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PROPOSAL FOR DRAFT SUPPLEMENT 2 TO REGULATION No. 13-H

(Harmonized braking)

Transmitted by the Working Party on Brakes and Running Gear (GRRF)

Note: The text reproduced below was adopted by GRRF at its forty-ninth session, and is transmitted for consideration to WP.29 and to AC.1. It is based on documents TRANS/WP.29/GRRF/2000/13 and Add.1, TRANS/WP.29/GRRF/2000/16 and TRANS/WP.29/GRRF/2001/1, all amended by GRRF (TRANS/WP.29/GRRF/49, paras. 10, 12, 26 and annex 3).

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Paragraph 2.17., amend to read:

"2.17. "Electric regenerative braking" means a braking system which, during deceleration, provides for the conversion of vehicle kinetic energy into electrical energy."

Paragraph 2.17.1., should be deleted.

Paragraphs 2.17.2. to 2.17.6. (former), renumber as paragraphs 2.17.1. to 2.17.5.

Insert a new paragraph 2.18., to read:

"2.18. "Phased braking" is a means which may be used where two or more sources of braking are operated from a common control, whereby one source may be given priority by phasing back the other source(s) so as to make increased control movement necessary before they begin to be brought into operation.

Paragraphs 2.18. and 2.18.1., renumber as paragraphs 2.19. and 2.19.1.

Paragraph 5.2.2.4., amend to read:

"... the vehicle is in motion. This requirement may be met by the actuation of the vehicle's service braking system, even partially, by means of an auxiliary control."

Paragraphs 5.2.6. and 5.2.7., amend to read (including a new footnote 3/):

"5.2.6. The service braking system shall act on all wheels of the vehicle and shall distribute its action appropriately among the axles.

5.2.7. In the case of vehicles equipped with electric regenerative braking systems of category B, the braking input from other sources of braking, may be suitably phased to allow the electric regenerative braking system alone to be applied, provided that both the following conditions are met:

5.2.7.1. Intrinsic variations in the torque output of the electrical regenerative braking system (e.g. as a result of changes in the electric state of charge in the traction batteries) are automatically compensated by appropriate variation in the phasing relationship as long as the requirements 3/ of one of the following annexes to this Regulation are satisfied:

Annex 3 paragraph 1.3.2., or
Annex 6 section 5.3. (including the case with the electric motor engaged), and

5.2.7.2. Wherever necessary, to ensure that braking rate 3/ remains related to the driver's braking demand, having regard to the

available tyre/road adhesion, braking shall automatically be caused to act on all wheels of the vehicle.

3/ The Authority, which is to grant approval, shall have the right to check the service braking system by additional vehicle test procedures."

Paragraph 5.2.8., the reference to footnote 3/ and footnote 3/ (former), renumber as footnote 4/.

Paragraph 5.2.10., amend to read:

"5.2.10. The service, secondary and parking braking systems must act on braking surfaces connected to the wheels through components of adequate strength.

Where braking torque for a particular axle or axles is provided by both a friction braking system and an electrical regenerative braking system of category B, disconnection of the latter source is permitted, providing that the friction braking source remains permanently connected and able to provide the compensation referred to in paragraph 5.2.7.1.

However, in the case of short disconnection transients, incomplete compensation is accepted, but within 1s, this compensation shall have attained at least 75 per cent of its final value.

Nevertheless, in all cases, the permanently connected friction braking source shall ensure that both the service and secondary braking systems continue to operate with the prescribed degree of effectiveness.

Disconnection of the braking surfaces of the parking braking system shall be permitted only on condition that the disconnection is controlled exclusively by the driver from his driving seat, by a system incapable of being brought into action by a leak."

Paragraph 5.2.18., amend to read:

"5.2.18. Additional requirements for vehicles equipped with electric regenerative braking systems."

Paragraphs 5.2.18.1. to 5.2.18.2.1., amend to read:

"5.2.18.1. Vehicles fitted with an electric regenerative braking system of category A.

"5.2.18.2. Vehicles fitted with an electric regenerative braking system of category B."

5.2.18.2.1. It must not be possible to disconnect, partially or totally, one part of the service braking system other than by automatic means. This should not be construed as a departure from the requirements of paragraph 5.2.10."

