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## Economic Commission for Europe

### Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

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Item 4.7.6 of the provisional agenda

#### 1958 Agreement:

Consideration of draft amendments to existing

UN Regulations submitted by GRVA

## Proposal for a Supplement 13 to the 03 series of amendments to UN Regulation No. 79 (Steering Equipment)

### Submitted by the Working Party on Automated/Autonomous and Connected Vehicles \*

The text reproduced below was adopted by the Working Party on Automated/Autonomous and Connected Vehicles (GRVA) at its twenty-first session (ECE/TRANS/WP.29/GRVA/21, para. 93). It is based on ECE/TRANS/WP.29/GRVA/2025/6 and ECE/TRANS/WP.29/GRVA/2025/7 as amended by informal document GRVA-21-11/Rev.2. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their June 2025 sessions.

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\* In accordance with the programme of work of the Inland Transport Committee for 2025 as outlined in proposed programme budget for 2025 (A/79/6 (Sect. 20), table 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.



*Insert new paragraphs 2.12. to 2.17., to read:*

- “2.12.        *"Electrical Storage Device (ESD)"* means a device, or combination of individual devices, each capable of storing an electrical charge and of providing electrical power to the transmission of a full-power steering system. Electrical storage devices which are connected in series and/or parallel shall be considered as one electrical storage device within this Regulation. Additionally, an electrical storage device is to be understood as an energy reservoir within the meaning of paragraph 2.3.6.2.
- 2.13.        The *"performance of an electrical storage device"* means its ability to provide power (W) and quantity of energy (Wh) when fully charged.
- 2.14.        The *"state of an electrical storage device"* means its ability to provide power (W) and quantity of energy (Wh) at the time.
- 2.15.        The *"effect of ageing"* is quantifying the irreversible degradation of the performance of an electrical storage device of a full power steering system, due to e.g., the effects of time, use, and environmental exposure.
- 2.16.        *"Energy Management System"* means, an electrical device(s), being part of, or used by, a full power steering system, that monitors critical variables that impact on the performance and state of the electrical storage device(s) (e.g., voltage, temperature, internal resistance, effect of ageing, state of charge, power consumption, charging cycles, etc.) and deduces the actual capability of the devices to fulfil the performance requirements of this Regulation.
- 2.17.        *"Electrical supply"* means a device (e.g. battery, REESS, generator, fuel-cell or a combination of these components) that supplies electrical power to the steering system's electrical storage device(s).”

*Paragraph 5.3.1.1., amend to read:*

- “5.3.1.1.     For the purposes of this Regulation the steered wheels, the steering control and all mechanical parts of the steering transmission shall not be regarded as liable to breakage if they are amply dimensioned, are readily accessible for maintenance, and exhibit safety features at least equal to those prescribed for other essential components (such as the braking system) of the vehicle. Where the failure of any such part would be likely to result in loss of control of the vehicle, that part shall be made of metal or of a material with equivalent characteristics (e.g. similar strength and fatigue life attributes) and shall not be subject to significant distortion in normal operation of the steering system.”

*Paragraphs 5.3.1.4. to 5.3.1.6., (unchanged) reproduced for easy reference:*

- “5.3.1.4.     In the case where the braking system of the vehicle shares the same energy source as the steering system and this energy source fails, the steering system shall have priority and shall be capable of meeting the requirements of paragraphs 5.3.2. and 5.3.3. as applicable. In addition the braking performance on the first subsequent application, shall not drop below the prescribed service brake performance, as given in paragraph 2. of Annex 3 to this Regulation.
- 5.3.1.5.     In the case where the braking system of the vehicle shares the same energy supply as the steering system and there is a failure in the energy supply, the steering system shall have priority and shall be capable of meeting the requirements of paragraphs 5.3.2. and 5.3.3. as applicable. In addition the braking performance on the first subsequent application shall comply with the prescriptions of paragraph 3. of Annex 3 to this Regulation.
- 5.3.1.6.     The requirements for the braking performance in paragraphs 5.3.1.4. and 5.3.1.5. above shall not apply if the braking system is such that in the absence of any energy reserve it is possible with the service brake control to achieve the safety requirement for the secondary braking system mentioned in:
- (a)        Paragraph 2.2. of UN Regulation No. 13-H, Annex 3 (for M<sub>1</sub> and N<sub>1</sub> vehicles);

- (b) Paragraph 2.2. of UN Regulation No. 13, Annex 4 (for M<sub>2</sub>, M<sub>3</sub> and N vehicles).”

