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1958 Agreement:
Consideration of draft amendments to existing UN Regulations submitted by GRBP

Proposal for Supplement 13 to the 02 series of amendments to UN Regulation No. 117 (Tyre rolling resistance, rolling noise and wet grip)

Submitted by the Working Party on Noise and Tyres*

The text reproduced below was adopted by the Working Party on Noise and Tyres (GRBP) at its seventy-second session (ECE/TRANS/WP.29/GRBP/70, paras. 16 and 17). It is based on ECE/TRANS/WP.29/GRBP/2020/16, ECE/TRANS/WP.29/GRBP/2020/17 and Annex VIII to the report. 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 March 2021 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), 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.

Paragraph 2.18., amend to read:

"2.18. "*Standard Reference Test Tyre*" or "*SRTT*" means a tyre that is produced, controlled and stored in accordance with the standards of ASTM International:

(a) E1136 – 17 for the size P195/75R14 and referred to as "SRTT14",

(b) F2872 – 16 for the size 225/75R16C and referred to as "SRTT16C",

(c) F2871 – 16 for the size 245/70R19.5 and referred to as "SRTT19.5",

(d) F2870 – 16 for the size 315/70R22.5 and referred to as "SRTT22.5",

(e) F2493 – 19 for the size P225/60R16 and referred to as "SRTT16"."

Paragraph 2.19.3., amend to read:

"2.19.3. "*Control tyre*" means a normal production tyre that is used to establish the wet grip or snow grip performance of tyre sizes unable to be fitted to the same vehicle as the standard reference test tyre – see paragraph 2.2.2.8. of Annex 5, part (B) and paragraph 3.4.3. of Annex 7 to this Regulation."

Paragraph 2.19.4., amend to read:

"2.19.4. "*Wet grip index*" (*G*) means the wet grip performance of a candidate tyre relative to that of the applicable standard reference test tyre."

Paragraph 2.19.5., amend to read:

"2.19.5. "*Snow grip index ("SG")*" means the snow grip performance of a candidate tyre relative to the performance of the applicable SRTT."

Insert a new paragraph 4.3.1. to read:

"4.3.1. In case the approval of a tyre pursuant to this Regulation has been granted by the same Type Approval Authority than that granting the approval pursuant to UN Regulation No. 30 or UN Regulation No. 54, the approval mark pursuant to UN Regulation No. 30 or UN Regulation No. 54 can be combined with an indication of the applicable series of amendments to which the tyre was approved pursuant to UN Regulation No. 117 on the form of 2 digits (example "02" indicating that the UN Regulation No.117 approval was granted following the 02 series of amendments) and the suffixes according to paragraph 5.2.2. using the addition sign "+", as described in Annex 2, Appendix 3 of this Regulation, for example "0236378 + 02S1WR2"."

Paragraph 4.4., amend to read:

"4.4. The markings referred to in paragraph 4.2. and the approval mark prescribed in paragraph 5.4. of this Regulation shall be clearly legible, indelible and raised above or sunk below the tyre surface."

Paragraph 4.4.1., amend to read:

"4.4.1. The markings shall be situated in the lower area of the tyre on at least one of its sidewalls. However, in the case of tyres identified by the "tyre to rim fitment configuration" symbol "A" or "U", the markings may be located anywhere on the outside sidewall of the tyre."

Paragraph 5.4.4., amend to read:

"5.4.4. The marking on the tyre sidewalls of suffix(es) to the approval number removes the requirement for any additional marking on the tyre of the specific type approval number for conformity to the Regulation(s) to which the suffix refers as per paragraph 5.2.2. above."

Paragraph 6.4.1.1., amend to read:

"6.4.1.1. Class C1, C2 and C3 tyres

The minimum snow grip index value, as calculated in the procedure described in Annex 7 and compared with the respective Standard Reference Test Tyre (SRTT) shall be as follows:

Class of tyre	*Snow grip index (brake on snow method)* [(a)]		*Snow grip index (spin traction method)* [(b)]	*Snow grip index (acceleration method)* [(c)]
	Ref.s = SRTT14, SRTT16	*Ref. = SRTT16C*	*Ref.s = SRTT14, SRTT16*	*Ref.s = SRTT19.5, SRTT22.5*
C1	1.07	No	1.10	No
C2	No	1.02	1.10	No
C3	No	No	No	1.25

[(a)] See paragraph 3. of Annex 7 to this Regulation
[(b)] See paragraph 2. of Annex 7 to this Regulation
[(c)] See paragraph 4. of Annex 7 to this Regulation "

Paragraphs 7.1.3. and 7.1.4., renumber as 7.2. and 7.3.

Paragraph 9.1., amend to read:

"9.1. The approval granted in respect of a type of tyre pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 8. above are not complied with, or if any tyre of the type of tyre exceeds the limits given in paragraphs 8.4. or 8.5. above."

Insert new paragraphs 12.10. to 12.12. to read:

"12.10. Until 3 months after the date of entry into force of Supplement 13 to the 02 series of amendments to this Regulation, Contracting Parties applying this Regulation can continue to grant type approvals according to the 02 series of amendments to this Regulation, without taking into account the provisions of Supplement 13.

12.11. Until 1 September 2024, Contracting Parties applying this Regulation may continue to grant type approvals according to the 02 series of amendments to this Regulation, based on snow performance test described in Annex 7 to this Regulation using SRTT14 as reference tyre. [(a)]

12.12. Until 1 September 2024, Contracting Parties applying this Regulation may continue to grant type approvals according to the 02 series of amendments to this Regulation, based on the test procedures for measuring wet grip described in Annex 5 of this Regulation, without taking into account the provisions of Supplement 13."

Add a new footnote (a) to read:

" [(a)] SRTT14 will be available from the supplier until end of October 2021."

Annex 1

Item 8.4., amend to read:

"8.4. Snow grip level of the representative tyre size, see paragraph 2.7. of UN Regulation No. 117, as per item 7. of the test report in the appendix[5] to Annex 7:……. (Snow grip index) using the brake on snow method,[2] spin traction method[2] or acceleration method.[2]"

Footnote 3, renumber to 5.

Item 16.1., amend to read:

"16.1. A list of documents in the approval file deposited at the Type Approval Authorities having delivered the approval and which can be obtained upon request.[6]"

Footnote 4, renumber to 6 and amend to read:

"[6] In the case of "snow tyre for use in severe snow conditions" a test report according to Appendix 2 or Appendix 3, as applicable, to Annex 7 shall be submitted."

Annex 2

Appendix 3, amend to read:

"Combinations of markings of approvals issued in accordance with UN Regulations Nos. 117, 30 or 54

Example 1

…

The above approval mark shows that the tyre concerned has been approved in the Netherlands (E 4) pursuant to UN Regulation No. 30 according to its 02 series of amendments (indicated by the first two digits of the approval number, "02") under approval number 0236378. It is also marked by "+ 02S1" which indicates that the tyre was also approved pursuant to UN Regulation No. 117 (02 series of amendments) for rolling sound at stage 1.

