2**.

…"

Part 2) – Further amendments to Annex 4 proposed by OICA, not included in the document ECE/TRANS/WP.29/GRPE/2021/6

Paragraph 8.2., amend to read:

"8.2. NOx correction for humidity

As the NOx emission depends on ambient air conditions, the NOx concentration shall be corrected for humidity with the factors given in paragraph 8.2.1. or 8.2.2. The intake air humidity Ha may be derived from relative humidity measurement, dew point measurement, vapour pressure measurement or dry/wet bulb measurement using generally accepted equations.

For all humidity calculations (for example Ha, Hd) using generally accepted equations the saturation vapour pressure is required. For calculating the saturation vapour pressure which is in general a function of the temperature (at the humidity measurement point) the equation D.15 specified in Annex D to ISO Standard 8178-4:2020 should be used."

Paragraph 9.2., Table 7, amend to read:

"Table 7
Linearity requirements of instruments and measurement systems

Measurement system	*χmin X (a1 - 1)+ a0*	*Slope a1*	*Standard error SEE*	*Coefficient of Determination r2*
Engine speed	≤ 0.05 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Engine torque	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Fuel flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Airflow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Exhaust gas flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Diluent flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Diluted exhaust gas flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Sample flow	≤ 1 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990

Gas analyzers	≤ 0.5 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Gas dividers	≤ 0.5 % max	0.98 - 1.02	≤ 2 % max	≥ 0.990
Temperatures	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Pressures	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
PM balance	≤ 1 % max	0.99 - 1.01	≤ 1 % max	≥ 0.998
Humidity measurement device	**≤ 2 % max.**	**0.98 – 1.02**	**≤ 2 %**	**≥ 0.95**

"

Paragraph 9.3.3.1., amend to read:

"9.3.3.1. Pure gas

…

Hydrogen ~~**helium**~~ mixture (FID burner fuel)
(40 ± 1 per cent hydrogen, balance helium **or alternatively nitrogen**)
(Contamination ≤1 ppm C1, ≤400 ppm CO2)"

Paragraph 9.3.6.8., amend to read:

"9.3.6.8. NO**x** mode

~~**Switched to**~~ **Keeping** NO**x** mode with the ozonator deactivated, the flow of oxygen or synthetic air shall be shut off. The NOx reading of the analyzer shall not deviate by more than ±5 per cent from the value measured according to paragraph 9.3.6.2. (the analyzer is in the NO**x** mode)."

Paragraph 9.3.6.2., amend to read:

"9.3.6.2. Calibration

The CLD and the HCLD shall be calibrated in the most common operating range following the manufacturer's specifications using zero and span gas (the NO content of which shall amount to about 80 per cent of the operating range and the NO2 concentration of the gas mixture to less than 5 per cent of the NO concentration). **With the ozonator deactivated**, the NOx analyzer shall be in the NO mode so that the span gas does not pass through the converter. The indicated concentration has
to be recorded."

II. Justification

For Part 1)

1. Paragraph 8.4.2.3. /8.4.2.4.

In equations (36) and (37), all the calculation equations after Sigma need to be performed in Sigma. Therefore, parentheses are added to calculations after sigma.

2. Paragraph 8.5.1.4.

In the dimension of the volume flow equation, the coefficient A_0 must be divided by 60. Similarly, the coefficient A_0 must be 0.005692 in the standard conditions (273K, 101.3kPa). In addition, the unit of the SSV throat diameter d_V must be (mm).

3. Paragraph 8.5.2.3.1.

Equation (57) needs to be multiplied by 1/1000 to adjust the number of digits. The number of digits is correctly adjusted in the equations (38) and (39), and the number of digits is similarly adjusted in the equation (57).

4. Paragraph 8.6.1.

In the text, the equation to be referenced is incorrect. It is equation (58) that needs to be referenced.

5. Paragraph 9.5.4.1.

The discharge coefficient of the SSV needs to be correlated with the SSV mass flow rate calculation formula. Therefore, the coefficient A_0 divided by 60 is added. In addition, the unit of the SSV throat diameter d_V must be (mm).