*Insert a new paragraph 5.3.1.8., to read:*

- “5.3.1.8. When a full power steering system satisfies paragraph 5.3.3.6., it is considered to have been given sufficient priority as specified in paragraphs 5.3.1.4. and 5.3.1.5.”

*Amend paragraph 5.3.3.3. to 5.3.3.5., to read:*

- “5.3.3. Full power steering systems
- 5.3.3.1. The system shall be designed such that the vehicle cannot be driven indefinitely at speeds above 10 km/h where there is any fault which requires operation of the warning signal referred to in paragraph 5.4.2.1.1.
- 5.3.3.2. In case of a failure within the control transmission, with the exception of those parts listed in paragraph 5.1.4., it shall still be possible to steer with the performance laid down in paragraph 6. for the intact steering system.
- 5.3.3.3. In the event of a failure of the energy source, or of the electrical supply, of the control transmission, it shall be possible to carry out at least 24 "figure of eight" manoeuvres, where each loop of the figure is 40 m diameter at 10 km/h speed and at the performance level given for an intact system in paragraph 6. The test manoeuvres shall begin at an energy storage level given in paragraph 5.3.3.5. In the case where the energy transmission, or a part of it, shares the same energy source, or same electrical supply, as the control transmission, the requirements of paragraph 5.3.3.6. may be used as an alternative to those above.
- 5.3.3.4. In the event of a failure within the energy transmission, with the exception of those parts listed in paragraph 5.3.1.1., there shall not be any immediate changes in steering angle. As long as the vehicle is capable of being driven at a speed greater than 10 km/h the requirements of paragraph 6. for the system with a failure shall be met after the completion of at least 25 "figure of eight" manoeuvres at 10 km/h minimum speed, where each loop of the figure is 40 m diameter.

The test manoeuvres shall begin at an energy storage level given in paragraph 5.3.3.5. In case the safety concept of the vehicle manufacturer is preventing from performing the 25 "figure of eight" manoeuvres as specified above (e.g. the traction is limited to below 10km/h before the completion of the 25 manoeuvres), the procedure by which this requirement can be checked shall be agreed between the manufacturer and the Technical Service. This procedure shall be recorded in the test report and included in the type-approval documentation.

Additionally, in case the safety concept also includes automatic braking to actively reduce the vehicle speed, the deceleration demand shall not exceed 2 m/s<sup>2</sup>. Any automatic deceleration demand shall start earliest 60 seconds after the failure detection. In case the longitudinal movement is controlled by another system (e.g. Advanced Emergency Braking System (AEBS), Automatic Cruise Control (ACC)) the vehicle may decelerate at a higher value or at an earlier point in time than specified above, e.g. to avoid a collision.

The safety concept used to fulfil the requirements above shall be described by the vehicle manufacturer and assessed according to the requirements of Annex 6.

- 5.3.3.5. The energy level to be used for the tests referred to in paragraphs 5.3.3.3. ~~and~~, 5.3.3.4. and 5.3.3.6. shall be the energy storage level at which a failure is indicated to the driver.

In the case of electrically powered systems subject to Annex 6, this level shall be the worst case situation outlined by the manufacturer in the documentation

submitted in connection with Annex 6 and shall take into account the effects of e.g. temperature and ageing on battery performance.”