Example 2

[…]

The above approval mark shows that the tyre concerned has been approved in the Netherlands (E 4) pursuant to Regulation No. 30 according to its 02 series of amendments (indicated by the first two digits of the approval number, "02") under approval number 0236378. It is also marked by "+ 02S1WR2" which indicates that the tyre was also approved pursuant to Regulation No. 117 (02 series of amendments) for S1 (rolling sound at stage 1) W (wet adhesion) and R2 (rolling resistance at stage 2)."

Footnote 1, delete.

Annex 5

Title, amend to read:

"Test procedures for measuring the wet grip index of new tyres"

Part (A),

Paragraphs 1.1. and 1.2., delete.

Paragraph 1.3., renumber as 1.1.

Insert new paragraphs 2.2. and 2.3. to read:

"2.2. "*Braking test*" means a series of a specified number of test runs of the same test tyre (set) repeated within a short time frame.

2.3. "*Test cycle*" means a sequence of braking tests of the test tyres."

Paragraph 2.2., renumber as 2.4. and amend to read:

"2.4. "*Test tyre*" or "*test tyre set*" means a tyre or a tyre set whose wet grip braking performance is measured in a braking test."

Paragraph 2.3., renumber as 2.5. and amend to read:

"2.5. "*Candidate tyre*" or "c*andidate tyre set*" means a tyre or a tyre set whose wet grip braking performance is evaluated relative to that of a reference tyre or reference tyre set."

Paragraph 2.4., renumber as 2.6. and amend to read:

"2.6. "*Reference tyre*" or "*Reference tyre set*" means a tyre or a tyre set of Standard Reference Test Tyres SRTT16."

Paragraph 2.5. (former), delete.

Paragraph 2.6., renumber as 2.7. and amend to read:

"2.7. "*Braking force*" means the longitudinal force, expressed in newtons, resulting from braking torque application."

Paragraph 2.7., renumber as 2.8. and amend to read:

"2.8. "*Average Braking Force Coefficient*" (BFC) means, for the vehicle method, the ratio of the average deceleration in a braking test to the acceleration due to gravity (rounded to 9.81 $m \cdot s^{-2}$)."

Insert a new paragraph 2.9. to read:

"2.9. "*Dynamic braking force coefficient*" ($\mu(t)$) means, for the trailer (or tyre test vehicle) method, the ratio of the braking force to the vertical load acquired in real time."

Paragraph 2.8., renumber as 2.10. and amend to read:

"2.10. "*Peak braking force coefficient*" (μ_{peak}) means, for the trailer (or tyre test vehicle) method, the maximum value of the dynamic braking force coefficient that occurs prior to lockup of the wheel as the braking torque is progressively increased."

Paragraph 2.9., renumber as 2.11.

Paragraph 2.10., renumber as 2.12. and amend to read:

"2.12. "*Vertical load*" means the normal force, expressed in newtons, exerted on the road resulting from the mass supported by the tyre."

Paragraph 2.11., renumber as 2.13.

Insert a new paragraph 2.14. to read:

"2.14. "*Tyre set*" means, for the trailer (or tyre test vehicle) method, one (1) tyre and, for the vehicle method, four (4) tyres."

Insert a new paragraph 2.15. to read:

"2.15. "*Instrumented passenger car*" means a commercialized passenger car equipped with an Antilock Braking System (ABS) and the measuring equipment listed in paragraph 4.1.2.2. of this Annex."

Paragraph 3.1.1., amend to read:

"3.1.1. The surface shall have a dense asphalt surface with a uniform gradient of not more than 2 per cent in both longitudinal and lateral directions and shall not deviate more than 6 mm when tested with a 3 m straight edge."

Paragraph 3.1.4., amend to read:

"3.1.4. The average macro texture depth as measured in accordance with ASTM E965-96 (Reapproved 2006) by a sand patch shall be 0.7 ± 0.3) mm. In case the vehicle method is used, the average macro texture depth shall be determined in both lanes where the tyres are going to brake."

Paragraph 3.1.5., amend to read:

"3.1.5. The wetted frictional properties of the surface shall be measured using the Standard Reference Test Tyre SRTT16 either with the method described in

paragraph 3.2.1. of this Annex in case the vehicle method (according to paragraph 4.1. below) is used, or with the method described in paragraph 3.2.2. in this Annex in case the trailer (or tyre test vehicle) method is used."

Paragraph 3.2.1., amend to read:

"3.2.1. Using the procedure described in paragraph 4.1. of this Annex, perform two braking tests of the reference tyre, each consisting of at least six (6) valid test runs in the same direction on aligned segments of the track. The braking tests shall cover the entire potential braking area, including where the texture depth was measured.

Evaluate the braking tests as described in paragraphs 4.1.6.1. and 4.1.6.2. of this Annex. If the coefficient of variation of one braking test CV_{BFC} exceeds 4 per cent, dismiss the results and repeat the braking tests.

For each braking test, the arithmetic mean $\overline{BFC_{\text{ave}}}$ of the average Braking Force Coefficients shall be corrected for effects of temperature as follows:

$$BFC_{\text{ave,corr}} = \overline{BFC_{\text{ave}}} + a \cdot (\vartheta - \vartheta_0)$$

where

ϑ is the wetted surface temperature in degrees Celsius,

$a = 0.002\ ℃^{-1}$ and $\vartheta_0 = 20\ ℃$.

For each braking test, the temperature-corrected average Braking Force Coefficient ($BFC_{\text{ave,corr}}$) shall be not less than 0.57 and not greater than 0.79.

The arithmetic means of the temperature-corrected average Braking Force Coefficients of the two braking tests shall not differ by more than 10 per cent of the average of the two values:

$$CVal\left(BFC_{\text{ave,corr}}\right) = 2 \cdot \left|\frac{BFC_{\text{ave,corr,1}} - BFC_{\text{ave,corr,2}}}{BFC_{\text{ave,corr,1}} + BFC_{\text{ave,corr,2}}}\right| \leq 10\ \%$$

"

Paragraph 3.2.2., amend to read:

"3.2.2. Using the procedure described in paragraph 4.2. of this Annex, perform in the same area where the average macro texture depth was measured one braking test of the reference tyre, consisting of at least six (6) valid test runs in the same direction.

Evaluate the braking test as described in paragraphs 4.2.8.1. and 4.2.8.2. of this Annex. If the coefficient of variation CV_{μ} exceeds 4 per cent, dismiss the results and repeat the braking test.

The arithmetic mean ($\overline{\mu_{\text{peak}}}$) of the measured peak braking force coefficients shall be corrected for effects of temperature as follows:

$$\mu_{\text{peak,corr}} = \overline{\mu_{\text{peak}}} + a \cdot (\vartheta - \vartheta_0)$$

where

ϑ is the wetted road surface temperature in degrees Celsius,

$a = 0.002\ ℃^{-1}$ and $\vartheta_0 = 20\ ℃$.

The temperature-corrected average peak braking force coefficient ($\mu_{\text{peak,corr}}$) shall be not less than 0.65 and not greater than 0.90."

Paragraph 3.3., amend to read:

"3.3. Atmospheric conditions

The wind conditions shall not interfere with wetting of the surface (wind-shields are allowed).