Paragraph 5.2.18.3., amend to read:

"5.2.18.3. For vehicles fitted with an electric regenerative braking system of either category, all the relevant prescriptions shall apply "

Insert a new paragraph 5.2.18.6., including its corresponding footnote 5/, to read:

"5.2.18.6. The state of charge of the traction batteries is determined by the method set out in appendix 1 to annex 3 to this Regulation. 5/

5/ By agreement with the technical service, state of charge assessment will not be required for vehicles, which have an on-board energy source for charging the traction batteries and the means for regulating their state of charge."

Paragraph 5.2.20.3., the reference to footnote 5/ and footnote 5/ (former), renumber as footnote 6/.

Annex 3,

Paragraphs 1.2.8. and 1.2.9., amend to read:

"1.2.8. For vehicles powered completely or partially by an electric motor (or motors), permanently connected to the wheels, all tests must be carried out with these motor(s) connected.

1.2.9. For vehicles as described in paragraph 1.2.8. above, fitted
..... "

Insert a new paragraph 1.2.11., to read:

"1.2.11. For a vehicle with electrically actuated service brakes powered from traction batteries (or an auxiliary battery) which receive(s) energy only from an independent external charging system, these batteries shall, during braking performance testing, be at an average of not more than 5 per cent above that state of charge at which the brake failure warning prescribed in paragraph 5.2.20.5. is required to be given.

If this warning is given, the batteries may receive some recharge during the tests, to keep them in the required state of charge range."

Paragraph 1.3.2., amend to read:

"1.3.2. Behaviour of the vehicle during braking on a road on which adhesion is reduced must meet the relevant requirements of annex 5 and/or annex 6 to this Regulation."

Insert a new paragraph 1.3.2.1. (including a new footnote 1/), to read:

"1.3.2.1. In the case of a braking system according to paragraph 5.2.7. where the braking for a particular axle (or axles) is comprised of more than one source of braking torque, and any individual source can be varied with respect to the other(s), the vehicle shall satisfy the requirements of annex 5, or alternatively, annex 6 under all relationships permitted by its control strategy 1/.

1/ The manufacturer shall provide the technical service with the family of braking curves permitted by the automatic control strategy. These curves may be verified by the technical service."

Insert a new paragraph 1.4.1.2.3., to read:

"1.4.1.2.3. In the case of a vehicle equipped with an electric regenerative braking system, the requirements depend on the category of this system:

Category A. Any separate electric regenerative braking control which is provided, shall not be used during the Type-0 tests.

Category B. The contribution of the electric regenerative braking system to the braking force generated shall not exceed that minimum level guaranteed by the system design.

This condition is deemed to be satisfied if the state of charge of the batteries is in one of the following conditions:

- (a) at the maximum charge level recommended by the manufacturer, as listed in the vehicle specification,
- (b) at a level not less than 95 per cent of the full charge level, where the manufacturer has made no specific recommendation,
- (c) at a maximum level resulting from automatic charge control on the vehicle."

Paragraphs 1.4.1.2.3. and 1.4.1.2.4. (former), renumber as paragraphs 1.4.1.2.4. and 1.4.1.2.5.

Paragraph 1.5.1.6., amend to read:

"1.5.1.6. For vehicles not having sufficient autonomy to carry out the cycles of heating of the brakes, the tests shall be carried

out by achieving the prescribed speed before the first braking application and thereafter by using the maximum acceleration available to regain speed and then braking successively at the speed reached at the end of each 45 second cycle duration."

Insert a new paragraph 1.5.1.7., to read:

"1.5.1.7. For vehicles equipped with an electric regenerative braking system of category B, the condition of the vehicle batteries at the start of the test, shall be such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design. This requirement is deemed to be satisfied if the batteries are at one of the state of charge conditions as listed in paragraph 1.4.1.2.3. above."

Paragraph 1.5.2.2., the reference to footnote 1/ (former) and the footnote 1/, renumber as footnote 2/

Paragraph 1.5.2.3., amend to read:

"1.5.2.3. For vehicles fitted with an electric

Insert a new paragraph 1.5.2.4., to read:

"1.5.2.4. In the case of vehicles equipped with an electric regenerative braking system of category B, having carried out the heating cycles according to paragraph 1.5.1.6. of this annex, the hot performance test shall be carried out at the maximum speed which can be reached by the vehicle at the end of the brake heating cycles, unless the speed specified in paragraph 2.1.1. (A) of this annex can be reached.

For comparison, a later Type-0 test with cold brakes shall be repeated from this same speed and with a similar electric regenerative braking contribution, as set by an appropriate state of battery charge, as was available during the hot performance test.