*Insert a new paragraph 5.3.3.6. and subparagraphs, to read:*

“5.3.3.6. In case the alternative to paragraph 5.3.3.3. is used, the following requirements shall apply:

5.3.3.6.1. The vehicle shall be brought to one of the conditions below, whereby the requirements of paragraph 6 for an intact system shall be satisfied until the corresponding condition is reached:

- (a) A speed below or equal 10 km/h or standstill, in case the failure does not affect the ability of the braking system to provide the service braking performance as specified in UN Regulation No. 13 or 13-H (as relevant), or
- (b) Standstill, in case the failure affects the ability of the braking system to provide the service braking performance.

5.3.3.6.2. It shall be ensured that the condition as per paragraph 5.3.3.6.1. is reached at the latest before the energy level is down to an amount not allowing for a further lane change as specified in paragraph 5.3.3.6.3., unless the failure leads to loss of propulsion.

Additionally, the system shall aim at using the remaining energy in order to maximize the time before reaching the condition as per paragraph 5.3.3.6.1. The means by which this requirement is fulfilled shall be described by the manufacturer and assessed according to Annex 6.

5.3.3.6.3. After failure occurrence sufficient energy shall be available to steer the vehicle. The amount of energy is deemed sufficient if it is possible to perform 18 subsequent lane changes for vehicles of Categories M<sub>1</sub> and N<sub>1</sub>, and 9 lane changes for vehicles of categories M<sub>2</sub>, M<sub>3</sub>, N<sub>2</sub> and N<sub>3</sub>, within a maximum time of 90s, with a vehicle speed of 20 km/h (+/- 2 km/h). The lane changes shall be alternately to the left and then to the right, while the lateral movement of the vehicle shall be at least 3 meters. In case the safety concept of the vehicle manufacturer is preventing from completing the number of lane changes as specified above at the required speed, the remaining number of lane changes shall be performed at the reduced speed according to the safety concept. This procedure shall be recorded in the test report and included in the type-approval documentation.

It shall be understood, that para. 6.1.4. applies during the procedure as described above.

5.3.3.6.4. The maximum deceleration demand to reach the condition as per paragraph 5.3.3.6.1. shall not exceed 2 m/s<sup>2</sup>.

However, the deceleration demand may be increased up to 4 m/s<sup>2</sup>, only in the case that such higher deceleration is necessary to comply with the requirements of paragraphs 5.3.3.6.2. and 5.3.3.6.3., in specific conditions to be specified by the vehicle manufacturer and to be assessed as per Annex 6 to this regulation. It should be understood that the driver still has the possibility to stop the vehicle earlier. In case the longitudinal movement is controlled by another system (e.g. AEBS, ACC) the vehicle may decelerate at a higher value, e.g. to avoid a collision.

5.3.3.6.5. Any automatic deceleration shall start earliest 60 seconds after the failure detection, unless the condition specified in 5.3.3.6.2. and/or 5.3.3.6.4. (i.e. in case the longitudinal movement is controlled by other systems like AEBS, ACC) are met before. Additionally, there shall be a warning that includes information on the immediacy of the need to bring the vehicle to a stop, and a dynamic indication of when the automatic deceleration is expected to begin (e.g. status bar). The signal to activate the hazard warning lights shall be

generated with the start of the automatic deceleration. The hazard warning light signal shall be overridden by the direction indicator, when the driver manually activates it.

- 5.3.3.6.6. Upon reaching standstill the vehicle shall be prevented from rolling away either automatically or by requesting an action by the driver. If required, sufficient energy shall be available to satisfy this requirement (e.g. application of an electric parking brake).
- 5.3.3.6.7. There shall be an energy management system for the electrical storage device(s).
- 5.3.3.6.7.1. The energy management system shall be capable of continuously assessing the electrical storage device(s), to determine their ability to deliver to the steering transmission the needed power, over time, to fulfil the performance requirements of this Regulation and, where appropriate, of activating the warning signals required by this Regulation.

If the assessment is not complete at the time that the start/run switch is moved to the on (run) position, a red warning signal shall be activated and shall remain active until the safe status of the electrical storage device(s) has been confirmed. The red warning signal prescribed in paragraph 5.4.2.1.1. may be used. This requirement shall apply even after a maintenance operation on the electrical storage device and/or the energy management system (e.g. the replacement/temporary disconnection of an electrical storage device, or the replacement of the energy management system itself).