The wetted surface temperature and the ambient temperature shall be between:

Category of use		*Wetted surface temperature*	*Ambient temperature*
Normal tyres		12 °C – 35 °C	12 °C – 40 °C
Snow tyres		5 °C – 35 °C	5 °C – 40 °C
	Snow tyres for use in severe snow conditions	5 °C – 20 °C	5 °C – 20 °C
Special use tyres		not applicable	not applicable

Moreover, the wetted surface temperature shall not vary during the test by more than 10 °C.

The ambient temperature shall remain close to the wetted surface temperature; the difference between the ambient and the wetted surface temperatures shall be less than 10 °C."

Paragraph 4.1.1., amend to read:

"4.1.1. Principle

The testing method covers a procedure for measuring the deceleration performance of C1 tyres during braking, using an instrumented passenger car.

Starting with a defined initial speed, the brakes are applied hard enough on four wheels at the same time to activate the ABS. The average deceleration is calculated between two pre-defined speeds."

Paragraph 4.1.2.1., amend to read:

"4.1.2.1. Vehicle

Any commercialized passenger car, preferably not older than 5 years, type approved pursuant to UN Regulation No. 13-H with regards to its braking system, which is fitted with an anti-lock system (ABS), shall be considered as suitable for the purpose of the test provided that the mechanical conditions of the passenger car meet the car manufacturer's recommendations and no warning from ABS (e.g. warning lights) is displayed.

Permitted modifications on the passenger car are as follows:

(a) Those allowing the number of tyre sizes that can be mounted on the vehicle to be increased;

(b) Those permitting automatic activation of the braking device to be installed;

(c) Those permitting the vehicle to be guided or accelerated externally.

Any other modification of the vehicle and specifically of the braking system is prohibited."

Paragraph 4.1.2.2., amend to read:

"4.1.2.2. Measuring equipment

The exposed portions of the system shall tolerate 100 per cent relative humidity (rain or spray) and all other conditions, such as dust, shock and vibrations, which may be encountered in regular operation.

The vehicle shall be fitted with a sensor suitable for measuring speed on a wet surface and distance covered between two speeds.

To measure vehicle speed, a fifth wheel or non-contact precision (including e. g. radar, GPS, etc.) speed-measuring system shall be used.

The following tolerances shall be respected:

(a) For speed measurement: ± 1 % or ± 0.5 km/h, whichever is greater;

(b) For distance: ± 1 · 10^{-1} m."

Paragraph 4.1.3., amend to read:

"4.1.3. Conditioning of the test track and wetting condition

The test track surface shall be watered at least half an hour prior to testing in order to equalize the surface temperature and water temperature. External watering should be supplied continuously throughout testing. For the whole testing area, the water depth shall be (1.0 ± 0.5) mm, measured from the peak of the pavement.

The test track should then be conditioned by conducting at least ten test runs with tyres not involved in the test programme at 90 km/h."

Paragraph 4.1.4.1., amend to read:

"4.1.4.1. Tyre preparation and stabilization, rims and fitment on the vehicle

The test tyres shall be trimmed to remove all protuberances on the tread surface caused by mould air vents or flashes at mould junctions.

Fit the test tyres on rims specified by a recognized tyre and rim standards organization as listed in Appendix 4 to Annex 6 to this Regulation. Rim width code shall not differ by more than 0.5 from the measuring rim width code. Ensure proper bead seating by the use of a suitable lubricant. Excessive use of lubricant should be avoided to prevent slipping of the tyre on the wheel rim.

The tyres should be stabilized in performance prior to testing, which means that no evolution of the BFC value in test runs should be detectable; in any case there will be an ex-post verification according to paragraph 4.1.6.2. of this Annex. In all cases, tyre designed tread depth and designed tread block or rib integrity shall not change significantly with break-in, which means the pace and "severity" of the break-in needs to be carefully controlled to avoid such changes.

Place the fitted test tyres in a location such that they all have the same ambient temperature prior to testing and shield them from the sun to avoid excessive heating by solar radiation.

Maximum spacer (adapter) width allowed to mount tyres on the vehicle is 60 mm."

Paragraph 4.1.4.2., amend to read:

"4.1.4.2. Tyre load

The static load on each axle tyre shall lie between 60 per cent and 90 per cent of the tested tyre load capacity. Tyre loads on the same axle should not differ by more than 10 per cent.

It is prohibited to exceed the maximum axle load of the vehicle."

Paragraph 4.1.4.3., amend to read:

"4.1.4.3. Tyre inflation pressure

On the front axle, the inflation pressures p shall be calculated as follows:

$$p = p_{\text{ref}} \cdot \left(1.3 \cdot \frac{Q}{Q_{\text{ref}}}\right)^{1.25}$$

where

p_{ref} is the reference inflation pressure (250 kPa for standard-load and 290 kPa for extra-load versions, regardless of the reference pressure in the applicable standard);

Q is the average tyre vertical load on the front axle;

Q_{ref} is the reference vertical load associated with the load-capacity index.

On the rear axle, the inflation pressure shall be 220 kPa (for both standard-load and extra-load versions). The tyre pressure should be checked just prior to testing at ambient temperature and adjusted if required."

Paragraph 4.1.5.1.1., amend to read:

"4.1.5.1.1. The passenger car is driven in a straight line up to (85 ± 2) km/h."

Paragraph 4.1.5.1.2., amend to read:

"4.1.5.1.2. Once the passenger car has reached (85 ± 2) km/h, the brakes shall always be activated at the same place on the test track referred to as "braking starting point", with a longitudinal tolerance of 5 m and a transverse tolerance of 0.5 m. Braking tests shall occur on the same lanes and in the same direction that was used to examine the surface, including where the macro texture depth was measured, in accordance with paragraphs 3.1.4. and 3.1.5. above (with a transverse tolerance of 0.5 m)."

Paragraph 4.1.5.1.3.2., amend to read:

"4.1.5.1.3.2. The manual activation of the brakes depends on the type of transmission as follows. In both cases, the pedal effort shall be high enough to activate the ABS.

For manual transmission, as soon as the driver is in the measuring zone and having reached (85 ± 2) km/h, the driver should release the clutch and depress the brake pedal sharply, holding it down as long as necessary to perform the measurement.

For automatic transmission, as soon as the driver is in the measuring zone and having reached (85 ± 2) km/h, the driver should select neutral gear and then depress the brake pedal sharply, holding it down as long as necessary to perform the measurement.

For each braking test and for tyres not tested before, the first two runs shall be discarded."

Paragraph 4.1.5.1.4., amend to read:

"4.1.5.1.4. If any of the specifications listed above (including speed tolerance, longitudinal and transverse tolerance for the braking starting point, and braking time) are not met when a test run is made, the test run is invalidated and a new test run is made."

Paragraph 4.1.5.2., amend to read:

"4.1.5.2. Braking test and test cycle

Within the same test cycle, each test run of each braking test shall be made in the same direction and in accordance with paragraph 4.1.5.1. of this Annex. Several test cycles may be performed consecutively, where the final braking test of the reference tyre set of a test cycle may serve as the initial braking test of the reference test tyre set for the next test cycle.

Up to three different candidate tyre sets may be measured within the same test cycle according to the following procedure:"

Paragraph 4.1.5.2.1., amend to read:

"4.1.5.2.1. Initial braking test of the reference tyre (R_i): First, the reference tyre set is mounted on the instrumented passenger car and at least four (4) valid test runs shall be made."