Reynolds number must be multiplied by 60. The coefficient A_1 must be 27.43831 in the standard state (273K, 101.3kPa). In addition, the coefficient A_1 needs (kg) when converted to SI units.

6. Paragraph A.2.1.3.

In Figure 9, raw exhaust gas sampling probe is represented by “SP1”, whereas “SP” is indicated in the text. Therefore, it is necessary correctly set “SP1” in the text.

7. Paragraph A.2.2.1.

In the text, the flow controller is represented by “FC1”, whereas in Figure 12, it is “FC2”. Therefore, it is necessary to correctly set “FC1” in Figure 12.

8. Paragraph A.2.2.5.

In Figure 16 and Figure 17, the sample flow controller is represented as “FC2”, whereas in the text, it is “FC3”. Therefore, it is necessary correctly set “FC2” in the text.

For Part 2)

1. UN Regulation No.49 defines no linearity requirements for humidity sensors. As the humidity content of the intake air is an essential measure for the calculation of the specific exhaust emission, it is important to add requirement for humidity sensor.

Reference: ISO 16183 the accuracy of the absolute humidity shall be +- 5%.

2. Typo error, the instrument should be now in NOx mode.

3. To clarify the operation procedure, make the text easier to be understood.

Annex XI

[English only]

Adopted amendments to ECE/TRANS/WP.29/GRPE/2021/16

Amended during the session (see para. 0031)

A new Supplement to UN Regulation No. 133

I. Proposal

Annex 6, ~~paragraph 1.,~~ amend to read:

"~~1. Introduction~~

~~This annex addresses~~ **contains** ~~the component parts of vehicles belonging to category M_1 and those belonging to category N_1 which: shall not be reused in the construction of new vehicles.~~

~~**(a) Be deemed to be non-reusable for the purposes of calculating the recyclability and recoverability rates;**~~

~~**(b) Not be reused in the construction of vehicles covered by this Regulation."**~~

1. List of component parts:

(a) All airbags, including cushions, pyrotechnic actuators, electronic control units and…"

II. Justification

1. Paragraph 7.1. of the core text of UN Regulation No. 133 contains the reference to Annex 6. The proposal is to reproduce subparagraphs (a) and (b) of that paragraph 7.1. correctly into Annex 6 or to delete the introduction part totally. The final decision is to delete the introduction totally.

2. Thus, it becomes not possible to interpret paragraph 1. of Annex 6 in a different way from the interpretation of paragraph 7.1. of the core text of UN Regulation No. 133.

Annex XII

[English only]

Request for authorization to develop a new UN GTR on brake PM and PN emissions

Adopted on the basis of GRPE-83-11 (see para. 036)

I. Mandate and Objectives

1. In 2013, following the submission of informal documents by the Russian Federation, UNECE WP.29 agreed with the GRPE decision to assign the follow-up of the issues concerning the emissions of particles from tyre and brake wear to the Informal Working Group on Particle Measurement Programme (IWG on PMP).

2. The main objective of the Informal Working Group on Particle Measurement Programme (IWG on PMP) was to investigate whether there is a need to extend particle measurement procedures to additional sources such as brake wear and the interaction between tyres and road.

3. Under continued work by the Informal Working Group on Particle Measurement Programme (IWG on PMP), the main objective of this proposal is to seek authorization for the IWG on PMP to begin a new mandate, specifically to develop a new UN GTR on the topic of brake PM and PN emissions of LDV's brake systems.