The method by which the energy management system determines the safe status, including after maintenance, shall be described by the manufacturer at the time of type approval. Compliance with these requirements shall be demonstrated to the satisfaction of the Technical Service, including an assessment according to Annex 6.

- 5.3.3.6.7.2. It shall be demonstrated that the energy management system accurately identifies the condition at which the warning signals required by paragraph 5.4.2.1.5. of this Regulation are activated.

The Technical Service shall take account of the influence of the individual variables used by the energy management system, on both the performance and the state of the electrical storage device(s).

The Technical Service shall verify that the accuracy of the energy management system is ensured under all operating conditions (for example different environmental conditions) that can reasonably be foreseen by reviewing the documentation provided by the manufacturer and performing tests of the energy management system in different conditions (e.g., changes in temperature).

- 5.3.3.6.7.3. In the context of the assessment described in paragraph 5.3.3.6.7.2., the manufacturer shall provide the following information as part of the documentation required by Annex 6, paragraph 3:

- (a) Regarding the Energy Management System;
  - (i) A detailed overview of the energy management system, explaining its architecture, components, and functionality,
  - (ii) A description of how the system monitors electrical storage device(s).
  - (iii) Sufficient information about the energy management system strategy to illustrate the algorithms and logic used to assess the state and the performance of electrical storage device(s).
  - (iv) A list of all the input variables considered by the energy management system in assessing the state and the performance of the electrical storage device(s).

- (v) A sensitivity analysis showing how each of the listed variables affects the ability of the energy management system to accurately identify when a warning signal shall be activated.
  - (b) Regarding the relevant verification testing the documentation shall include:
    - (i) The thresholds, or criteria, that trigger the warning signals described in paragraph 5.4.2.1.1. and paragraph 5.4.2.1.2.
    - (ii) Results of verification testing to assess the accuracy of the energy management system.
    - (iii) Data on different operating conditions, such as temperature or battery ageing.
    - (iv) An outline of the boundary conditions that could impact the accuracy of the energy management system (e.g., temperature, aging characteristics)
    - (v) In response to paragraph 3.4.4. of Annex 6, a description of the strategy in the event of a failure of the energy management system, or of an input channel to the energy management system, when relevant to the steering functionality.
    - (vi) When applicable, the procedures for updating the energy management system and ensuring its ongoing maintenance.
    - (vii) The appropriate testing procedures to be taken into account when performing the relevant verification testing to assess compliance with paragraph 5.4.2.1.5.
- 5.3.3.6.7.4. In the event of a failure of the energy management system or an input channel of the energy management system that prevents the assessment of the state of the electrical storage device(s), a red visual warning signal, accompanied by an audible signal, shall be activated at the moment of the detection of the failure (i.e. a first time in operation then at each start-up thereafter). The operation of the acoustic signal may be temporary, but the visual warning must remain active as long as the failure persists. The red warning signal prescribed in paragraph 5.4.2.1.1. may be used for visual alert. If the manufacturer's failure strategy affects steering functionality, details shall be given in the documentation required in paragraph 5.3.3.6.7.3.
- Even in the event of the failure described above, if the energy management system is still able to assess the status of the electrical storage device(s), it is sufficient to use only the yellow warning signal specified in paragraph 5.4.2.1.2.
- 5.4.2. Special provisions for full-power steering equipment
- 5.4.2.1. Power-driven vehicles shall be capable of providing steering failure and defect warning signals, as follows:
- Paragraph 5.4.2.1.1., amend to read:*
- 5.4.2.1.1. A red warning signal, indicating failures defined in paragraph 5.3.1.3. within the main steering equipment, if a single additional failure could result in a complete loss of steering function.
- Insert a new paragraph 5.4.2.1.5., to read:*
- 5.4.2.1.5. In the case where an energy management system as per paragraph 5.3.3.6.7. is installed, the following warning signals shall be displayed.
- 5.4.2.1.5.1. A warning signal shall be displayed no later than when the effect of ageing on the electrical storage device(s) is such that its performance is not sufficient to fulfil the requirements of paragraph 5.3.3.6.3. The yellow warning signal described in paragraph 5.4.2.1.2. shall be used accompanied by an information

to the driver (e.g. extra telltale, text message) that electrical storage device(s) require a maintenance check.