Paragraph 4.1.5.2.2., amend to read:

"4.1.5.2.2. Braking test of a candidate tyre set (T_n): The reference tyre set is replaced by a candidate tyre set (T_n) and at least six (6) valid test runs of the candidate tyres shall be performed."

Paragraph 4.1.5.2.3., amend to read:

"4.1.5.2.3. After the braking test of the first candidate tyre set, up to two more candidate tyre sets may be measured."

Paragraph 4.1.5.2.4., amend to read:

"4.1.5.2.4. Final braking test of the reference tyres (R_f): The test cycle is closed by at least four (4) valid test runs of the same reference tyre set as at the beginning of the test cycle.

Examples:

(a) The run order for a test cycle of three candidate tyre sets (T_1 to T_3) would be the following:

$R_i – T_1 – T_2 – T_3 – R_f$

(b) The run order for a braking test (consisting of two test cycles) of five candidate tyre sets (T_1 to T_5) would be the following:

$R_i – T_1 – T_2 – T_3 – R_f/R_i – T_4 – T_5 – R_f$"

Paragraph 4.1.6.1., amend to read:

"4.1.6.1. Calculation of the average Braking Force Coefficient

For each valid test run *j*, the average Braking Force Coefficient $BFC_{ave,j}$ is calculated from the distance d_j covered between 80 km/h and 20 km/h as follows:

$$BFC_{ave,j} = \frac{v_i^2 - v_f^2}{2 \cdot d_j \cdot g}$$

where

v_f is the final speed in m/s; v_f = 20 km/h = 5.556 m/s

v_i is the initial speed in m/s; v_i = 80 km/h = 22.222 m/s

d_j is the distance covered in test run *j* between v_i and v_f in meters;

g is the acceleration due to gravity = 9.81 $m \cdot s^{-2}$."

Paragraph 4.1.6.2., amend to read:

"4.1.6.2. Validation of results

The coefficient of variation CV_{BFC} is calculated as follows:

$$CV_{BFC} = 100\% \cdot \frac{\sigma_{BFC}}{\overline{BFC_{ave}}}$$

where

$\sigma_{BFC} = \sqrt{\frac{1}{N-1}\sum_{j=1}^{N}\left(BFC_{ave,j} - \overline{BFC_{ave}}\right)^2}$ denotes the corrected sample standard deviation and

$\overline{BFC_{ave}}$ the arithmetic mean of the average Braking Force Coefficients $BFC_{ave,j}$ of *N* test runs.

For the reference tyre:

(a) The coefficient of variation CV_{BFC} of the initial and the final braking test of the reference tyre within one test cycle shall be less than or equal to 4 per cent.

(b) The arithmetic means of the average Braking Force Coefficients of the initial and the final braking test shall not differ by more than 5 per cent of the average of the two values:

$$CVal(BFC_{ave}) = 100\% \cdot 2 \cdot \left|\frac{\overline{BFC_{ave}}(R_i) - \overline{BFC_{ave}}(R_f)}{\overline{BFC_{ave}}(R_i) + \overline{BFC_{ave}}(R_f)}\right| \leq 5\%$$

where

$\overline{BFC_{ave}}(R_i)$ / $\overline{BFC_{ave}}(R_f)$ is the arithmetic mean of the average Braking Force Coefficients in the initial/final braking test of the reference tyre within a test cycle.

(c) The temperature-corrected average Braking Force Coefficients ($BFC_{ave,corr}$, see paragraph 3.2.1. of this Annex) as calculated from the initial and from the final braking tests of the reference tyre within a test cycle shall be not less than 0.57 and not greater than 0.79.

If one or more of the above conditions is not met, the complete test cycle shall be performed again.

For the candidate tyres (T):

The coefficient of variation CV_{BFC} is calculated for each candidate tyre set. If one coefficient of variation is higher than 4 per cent, the data shall be discarded and the braking test repeated for that candidate tyre set."

Paragraph 4.1.6.3., amend to read:

"4.1.6.3. Calculation of adjusted average Braking Force Coefficient

The average Braking Force Coefficient of the reference tyre set used for the calculation of its braking force coefficient is adjusted according to the positioning of each candidate tyre set in a given test cycle.

This adjusted average Braking Force Coefficient of the reference tyre $BFC_{adj}(R)$ is calculated in accordance with Table 1 where $\overline{BFC_{ave}}(R_i)$ is the arithmetic mean of the average Braking Force Coefficients in the initial braking test of the reference tyre set (R_i) and $\overline{BFC_{ave}}(R_f)$ is the arithmetic mean of the average Braking Force Coefficients in the final braking test of the same reference tyre set (R_f) within the test cycle.

Table 1

If the number and the sequence of candidate tyre sets within one test cycle is:	*and the candidate tyre set to be qualified within this test cycle is:*	*the corresponding adjusted average Braking Force Coefficient of the reference tyre is calculated as follows:*
1 $R_i – T_1 – R_f$	T_1	$BFC_{adj}(R) = {}^1/_2 \cdot [\overline{BFC_{ave}}(R_i) + \overline{BFC_{ave}}(R_f)]$
2 $R_i – T_1 – T_2 – R_f$	T_1	$BFC_{adj}(R) = {}^2/_3 \cdot \overline{BFC_{ave}}(R_i) + {}^1/_3 \cdot \overline{BFC_{ave}}(R_f)$
	T_2	$BFC_{adj}(R) = {}^1/_3 \cdot \overline{BFC_{ave}}(R_i) + {}^2/_3 \cdot \overline{BFC_{ave}}(R_f)$
3 $R_i – T_1 – T_2 – T_3 – R_f$	T_1	$BFC_{adj}(R) = {}^3/_4 \cdot \overline{BFC_{ave}}(R_i) + {}^1/_4 \cdot \overline{BFC_{ave}}(R_f)$
	T_2	$BFC_{adj}(R) = {}^1/_2 \cdot [\overline{BFC_{ave}}(R_i) + \overline{BFC_{ave}}(R_f)]$
	T_3	$BFC_{adj}(R) = {}^1/_4 \cdot \overline{BFC_{ave}}(R_i) + {}^3/_4 \cdot \overline{BFC_{ave}}(R_f)$

"

Paragraph 4.1.6.4., delete.

Paragraph 4.1.6.5., renumber as 4.1.6.4. and amend to read:

"4.1.6.4. Calculation of the wet grip index of the candidate tyre

The wet grip index $G(T_n)$ of the candidate tyre T_n (n = 1, 2 or 3) is calculated as follows:

$$G(T_n) = K_{\text{vehicle}} \cdot \{\overline{BFC_{ave}}(T_n) - [a \cdot \Delta BFC(R) + b \cdot \Delta\vartheta + c \cdot (\Delta\vartheta)^2 + d \cdot \Delta MTD]\}$$

where:

$\overline{BFC_{ave}}(T_n)$ is the arithmetic mean of the average Braking Force Coefficients of the candidate tyre T_n within a braking test;

$$\Delta BFC(R) = BFC_{adj}(R) - BFC(R_0)$$

$BFC_{adj}(R)$ is the adjusted average Braking Force Coefficient in accordance with Table 1;

$BFC(R_0) = 0.68$ is fixed as the Braking Force Coefficient for the reference tyre in the reference conditions;

$$\Delta\vartheta = \vartheta - \vartheta_0$$

ϑ is the measured wet surface temperature in degrees Celsius when the candidate tyre T_n is tested;

ϑ_0 is the wetted surface reference temperature for the candidate tyre according to its category of use as listed in Table 2;

$$\Delta MTD = MTD - MTD_0$$

MTD is the measured macro texture depth in mm of the track (see paragraph 3.1.4. of this Annex);

$MTD_0 = 0.8$ mm is the macro texture depth of the reference track;

$K_{vehicle} = 1.87$ is a factor to grant consistency between previous calculation of the wet grip index and this one, and to ensure convergence between vehicle and trailer method and

coefficients *a*, *b*, *c* and *d* are given in Table 2.