II. Introduction

4. Since the beginning of the Informal Working Group on Particle Measurement Programme (IWG on PMP), the activities focused on the development of an alternative metric to the Particulate Matter (PM) mass measurement system for Heavy Duty (HD) and Light Duty (LD) engines/vehicles (M and N category vehicles). This phase concluded with the development and adoption of the UN Regulation No. 83 (Emissions of M_1 and N_1 vehicles) (R83) and the UN Regulation No. 49 (Emissions of compression ignition and positive ignition (LPG and CNG) engines) (R49) of a particle number (PN) counting method for ultrafine solid particles and the enhancements to the PM measurement procedure for R83. Initially, the PN protocol was applied for diesel engines/vehicles only in the 06 series of amendments of UN Regulation No. 83 (R83.06) and UN Regulation No. 49 (R49.06), and subsequently has been extended to cover vehicles using spark ignition direct injection engines in R83.06. In 2013, the European Union (EU) and Switzerland requested further investigation of PN emissions from spark ignition engines relating to particle size (reduction of the 50% counting efficiency specification, d50) and to emissions under rich operation conditions. **At the same time, it was also requested to consider whether there is a need to extend particle measurement procedures to additional sources such as brake wear and the interaction between tyres and road.**

5. In June 2013, the first mandate of the IWG on PMP with reference to non-exhaust emissions was approved by AC.3. The IWG on PMP aimed to accomplish the following objectives, which were successfully completed by June 2016:

(a) Conduct a literature survey with the objective of summarizing the current knowledge on the physical/chemical nature, mass, number and size distribution of non-exhaust particle emissions;

(b) Identify and report the main knowledge gaps and the needs for future research and consideration. This objective was materialized as a report submitted to the 69th GRPE session (Informal Document GRPE-69-23);

(c) Establish a group of experts on the field of non-exhaust emissions as well as a mechanism for sharing information and on-going research on topics related to non-exhaust emissions and the environment;

(d) Analyse the WLTP database with the aim of defining normal and extreme driving conditions and gather information on existing methodologies for sampling and measuring non-exhaust emissions;

(e) Introduce the discussion regarding the selection of the most suitable testing approach for brake emissions and define the pros and cons of different available options (brake test rig, full vehicle chassis dyno, full vehicle on-road, etc.).

6. Subsequently, a second mandate for the IWG on PMP with specific reference to non-exhaust emissions was approved in June 2016 by AC.3. The IWG on PMP was mandated to develop a suggested common test procedure for sampling and assessing brake wear particles both in terms of mass and number. The aim of the suggested methodology would be to provide the necessary tool for rendering future studies on brake emissions comparable to each other. During the reporting period of the 2016 mandate the following items were addressed:

(a) Selection or development of a test cycle appropriate for the investigation of Brake Wear Particles;

(b) Investigation and selection of the appropriate methodologies for particles generation and sampling;

(c) Investigation and selection of the appropriate instrumentation for the measurement and characterization of brake wear particles.

7. After completing a thorough analysis regarding the suitability of existing brake cycles the IWG on PMP decided to proceed with the development of a novel test cycle appropriate for the investigation of Brake Wear Particles. For that reason, the IWG on PMP decided to create a dedicated Task Force (TF1) to accelerate the development (October 2016). In September 2017, the IWG on PMP decided to create a dedicated Task Force (TF2) with the aim of addressing items (b) and (c). The TF2 decided to merge items (b) and (c) and initiated its activities in October 2017.

8. During the reporting period (2016-2019), the IWG on PMP aimed to accomplish the following objectives:

(a) Selection of the brake test rig methodology for the generation and sampling of brake wear particles;

(b) Agreement on the method's target measurement parameters. TF2 agreed unanimously that both PM (PM_{10} and $PM_{2.5}$) and PN (>10 nm) emissions shall be addressed;

(c) Development and publication of the WLTP-Brake cycle. The cycle is based on real-world data extracted from the WLTP database and is considered representative of real-world applications;

(d) Validation of the WLTP-Brake cycle through a Round Robin exercise which was completed in 8 different laboratories in Europe and the United States;

(e) Thorough analysis of the existing methods and setups for the sampling and measurement of brake particle emissions. Agreement on the need of defining a set of minimum specifications and requirements for sampling and measurement of brake particle emissions.