- 5.4.2.1.5.2. A warning signal shall be displayed no later than when the state of the electrical storage device is insufficient for more than 60 seconds to fulfil the requirements of paragraph 5.3.3.6.3. The yellow warning signal described in paragraph 5.4.2.1.2. shall be used.

Additionally, a red warning shall be displayed when the state of the ESD(s) is not sufficient to perform at least half of the values specified in paragraph 5.3.3.6.3.”

*Paragraph 5.6.4.2.1., amend to read:*

- “5.6.4.2.1. The default status of the system shall be the off mode at the initiation of the powertrain<sup>5</sup>. A new engine start (or run cycle), which is performed automatically, e.g. the operation of a stop/start system, shall not be considered an “initiation of the powertrain” wherever that term is used in this Regulation.”

Insert new *footnote 5*, to read:

- “<sup>5</sup> As defined in Mutual Resolution Mutual Resolution No. 2 (M.R.2) of the 1958 and the 1998 Agreements containing vehicle propulsion system definitions, document ECE/TRANS/WP.29/1121.”

*Renumber subsequent footnotes accordingly.*

*Paragraph 5.6.4.8.3., amend to read:*

- “5.6.4.8.3. After each initiation of the powertrain, the ACSF of Category C function shall be prevented by the power-driven vehicle from performing a lane change manoeuvre until the system of the power driven vehicle or the trailer (as relevant) has detected, at least once, a moving object at a distance greater than the minimum distance  $S_{\text{rear}}$  declared by the manufacturer in paragraph 5.6.4.8.1. above.”

*Annex 8, Paragraph 3.5.6.1., amend to read:*

- “3.5.6.1. The test vehicle shall be driven in a lane of a straight test track, which has at least two lanes in the same direction of travel, with road markings on each side of the lanes.

The vehicle speed shall be:  $V_{\text{min}} + 10\text{km/h}$ .

The ACSF of Category C shall be activated (standby mode), unless the system is already enabled according to paragraph 5.6.4.8.3., and another vehicle shall approach from the rear in order to enable the system as specified in paragraph 5.6.4.8.3. above.

The approaching vehicle shall then pass the vehicle under test entirely.

The rear sensor(s) shall be made blind, with means agreed between the vehicle manufacturer and the Technical Service, which shall be recorded in the test report. This operation may be carried out at standstill, provided no new initiation of the powertrain is performed.

The vehicle shall be driven to a speed of  $V_{\text{min}} + 10\text{km/h}$ , and a lane change procedure shall be initiated by the driver.”

*Annex 8, paragraph 3.5.7., amend to read:*

- “3.5.7. Initiation of the powertrain test

The test is divided in 3 consecutive phases as specified below.

The vehicle speed shall be:  $V_{\text{min}} + 10\text{km/h}$ .”

*Annex 8, paragraph 3.5.7.1.1., amend to read:*

“3.5.7.1.1. Following a new initiation of the powertrain performed by the driver, the test vehicle shall be driven in a lane of a straight test track, which has at least two lanes in the same direction of travel, with road markings on each side of the lanes.

The ACSF of Category C shall not be activated (off mode) and another vehicle shall approach from the rear and the approaching vehicle shall pass the vehicle entirely.

A lane change procedure and manoeuvre shall then be initiated by the driver with the appropriate deliberate action(s).”

*Annex 8, Paragraph 3.5.7.2.1., amend to read:*

“3.5.7.2.1. Following a new initiation of the powertrain performed by the driver, the test vehicle shall be driven in a lane of a straight test track, which has at least two lanes in the same direction of travel, with road markings on each side of the lanes.

The ACSF of Category C shall be manually activated (standby mode).

A lane change procedure and manoeuvre shall then be initiated by the driver with the appropriate deliberate action(s).”

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