Table 2

Category of use		ϑ_0 *(°C)*	*a*	*b* *($°C^{-1}$)*	*c* *($°C^{-2}$)*	*d* *(mm^{-1})*
Normal tyre		20	+0.99382	+0.00269	−0.00028	−0.02472
Snow tyre		15	+0.92654	−0.00121	−0.00007	−0.04279
	Snow tyre for use in severe snow conditions	10	+0.72029	−0.00539	+0.00022	−0.03037
Special-use tyre		not defined				

"

Paragraph 4.1.7., amend to read:

"4.1.7. When a direct comparison between a candidate tyre and a reference tyre on the same vehicle is not possible the test method using a trailer or a tyre test vehicle (paragraph 4.2. of this Annex) shall be used."

Paragraphs 4.1.7.1. to 4.1.7.3., delete.

Paragraph 4.1.7.4. renumber as 3.4. and amend to read:

"3.4. Replacement of reference tyres

When irregular wear or damage results from tests, or when wear or aging influences the test results, the use of the reference tyre shall be discontinued."

Paragraph 4.2.2.1., amend to read:

"4.2.2.1. Tow vehicle and trailer or tyre test vehicle

The tow vehicle or the tyre test vehicle shall have the capability of maintaining the specified speed of (65 ± 2) km/h even under the maximum braking forces.

The trailer or the tyre test vehicle shall be equipped with one place where the tyre can be fitted for measurement purposes, hereinafter called "test position", and the following accessories:

(a) Equipment to activate brakes in the test position;

(b) A water tank to store sufficient water to supply the road surface wetting system, unless external watering is used;

(c) Recording equipment to record signals from transducers installed at the test position and to monitor water application rate if the self-watering option is used.

In the case of the one axle trailer, in order to reduce "pitch disturbance", the longitudinal distance from the centre line of the articulation point of the coupling to the transverse centre line of the axle of the trailer shall be at least ten times the "hitch height" or the "coupling (hitch) height".

In order to reduce "lateral disturbance", the trailer or the tyre test vehicle should be technically designed to minimize lateral displacement during the application of maximum braking force. Visual lateral displacement should be avoided during braking manoeuvre.

The maximum variation of toe-settings and camber angle for the test position shall be within ±0.5° with maximum vertical load. Suspension arms and bushings shall have sufficient rigidity necessary to minimize free play and ensure compliance under application of maximum braking forces. The suspension system shall provide adequate load-carrying capacity and be of such a design as to isolate suspension resonance.

The test position shall be equipped with a typical or special automotive brake system which can apply sufficient braking torque to produce the maximum value of braking test wheel longitudinal force at the conditions specified.

The brake application system shall be able to control the time interval between initial brake application and peak longitudinal force as specified in paragraph 4.2.7.1. below.

The trailer or the tyre test vehicle shall be designed to accommodate the range of candidate tyre sizes to be tested.

The trailer or the tyre test vehicle shall have provisions for adjustment of vertical load as specified in paragraph 4.2.5.2. below."

Paragraph 4.2.2.2., amend to read:

"4.2.2.2. Measuring equipment

…

(a) The minimum frequency response shall be flat from 0 Hz to 100 Hz within ±1 per cent full scale;

…"

Paragraph 4.2.3., amend to read:

"4.2.3. Conditioning of the test track

The test track should be conditioned by conducting at least ten test runs with tyres not involved in the test program at (65 ± 2) km/h."

Paragraph 4.2.4., amend to read:

"4.2.4. Wetting conditions

The surface may be wetted from the track-side ("external watering") or by a wetting system incorporated in the test vehicle or the trailer ("self-watering").

4.2.4.1. If "external watering" is used, the test track surface shall be watered at least half an hour prior to testing in order to equalize the surface temperature and water temperature. External watering should be supplied continuously throughout testing. For the braking lanes used, the water depth shall be between 0.5 mm and 1.5 mm, measured from the peak of the pavement.

4.2.4.2. For "self-watering" systems, the tow vehicle and trailer or the tyre test vehicle is equipped with a pavement-wetting system, less the storage tank, which, in the case of the trailer, is mounted on the tow vehicle. The water being applied to the pavement ahead of the test tyres shall be supplied by a nozzle suitably designed to ensure that the water layer encountered by the test tyre has a uniform cross section at the test speed with a minimum splash and overspray.

The nozzle configuration and position shall ensure that the water jets are directed towards the test tyre and pointed towards the pavement at an angle of 20° to 30°.

The water shall strike the pavement 250 mm to 450 mm ahead of the centre of tyre contact. The nozzle shall be located 25 mm above the pavement or at the minimum height required to clear obstacles which the tester is expected to encounter, but in no case more than 100 mm above the pavement.

The water layer shall be at least 25 mm wider than the test tyre tread and applied so the tyre is centrally located between the edges. Water delivery rate shall ensure a water depth of (1.0 ± 0.5) mm and shall be consistent throughout the test to within ±10 per cent. The volume of water per unit of wetted width shall be directly proportional to the test speed. The quantity of water applied at 65 km/h shall be 18 l/s per meter of width of wetted surface in case of a water depth of 1.0 mm."

Paragraph 4.2.5.1., amend to read:

"4.2.5.1. Tyre preparation and stabilization and rims

The test tyres shall be trimmed to remove all protuberances on the tread surface caused by mould air vents or flashes at mould junctions.

The test tyre shall be mounted on a rim specified by a recognized tyre and rim standards organization as listed in Appendix 4 to Annex 6 to this Regulation. The rim width code shall not differ by more than 0.5 from the measuring rim width code.

A proper bead seat should be achieved by the use of a suitable lubricant. Excessive use of lubricant should be avoided to prevent slipping of the tyre on the wheel rim.

The tyres should be stabilized in performance prior to testing, which means that no evolution of the μ_{peak} value in test runs should be detectable; in any case there will be an ex-post verification according to paragraph 4.2.8.2. of this Annex. In all cases, tyre designed tread depth and designed tread block or rib integrity shall not change significantly with break-in, which means the pace and "severity" of the break-in needs to be carefully controlled to avoid such changes.

The test tyres/rim assemblies shall be stored in a location for a minimum of two hours such that they all have the same ambient temperature prior to testing. They should be shielded from the sun to avoid excessive heating by solar radiation."