Following the recovery process and test, further reconditioning of the linings shall be permitted before the test is made to compare this second cold performance with that achieved in the hot test, against the criteria of paragraphs 1.5.2.2. or 1.5.2.5. of this annex."

Paragraph 1.5.2.4. (former), renumber as paragraph 1.5.2.5.

Paragraph 1.5.2.5. (former), should be deleted.

Insert a new paragraph 1.5.3.1., to read:

"1.5.3.1. Vehicles equipped with an electrical regenerative braking system of category B may have their batteries re-charged or replaced by a charged set, in order to complete the recovery procedure."

Insert a new paragraph 1.5.4.1., to read:

"1.5.4.1. For vehicles equipped with an electrical regenerative braking system of category B, the recovery test shall be made with no regenerative braking component, i.e. under the conditions of paragraph 1.5.4. above.

After the further reconditioning of the linings, a second repeat Type-0 test shall be made from the same speed and with no electric regenerative braking contribution as in the recovery test with the engine/motors disconnected, and comparison shall be made between these test results.

The recovery performance must not be less than 70 per cent, nor more than 150 per cent of the figure recorded in this final repeat Type-0 test."

Paragraphs 2.2.4. to 2.2.4.2, amend to read:

"2.2.4. For vehicles employing electric regenerative braking systems, the braking performance shall additionally be checked under the two following failure conditions:

2.2.4.1. For a total failure of the electric component of the service braking output.

2.2.4.2. In the case where the failure condition causes the electric component to deliver its maximum braking force."

Insert a new appendix 1 to annex 3, to read:

"Annex 3 - Appendix 1

PROCEDURE FOR MONITORING THE STATE OF BATTERY CHARGE.

This procedure is applicable to vehicle batteries used for traction and regenerative braking.

The procedure requires the use of a bi-directional DC Watt-hour meter.

1. Procedure.

1.1. If the batteries are new or have been subject to extended storage, they shall be cycled as recommended by the manufacturer. A minimum 8 hour soak period at ambient temperature shall be allowed after completion of cycling.

A full charge shall be established using the manufacturer's recommended charging procedure.

- 1.3. When the braking tests of paragraphs 1.2.11., 1.4.1.2.3., 1.5.1.6., 1.5.1.7. and 1.5.2.4. of annex 3 are conducted the watt-hours consumed by the traction motors and supplied by the regenerative braking system shall be recorded as a running total which shall then be used to determine the state of charge existing at the beginning or end of a particular test.

1.4. To replicate a level of state of charge in the batteries for comparative tests, such as those of paragraph 1.5.2.4., the batteries shall be either recharged to that level or charged to above that level and discharged into a fixed load at approximately constant power until the required state of charge is reached. Alternatively, for vehicles with battery powered electric traction only, the state of charge may be adjusted by running the vehicle. Tests conducted with a battery partially charged at their start shall be commenced as soon as possible after the desired state of charge has been reached.

_____ "

Annex 5,

Paragraph 3.2.3., amend to read:

"3.2.3. For vehicles fitted with an electric regenerative braking system
..... "

Annex 6,

Paragraph 4.1.1., including its corresponding footnote 3/, amend to read:

"4.1.1. Sensor anomalies, which cannot be deleted under static conditions, shall be detected not later than when the vehicle speed exceed 10 km/h 3/. However, to prevent erroneous fault indication when a sensor is not generating a vehicle speed output, due to non-rotation of a wheel, verification may be delayed but detected not later than when the vehicle speed exceeds 15 km/h.

3/ The warning signal may light up again while the vehicle is stationary, provided that it is extinguished before the vehicle speed reaches 10 km/h or 15 km/h, as appropriate, when no defect is present."

Paragraph 4.1.2., amend to read:

"4.1.2. When the anti-lock braking system is energized with the vehicle stationary, electrically controlled pneumatic modulator valve(s) shall cycle at least once."

Paragraph 4.1.3., should be deleted.

Paragraph 5.2.5., amend by the addition of footnote 7/ to read:

"
shall be checked with the vehicle both laden and unladen 7/.
The laden test

7/ Until a uniform test procedure is established, the tests required by this paragraph may have to be repeated for vehicles equipped with electrical regenerative braking systems, in order to determine the effect of different braking distribution values provided by automatic functions on the vehicle."

Footnotes 7/ to 9/ (former), along with the corresponding references, renumber as footnotes 8/ to 10/.

Paragraph 5.3.7., amend by the addition of a reference to the new footnote 7/, to read:

"..... and during these tests no part of the (outer) tyres must cross this boundary 7/."