9. The mandate for the IWG on PMP with reference to non-exhaust emissions was further extended in June 2019 by AC.3. The revised mandate included an additional item compared to 2016, which foresaw the validation of the proposed methodology for the measurement and characterization of brake wear particles. During the reporting period (2019-2020), the IWG on PMP aimed to accomplish the following objectives:

(a) AC.3 approved the informal document GRPE-81-12 (June 2020). The GRPE-81-12 informed and updated the GRPE of the work of the IWG on PMP Task Force 1 (TF1) on the development of the novel WLTP-Brake Cycle and its application on the measurement and characterization of brake emissions at brake dynamometer level;

(b) A first discussion on how to address future technologies took place at the IWG on PMP level following the request of several GRPE stakeholders;

10. The mandate for the IWG on PMP with reference to non-exhaust emissions was further extended in June 2020 by AC.3. Following the discussion at the IWG on PMP level, the revised mandate included the extension of the proposed methodology to future technologies. In June 2020, several GRPE Contracting Parties urged the IWG on PMP to start considering a possible use of the proposed method as a regulatory tool. For that reason, the IWG on PMP was requested to start looking to the necessary changes/adaptations with the aim of extending the method to all existing technologies and other vehicle categories.

11. During the 81st GRPE session it was proposed to hold a workshop involving Stakeholders and Contracting Parties with the aim of discussing the possible approaches to regulate brake wear particle emissions. The workshop took place in January 2021 and its focus was to pave the way to a future regulatory process. The main topics discussed during the workshop include:

(a) The ideal scheme for regulating brake emissions from conventional ICE Light-Duty vehicles;

(b) How to handle non-conventional Light-Duty vehicles (i.e. HEVs, EVs) in a future regulatory approach;

(c) HD vehicle brake emissions and possible approaches.

12. As a follow up of the workshop the interested Contracting Parties and the IWG on PMP recommend that a UN GTR on brake PM and PN emissions from all types of LDV's brake systems is developed under a new mandate.

III. Areas of work

13. The representatives of the European Union, UK and Japan seek AC.3 the authorization to develop a new UN GTR on brake PM and PN emissions from all types of LDV's brake systems as follows:

(a) Validation of the developed novel test cycle for the investigation of Brake Wear Particles;

(b) Investigation and selection of the appropriate instrumentation and sampling methodology for the measurement and characterization of brake wear particles;

(c) Definition of the minimum requirements for brake wear particles sampling;

(d) Validation of the proposed approach for the measurement and characterization of brake wear particles through an Interlaboratory study;

(e) Inclusion of regenerative braking;

(f) Preparation of the PMP Brake protocol for sampling and measuring brake wear PM and PN emissions.

At a second phase, the following items might be addressed:

(a) Definition of a real world cycle/s for use in the laboratory;

(b) Adaptation of the proposed methodology to include future technologies;

(c) Adaptation of the proposed methodology to address brake emissions from heavy-duty vehicles.

IV. Existing regulations

14. Brake PM and PN emissions from LDV's are currently not regulated by any UN GTR or regional Regulations. The contracting parties sponsoring this activity consider a UN GTR governing brake emissions for these vehicles as necessary in order to regulate emissions of brakes.

V. Timeline

15. The timelines proposed below for the new mandate are target timelines. The plan will be regularly reviewed and updated to reflect progress and feasibility of the timeline.

(a) June 2021: timeline and framework for mandate request are presented in GRPE.

(b) June 2021: Request for authorization submitted to AC.3;

(c) June 2021: TF2 finalizes the discussion on the definition of the minimum requirements for brake wear particles generation and sampling;

(d) June 2021: TF2 finalizes the selection of the appropriate instrumentation and sampling methodology for the measurement and characterization of brake wear particles;

(e) June 2021 – September 2021: IWG on PMP organizes the Round Robin exercise with the aim of collecting information and data on the proposed approach for the measurement and characterization of brake wear particles;

(f) September 2021 – December 2021: IWG on PMP executes the Round Robin exercise with the aim of collecting information and data on the proposed approach for the measurement and characterization of brake wear particles;

(g) December 2021 – February 2022: Collection of the results and data processing from the Round Robin exercise;

(h) March 2022 – April 2022: Preparation of the PMP Brake protocol for sampling and measuring brake wear PM and PN emissions;

(i) June 2022: Submission of informal document with draft GTR

(j) October 2022: Submission of working document with draft GTR for January 2023 GRPE

(k) 2023-2025: Development of items in second phase.