Paragraph 4.2.5.2., amend to read:

"4.2.5.2. Tyre load

The test load on the test tyre is (75 ± 5) per cent of the tyre load capacity."

Paragraph 4.2.6.1., amend to read:

"4.2.6.1. The test tyre set shall be installed on the measuring device and loaded to the specified test load according to paragraph 4.2.5.2. of this Annex.

For one-axle trailers, the hitch height and transverse position shall be adjusted in order to avoid any disturbance of the measuring results."

Paragraph 4.2.7.1.1., amend to read:

"4.2.7.1.1. The tow vehicle or the tyre test vehicle is driven onto the test track in a straight line at the specified test speed (65 ± 2) km/h."

Paragraph 4.2.7.1.3., amend to read:

"4.2.7.1.3. For self-watering system, water shall be delivered to the pavement ahead of the test tyre approximately 0.5 s prior to brake application."

Paragraph 4.2.7.1.4., amend to read:

"4.2.7.1.4. The brakes shall be activated within an area of six (6) meters in the longitudinal direction and 0.5 meters in the transversal direction of a measurement point of the wetted frictional properties of the surface and sand depth in accordance with paragraphs 3.1.4. and 3.1.5. above. The test shall be run in the same direction as in paragraph 3.2.2. of this Annex. The rate of braking application shall be such that the time interval between initial application of force and peak longitudinal force is in the range 0.2 s to 0.5 s."

Paragraph 4.2.7.2., amend to read:

"4.2.7.2. Test cycle

Within the same test cycle, each test run of each braking test shall be made in the same direction and in accordance with paragraph 4.2.7.1. of this Annex. Several test cycles may be performed consecutively, where the final braking test of the reference tyre set of a test cycle may serve as the initial braking test of the reference tyre set for the next test cycle.

Up to three candidate tyre sets may be measured within the same test cycle, provided that the tests are completed within one day."

Paragraph 4.2.7.2.1., amend to read:

"4.2.7.2.1. Initial braking test of the reference tyre set (R_i): first, the reference tyre set is mounted and at least six (6) valid test runs shall be made in accordance with paragraph 4.2.7.1. above."

Paragraph 4.2.7.2.2., amend to read:

"4.2.7.2.2. Braking test of a candidate tyre set (T_n): the reference tyre set is replaced by a candidate tyre set and at least six (6) valid test runs with the candidate tyre set shall be performed."

Paragraph 4.2.7.2.3., amend to read:

"4.2.7.2.3. After the braking test of the first candidate tyre set, up to two more candidate tyre sets may be measured."

Paragraph 4.2.7.2.4., amend to read:

"4.2.7.2.4. Final braking test of the reference tyre set (R_f): the test cycle shall be closed by at least six (6) more valid test runs of the same reference tyre set as at the beginning of the test cycle.

Examples:

(a) The run order for a test cycle with three candidate tyre sets (T_1 to T_3) would be the following:

$R_i – T_1 – T_2 – T_3 – R_f$

(b) The run order for a braking test (consisting of two test cycles) of five candidate tyre sets (T_1 to T_5) would be the following:

$R_i – T_1 – T_2 – T_3 – R_f/R_i – T_4 – T_5 – R_f$ "

Paragraph 4.2.8.1., amend to read:

"4.2.8.1. Calculation of the peak braking force coefficient

For each test run, the peak braking force coefficient (μ_{peak}) is the highest value of $\mu(t)$ before lockup occurs calculated as follows for each test run. Analogue signals should be filtered to remove noise. Digitally recorded signals must be filtered using a moving average technique.

$$\mu(t) = \left|\frac{f_h(t)}{f_v(t)}\right|$$

where:

$\mu(t)$ is the dynamic tyre braking force coefficient in real time;

$f_h(t)$ is the dynamic braking force in real time, in N;

$f_v(t)$ is the dynamic vertical load in real time, in N."

Paragraph 4.2.8.2., amend to read:

"4.2.8.2. Validation of results

The μ_{peak} coefficient of variation CV_μ is calculated as follows:

$$CV_\mu = 100\% \cdot \frac{\sigma_\mu}{\overline{\mu_{peak}}}$$

where

$\sigma_\mu = \sqrt{\frac{1}{N-1}\sum_{j=1}^{N}\left(\mu_{peak,j} - \overline{\mu_{peak}}\right)^2}$ denotes the corrected sample standard deviation and

$\overline{\mu_{peak}}$ the arithmetic mean of the peak braking force coefficients ($\mu_{peak,j}$) of N test runs.

For the reference tyre (R):

(a) The coefficients of variation CV_μ of the initial and the final braking tests of the reference tyre within one test cycle shall be less than or equal to 4 per cent;

(b) The arithmetic mean of the peak braking force coefficients of initial and the final braking test of the reference tyre within one test cycle shall not differ by more than 5 per cent of the average of the two values:

$$CVal\left(\mu_{peak}\right) = 100\% \cdot 2 \cdot \left|\frac{\overline{\mu_{peak}}(\mathrm{R_i}) - \overline{\mu_{peak}}(\mathrm{R_f})}{\overline{\mu_{peak}}(\mathrm{R_i}) + \overline{\mu_{peak}}(\mathrm{R_f})}\right| \leq 5\ \%$$

where

$\overline{\mu_{peak}}(\mathrm{R_i})$ / $\overline{\mu_{peak}}(\mathrm{R_i})$ is the arithmetic mean of the peak braking force coefficients in the initial/final braking test of the reference tyre within a test cycle;

(c) The temperature-corrected average peak braking force coefficients ($\mu_{peak,corr}$, see paragraph 3.2.2. of this Annex) as calculated from the initial and from the final braking test of the reference tyre within a test cycle shall be not less than 0.65 and not greater than 0.90.

If one or more of the above conditions is not met, the complete test cycle shall be performed again.

For the candidate tyre(s) (T_n):

The coefficient of variation of the peak braking force coefficient CV_μ is calculated for each candidate tyre. If one coefficient of variation is greater than

5 per cent, the data shall be discarded and the braking test repeated for this candidate tyre."

Paragraph 4.2.8.3., amend to read:

"4.2.8.3. Calculation of the adjusted average peak braking force coefficient of the reference tyre

The average peak braking force coefficient of the reference tyre used for the calculation of its braking force coefficient is adjusted according to the positioning of each candidate tyre in a given test cycle.

This adjusted average peak braking force coefficient of the reference tyre $\mu_{peak,adj}(\mathrm{R})$ is calculated in accordance with Table 3 where $\overline{\mu_{peak}}(\mathrm{R_i})$ is the arithmetic mean of the peak braking force coefficients in the initial test of the reference tyre ($\mathrm{R_i}$) and $\overline{\mu_{peak}}(\mathrm{R_f})$ is the arithmetic mean of the peak-braking force coefficients in the final test of the same reference tyre ($\mathrm{R_f}$) within one test cycle.

