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Item 6(b) of the provisional agenda

Regulation No. 117**(Tyre rolling noise and wet grip adhesion)****Proposal for draft amendments to Regulation No. 117****Submitted by the expert from the European Commission ***

The text reproduced below was prepared by the Chair of the informal group on Special Tyre Definitions (STD). This group was requested by the Working Party on Noise (GRB) at its fifty-first session to examine various outstanding issues related to the introduction of the 02 series of amendments to the Regulation (ECE/TRANS/WP.29/GRB/49, para. 19), in particular with regard to the measurement of rolling resistance and the testing of snow tyres. Modifications to the 02 series of amendments to Regulation No. 117 (ECE/TRANS/WP.29/2010/63, as amended by ECE/TRANS/WP.29/1085 para. 45) are marked in bold for new or as strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2006–2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Paragraph 3.2.1., amend to read:

- “3.2.1. Details of the major features, with respect to the effects on **the performance** (i.e. rolling sound emission level, adhesion on wet surfaces, **rolling resistance and snow grip**) **of the tyres, including the tread pattern, included in the designated range of tyre sizes. This may be by means of descriptions supplemented by technical data, drawings, photographs and Computer Tomography (CT), and must** be sufficient to allow the type approval authority or technical service to determine whether any subsequent changes to the major features will adversely affect the tyre performance. The effects of changes to minor details of tyre construction on tyre performances will be evident and determined during checks on conformity of production;”

Paragraph 6.4., amend to read (inserting also a new footnote */):

- “6.4. In order to be classified in the category of use “snow tyre”, a tyre is required to meet performance requirements based on a test method by which:
- (a) the mean fully developed deceleration (“mfdd”) in a braking test,
 - (b) or alternatively ~~a maximum or an~~ average traction force in a traction test,
 - (c) or alternatively the mean fully developed acceleration in an acceleration test */

of a candidate tyre is compared to that of a standard reference tyre.

The relative performance shall be indicated by a snow index.

***/ This test procedure is currently under development.”**

Paragraph 6.4.1., amend to read:

- “6.4.1. Tyre snow performance ~~and design~~ requirements”

Paragraph 6.5.1., amend to read:

- “6.5.1. The tyre shall have a tread pattern with minimum two circumferential ribs, each containing a minimum of 30 block-like elements, separated by grooves and/or sipe elements the depth of which has to be minimum ½ of the tread depth. **The use of an alternative option of a physical test will only apply at a later stage following a further amendment to the Regulation including a reference to an appropriate test methods and limit values.**”

Paragraphs 12.1. to 12.3., amend to read:

- “12.1. As from the date of entry into force of the 02 series of amendments to this Regulation, Contracting Parties applying this Regulation shall not refuse to grant ECE approval under this Regulation for a type of tyre if the tyre complies with the requirements of the 02 series of amendments, including the stage 1 or stage 2 rolling sound requirements set out in paragraphs 6.1.1. to 6.1.3., the requirements for wet grip performance set out in paragraph 6.2.1., and the stage 1 or stage 2 rolling resistance requirements set out in paragraph 6.3.1. or 6.3.2.

- 12.2. As from 1 November 2012, Contracting Parties applying this Regulation shall refuse to grant ECE approval if the tyre type to be approved does not meet the requirements of this Regulation as amended by the 02 series of amendments, and shall, in addition, refuse to grant ECE approval if the stage 2 rolling sound requirements set out in paragraphs 6.1.1. to 6.1.3., the requirements for wet grip performance set out in paragraph 6.2.1., and the stage 1 rolling resistance requirements set out in paragraph 6.3.1. are not complied with.
- 12.3. As from 1 November 2014, Contracting Parties applying this Regulation may refuse to allow the sale or entry into service of a tyre which does not meet the requirements of this Regulation as amended by the 02 series, and which does not meet the requirements of this Regulation as amended by the 02 series of amendments including the wet grip performance requirements set out in paragraph 6.2.1.”

Annex 7

Paragraph 1.4., should be deleted.

Paragraph 2., amend to read (inserting also a reference to the existing footnote 1/):

- “2. Spin traction method for Class C1 and C2 tyres
- The test procedure of ASTM standard F1805-06 shall be used to assess snow performance through spin traction values **on medium packed snow (The snow compaction index measured with a CTI penetrometer 1/ shall be between 70 and 80).**

1/ Refer to the appendix of ASTM standard F1805-06 for details.”

Insert new paragraphs 2.1. and 2.2., to read:

- “**2.1. The test course surface shall be composed of a medium packed snow surface, as characterized in table A2.1 of ASTM standard F1805-06.**
- 2.2. The tyre load for testing shall be as per option 2 in paragraph 11.9.2. of ASTM standard F1805-06.”**

Paragraph 3.1.1., amend to read (including the existing footnote 1/):

- “3.1.1. Test course
- The braking tests shall be done on a flat test surface of sufficient length and width, with a maximum 2 per cent gradient, covered with packed snow.
- The snow surface shall be composed of a hard packed snow base at least 3 cm thick and a surface layer of medium packed and prepared snow about 2 cm thick.
- Both air temperature, measured about one meter above the ground, and snow temperature, measured at a depth of about one centimetre, shall be between -2 °C and -15 °C.
- It is recommended to avoid direct sun light, large variations of sun light or humidity, as well as wind.
- The snow compaction index measured with a CTI penetrometer 1/ shall be ~~between 70 and 90, preferably~~ between 75 and 85.

1/ Refer to the appendix of ASTM standard F1805-06 for details.”

Insert new Annexes 8 and 9, to read:

“Annex 8 (informative)

Procedure for inter-laboratory comparison for rolling resistance

1. General

- 1.1. This clause describes the procedure to be followed to perform an inter-laboratory comparison. The collected data can be used to define a reference based upon multiple [Technical Service]/[test laboratory] machines for the purpose of Annex 9. They can also be used for:**
- (a) the determination of the actual number N ($N \geq 5$) of tyres to be used for the purpose of Annex 9,**
 - (b) the selection of the nominal value of the N tyres to be used,**
 - (c) the determination of assigned values (see paragraph 1.3. below) for a set of tyres, as defined in paragraph 2. of this annex.**
- 1.2. This annex is not mandatory for Type Approval.**
- 1.3. This procedure requires a set of at least five appropriately selected tyres. The C_r results of each selected tyre measured by each [Technical Service] / [test laboratory] participating to the inter-laboratory comparison according to an applicable standard (e.g ISO 5725) can be used for determining the C_r assigned value for each selected tyre.**
- Every [Technical Service]/[test laboratory] machine participating to the inter-laboratory comparison shall be in accordance with Annex 6 of this Regulation.**
- 1.4. The assigned value for each reference tyre is the general average of the results obtained by all [Technical Services]/[test laboratories] for this reference tyre in this inter-laboratory comparison.**
- 1.5. According to paragraph 5.1. of Annex 9 of this Regulation, a [Technical Service's]/[test laboratory's] inter-laboratory alignment formula can be established and can be used to translate the results obtained on the different [Technical Service]/[test laboratory] machines into aligned results of each [Technical Service]/[test laboratory], in order to provide assigned values to candidate machines when aligning with one [Technical Service]/[test laboratory].**

2. Tyre selection requirements

The tyres used to conduct the procedure shall be identified to cover the needed usage range in terms of load index, C_r and F_r as follows:

- (a) C_r values shall have a gap between two selected tyres of:**

1.0 +/- 0.5 N/kN for Class C1 and C2 tyres, and

1.0 +/- 0.5 N/kN for Class C3 tyres.

and C_r values shall have a minimum range, between maximum C_r value and minimum C_r value of the alignment tyres, of:

3 N/kN for Class C1 and C2 tyres, and

2 N/kN for Class C3 tyres.

C_r values shall be distributed uniformly.

- (b) The selected tyre section width shall be:
 - ≤ 245 mm for machines for Class C1 and C2 tyres, and
 - ≤ 345 mm for machines for Class C3 tyres.
- (c) The selected tyre outer diameter shall be:
 - between 510 to 800 mm for machines for Class C1 and C2, and
 - between 771 to 1143 mm for machines for Class C3.
- (d) Load index values shall adequately cover the range for the tyres to be tested, ensuring that the F_r values also cover the range for the tyres to be tested.

The number of selected tyres shall be equal to at least five, i.e. there shall be:

- (a) at least five selected tyres for Class C1 and C2 tyres, and
- (b) at least five selected tyres for Class C3 tyres.

Each tyre shall be checked prior to use and replaced when:

- (a) it shows a condition which makes it unusable for further tests, and/or
- (b) there are deviations of C_r for measurement greater than 1.5 per cent relative to earlier measurements after correction for any machine drift.

3. [Technical Service]/[test laboratory] inter laboratory comparison frequency

The inter laboratory comparison process must be repeated at least every two years by each [Technical Service]/[test laboratory] in the list. During each two years period, the set of selected tyres and their assigned values will not be changed.