Table 3

If the number and the sequence of candidate tyre sets within one test cycle is:	*and the candidate tyre set to be qualified within this test cycle is:*	*the corresponding adjusted peak braking force coefficients of the reference tyre is calculated as follows:*
1 $\mathrm{R_i} - \mathrm{T_1} - \mathrm{R_f}$	$\mathrm{T_1}$	$\mu_{peak,adj}(\mathrm{R}) = {}^1\!/_2 \cdot \left[\overline{\mu_{peak}}(\mathrm{R_i}) + \overline{\mu_{peak}}(\mathrm{R_f})\right]$
2 $\mathrm{R_i} - \mathrm{T_1} - \mathrm{T_2} - \mathrm{R_f}$	$\mathrm{T_1}$	$\mu_{peak,adj}(\mathrm{R}) = {}^2\!/_3 \cdot \overline{\mu_{peak}}(\mathrm{R_i}) + {}^1\!/_3 \cdot \overline{\mu_{peak}}(\mathrm{R_f})$
	$\mathrm{T_2}$	$\mu_{peak,adj}(\mathrm{R}) = {}^1\!/_3 \cdot \overline{\mu_{peak}}(\mathrm{R_i}) + {}^2\!/_3 \cdot \overline{\mu_{peak}}(\mathrm{R_f})$
3 $\mathrm{R_i} - \mathrm{T_1} - \mathrm{T_2} - \mathrm{T_3} - \mathrm{R_f}$	$\mathrm{T_1}$	$\mu_{peak,adj}(\mathrm{R}) = {}^3\!/_4 \cdot \overline{\mu_{peak}}(\mathrm{R_i}) + {}^1\!/_4 \cdot \overline{\mu_{peak}}(\mathrm{R_f})$
	$\mathrm{T_2}$	$\mu_{peak,adj}(R) = {}^1\!/_2 \cdot \left[\overline{\mu_{peak}}(\mathrm{R_i}) + \overline{\mu_{peak}}(\mathrm{R_f})\right]$
	$\mathrm{T_3}$	$\mu_{peak,adj}(\mathrm{R}) = {}^1\!/_4 \cdot \overline{\mu_{peak}}(\mathrm{R_i}) + {}^3\!/_4 \cdot \overline{\mu_{peak}}(\mathrm{R_f})$

"

Paragraph 4.2.8.4., delete.

Paragraph 4.2.8.5., renumber as 4.2.8.4. and amend to read:

"4.2.8.4. Calculation of the wet grip index of the candidate tyre

The wet grip index $G(\mathrm{T}_n)$ of the candidate tyre T_n (n = 1, 2, 3) is calculated as follows:

$$G(\mathrm{T}_n) = K_{\mathrm{trailer}} \cdot \left\{\overline{\mu_{peak}}(\mathrm{T}_n) - \left[a \cdot \Delta\mu_{peak}(\mathrm{R}) + b \cdot \Delta\vartheta + c \cdot (\Delta\vartheta)^2 + d \cdot \Delta MTD\right]\right\}$$

where:

$\overline{\mu_{peak}}(\mathrm{T}_n)$ is the arithmetic mean of the peak braking force coefficients of the candidate tyre T_n within a braking test;

$$\Delta\mu_{peak}(\mathrm{R}) = \mu_{peak,adj}(\mathrm{R}) - \mu_{peak}(R_0)$$

$\mu_{\mathrm{peak,adj}}(\mathrm{R})$ is the adjusted peak braking force coefficient in accordance with Table 3;

$\mu_{\mathrm{peak}}(\mathrm{R_0}) = 0.85$ is fixed as the peak braking force coefficient for the reference tyre in the reference conditions;

$$\Delta\vartheta = \vartheta - \vartheta_0$$

ϑ is the measured wet surface temperature in degrees Celsius when the candidate tyre $\mathrm{T_n}$ is tested;

ϑ_0 is the wetted surface reference temperature for the candidate tyre according to its sidewall marking as listed in Table 4;

$$\Delta MTD = MTD - MTD_0$$

MTD is the measured macro texture depth of the track

MTD_0 = 0.8 mm is fixed as the macro texture depth of the reference track;

$K_{trailer}$ = 1.50 is a factor to grant consistency between previous calculation of the wet grip index and this one, and to ensure convergence between vehicle and trailer method and

coefficient *a*, *b*, *c* and *d* are given in Table 4.

Table 4

Category of use		ϑ_0 *(°C)*	*a*	*b* *($°C^{-1}$)*	*c* *($°C^{-2}$)*	*d* *(mm^{-1})*
Normal tyre		20	+0.99757	+0.00251	−0.00028	+0.07759
Snow tyre		15	+0.87084	−0.00025	+0.00004	−0.01635
	Snow tyre for use in severe snow conditions	10	+0.67929	+0.00115	−0.00005	+0.03963
Special-use tyre		not defined				

"

Part (B),

Paragraph 1.1., amend to read:

"1.1. Track characteristics

The surface shall be a dense asphalt surface with a uniform gradient of not more than two per cent and shall not deviate more than 6 mm when tested with a 3 m straight edge.

The test surface shall have a pavement of uniform age, composition, and wear. The test surface shall be free of loose material or foreign deposits.

The maximum chipping size shall be from 8 mm to 13 mm.

The average macro texture depth measured as specified in ASTM E 965-96 (reapproved 2006) shall be (0.7 ± 0.3) mm.

The surface friction value for the wetted track shall be established by one or other of the following methods according to the discretion of the Contracting Party."

Paragraph 1.1.1., amend to read:

"1.1.1. Standard Reference Test Tyre (SRTT) method

This method uses the Standard Reference Test Tyre SRTT16.

Using the procedure described in paragraph 4.2. of part (A) of this Annex, perform in the same area where the average macro texture depth was measured one braking test of the reference tyre, consisting of at least six (6) valid test runs in the same direction.

Evaluate the braking test as described in paragraphs 4.2.8.1. and 4.2.8.2. of part (A) of this Annex. If the coefficient of variation CV_μ exceeds 4 per cent, dismiss the results and repeat the braking test.

The arithmetic mean ($\overline{\mu_{peak}}$) of the measured peak braking force coefficients shall be corrected for the effects of temperature as follows:

$$\mu_{peak,corr} = \overline{\mu_{peak}} + a \cdot (\vartheta - \vartheta_0)$$

where

ϑ is the wetted track surface temperature in degrees Celsius,

$a = 0.002\ ℃^{-1}$ and $\vartheta_0 = 20\ ℃$.

The temperature corrected average peak braking force coefficient ($\mu_{peak,corr}$) shall be not less than 0.65 and not greater than 0.90.

The test shall be conducted using the lanes and length of the track to be used for the wet grip test.

For the trailer method, testing is run in such a way that braking occurs within 10 meters distance of where the surface was characterized."

Paragraph 1.1.2., delete.

Paragraph 1.1.3., renumber as 1.1.2.

Annex 5 – Appendix, amend to read*:*

"Annex 5 – Appendix

Test reports examples of wet grip index

Example 1: **Test report of wet grip index using trailer or tyre test vehicle method**

Test report number:		Test date:	

Track:			Minimum:	Maximum:
Texture depth (mm):		Wetted surface temp. (°C):		
$\mu_{peak,corr}$:		Ambient temp (°C):		
Water depth (mm):				

Speed (km/h):	

No.		***1***	***2***	***3***	***4***	***5***
Brand						
Pattern/Trade description		SRTT…				SRTT…
Size						
Service description						
Reference (test) inflation pressure(1) (kPa)						
Tyre identification						
M+S marking (Y/N)						
3PMSF marking (Y/N)						
Rim						
Load (kg)						
Pressure (kPa)						
μ_{peak}	1					
	2					
	3					
	4					
	5					
	6					

	7					
	8					
$\overline{\mu_{peak}}$						
Standard deviation, σ_μ						
$CV_\mu \leq 4$ %						
$CVal(\mu_{peak}) \leq 5$ %						
$\mu_{peak,corr}$(R)						
$\mu_{peak,adj}$(R)						
Wet grip index						
Wetted surface temp. (°C)						
Ambient temp. (°C)						
Remarks						

(1) for C2 and C3 tyres, corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation

Example 2: **Test report of wet grip index using vehicle method**

Test report number:		Test date:			Driver:		
Track:			Minimum:	Maximum:	Vehicle		
Texture depth (mm):		Wetted surface temp. (°C):			Brand:		
$BFC_{ave,corr,1}$:		Ambient temp (°C):			Model:		
$BFC_{ave,corr,2}$:					Type:		
$CVal(BFC_{ave,corr})$:					Year of registration:		
Water depth (mm):					Maximum axle load:	Front	Rear
Initial speed (km/h):		Final speed (km/h):					

No.		***1***		***2***		***3***		***4***		***5***	
Brand											
Pattern/Trade description		SRTT…								SRTT…	
Size											
Service description											
Reference (test) inflation pressure(1) (kPa)											
Tyre identification											
M+S marking (Y/N)											
3PMSF marking (Y/N)											
Rim											
Front axle pressure (kPa)		left:	right:	left:	right:	left:	right:	left:	right:	left:	right:
Rear axle pressure (kPa)		left:	right:	left:	right:	left:	right:	left:	right:	left:	right:
Front axle load (kg)		left:	right:	left:	right:	left:	right:	left:	right:	left:	right:
Rear axle load (kg)		left:	right:	left:	right:	left:	right:	left:	right:	left:	right:
		Braking distance (m)	*BFC_i*	*Braking distance (m)*	*BFC_i*	*Braking distance (m)*	*BFC_i*	*Braking distance (m)*	*BFC_i*	*Braking distance (m)*	*BFC_i*
Measurement	1										

	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
$\overline{BFC_{ave}}$											
Standard deviation, σ_{BFC}											
$CV_{BFC} \leq 4$ %											
$CVal(BFC_{ave}) \leq 5$ %											
$BFC_{ave,corr}$(R)											
BFC_{adj}(R)											
Wet grip index											
Wetted surface temp. (°C)											
Ambient temp. (°C)											
Remarks											

(1) for C2 and C3 tyres, corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation."

Annex 7

Paragraph 1.3., amend to read:

"1.3. "*Traction test*" means a series of a specified number of spin-traction test runs according to ASTM standard:

(a) F1805-06 in case SRTT14 is used as reference tyre or

(b) F1805-20 in case SRTT16 is used as reference tyre

of the same tyre repeated within a short time frame."

Paragraph 2., amend to read:

"2. Spin traction method for Class C1 and C2 tyres (traction ~~force~~ test per paragraph 6.4. (b) of this Regulation)

The test procedure of ASTM standard F1805-06 or F1805-20, as applicable according to paragraph 1.3., shall be used to assess snow performance through the traction performance index (TPI) on medium pack snow (The snow compaction index measured with a CTI penetrometer[1] shall be between 70 and 80)."

Paragraph 2.1., amend to read:

"2.1. The test course surface shall be composed of a medium pack snow surface, as characterized in table A2.1 of ASTM standard F1805-06 or ASTM F1805-20, as applicable."

Paragraph 2.2., amend to read:

"2.2. The tyre load for testing shall be as per option 2 in paragraph 11.9.2. of ASTM standard F1805-06 or ASTM F1805-20, as applicable. When the SRTT16 is used as reference tyre, it shall be tested with a load of 531 kg at an inflation pressure of 240 kPa (cold)."

Insert a new paragraph 2.3. to read:

"2.3. The snow grip index (SG) of a candidate tyre Tn shall be computed as follows:

$$SG(Tn) = f \cdot \frac{TPI}{100}$$

where

(a) $f = 1.000$ when using SRTT14 as reference tyre per ASTM F1805-06, and

(b) $f = 0.987$ when using SRTT16 as reference tyre per ASTM F1805-20,

and

TPI denotes the traction performance index as defined in ASTM F1805-06 or ASTM F1805-20, as applicable."

Insert a new paragraph 3.1.6. to read:

"3.1.6. In order to run this test, the Standard Reference Test Tyres (SRTT) as shown in the following table shall be used:

Class C1 tyres	*Class C2 tyres*
SRTT14 or SRTT16	SRTT16C

"

Paragraph 3.4.1.3., amend to read:

"3.4.1.3. The snow grip index (SG) of a candidate tyre Tn shall be computed from the arithmetic mean $\overline{a_{\mathrm{Tn}}}$ of the mfdd of the tyre Tn and the applicable weighted average wa_{SRTT} of the SRTT as shown in the table:

$$SG(\mathrm{Tn}) = f \cdot \frac{\overline{a_{\mathrm{Tn}}}}{wa_{\mathrm{SRTT}}}$$

where *f* is given in the following table

Tyre class	*Reference tyre*	*Factor*
C1	SRTT14	$f = 1.000$
	SRTT16	$f = 0.980$
C2	SRTT16C	$f = 1.000$

"

Paragraph 3.4.3.1., amend to read:

"3.4.3.1 The snow grip index of the control tyre C relative to the SRTT (SG1) is given by

$$SG1 = SG(\mathrm{C}) = f \cdot \frac{\overline{a_{\mathrm{C}}}}{wa_{\mathrm{SRTT}}}$$

where *f* is given in paragraph 3.4.1.3., and snow grip index of the candidate tyre Tn relative to the control tyre (SG2) is given by

$$SG2 = \frac{\overline{a_{\mathrm{Tn}}}}{wa_{\mathrm{C}}}$$

where wa_{C} is the applicable weighted average of the control tyre, shall be established using the procedure in paragraphs 3.1. to 3.4.2. above.

The snow grip index of the candidate tyre relative to the SRTT SG(Tn) shall be the product of the two resulting snow grip indices that is given by

$$SG(Tn) = SG1 \cdot SG2."$$

Appendix 2

Part 1, Report, amend to read:

"…

5. Tyre class: .....

6. Category of use: .....

7. Snow grip index SG

7.1. Test procedure and SRTT used .....

8. Comments (if any): .....

…"

Part 2, Test data, amend to read:

" …

5. Test results: mean fully developed decelerations ($m \cdot s^{-2}$) / traction coefficient(3)

Run number	*Specification*	*SRTT (1st test)*	*Candidate 1*	*Candidate 2*	*SRTT (2nd test)*
1					
2					
3					
4					
5					
6					
Mean					
Standard deviation					
Coefficient of variation	$CV_a \leq 6$ %				
Coefficient of Validation	$CVal_a$ (SRTT) ≤ 5 %				
SRTT weighted average					
Factor *f*					
Snow grip index		1.00			

(1) for C2 tyres, corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation

…"