4. Evolution of the list of participating [Technical Services]/[test laboratories]

Any [Technical Service]/[test laboratory] may participate to the inter-laboratory comparison or withdraw from the list. During each two years period, the set of tyres and their assigned values will not be changed.

A [Technical Service]/[test laboratory] entitled and willing to participate will receive a selected tyre set, measure it according to Annex 6 and get aligned according to Annex 9 using the existing assigned values for each tyre.

5. Procedure for [Technical Services]/[test laboratories] participating to the inter-laboratory comparison

- (a) Each time a tyre is measured, the tyre/wheel assembly shall be removed from the machine and the entire test procedure specified in section 4 of Annex 6 shall be followed again.

- (b) A list of all [Technical Services]/[test laboratories] willing to be part of the inter-laboratory comparison for the definition of the assigned values is established. Each [Technical Service]/[test laboratory] shall measure each alignment tyre three times in accordance with section 4 of Annex 6 and applying the conditions in section 3 of Annex 6, provide the individual values corrected for a temperature of 25 °C and a drum diameter of 2 m, the mean value and standard deviation established from the 3 measurements for each tyre.
- (c) The measured standard deviation σ_m for different classes of tyre shall be as follows:
 not greater than 0.05 N/kN for class C1 and C2 tyres, and
 not greater than 0.05 N/kN for class C3 tyres.
- (d) The average of the values given by all the participating [Technical Services]/[test laboratories] for each tyre is taken as the assigned value for this tyre.
- (e) The correlation shall be performed using a linear regression technique, $A1_i$ and $B1_i$, given in the equation:

$$C_{r_ass} = A1_i \times C_{r_TS_i} + B1_i$$

where:

C_{r_ass} is the assigned value of the rolling resistance coefficient;

$C_{r_TS_i}$ is the measured value of the rolling resistance coefficient by [Technical Service]/[test laboratory] “i”, including temperature and drum diameter influences.

The aligned C_r value for the [Technical Service]/[test laboratory] shall take into account coefficients $A1_i$ and $B1_i$.

Annex 9 (informative)

Procedure for measurement machines alignment and monitoring requirements for rolling resistance

1. Definitions

1.1. Alignment tyres

A common set of at least five different tyres, conforming to the specification of paragraph 2. of Annex 8, which are the same identical tyres measured by both the candidate and [Technical Service]/[test laboratory] machines shall be used to perform the machine alignment.

1.2. Deviation of alignment tyre

Difference in terms of time compared with the mean rolling resistance coefficient measurement results for a given alignment tyre with the appropriate number of repetitions.

2. General

- 2.1.** This annex describes the procedure to be followed if needed to align measurement results on assigned values issued from inter-laboratory comparisons. This Annex is not mandatory for Type Approval.
- 2.2.** The machine alignment procedure requires at least five alignment tyres used by the candidate laboratory operating the machine. These tyres are used to align candidate machine(s) by comparing the measured C_r results to the ones obtained by a [Technical Service]/[test laboratory] eligible in the inter-laboratory comparison. An alignment formula is then established and shall be used to translate the results obtained on the candidate machine into aligned results.
- 2.3.** The alignment tyre set will be provided by the candidate laboratory to the [Technical Service]/[test laboratory] it chose to perform the alignment.

3. Conditions for candidate machine

The candidate machine shall be in accordance with Annex 6 of this Regulation.

4. Alignment tyre requirements

- 4.1.** The alignment tyres used to conduct the alignment procedure shall be identified to cover the needed usage range in terms of load index, C_r and F_r as follows:

- (a) C_r values shall have a gap between two alignment tyres of:
- 1.0 +/- 0.5 N/kN for Class C1 and C2 tyres, and
- 1.0 +/- 0.5 N/kN for Class C3 tyres.
- and C_r values shall have a minimum range, between maximum C_r value and minimum C_r value of the alignment tyres, of:
- 3 N/kN for Class C1 and C2 tyres, and
- 2 N/kN for Class C3 tyres.
- C_r values shall be distributed uniformly.
- (b) The alignment tyre section width shall be:
- ≤ 245 mm for machines for Class C1 and C2 tyres, and
- ≤ 345 mm for machines for Class C3 tyres.
- (c) The alignment tyre outer diameter shall be:
- between 510 to 800 mm for machines for Class C1 and C2 tyres, and
- between 771 to 1143 mm for machines for Class C3 tyres.
- (d) Load index values shall adequately cover the range for the tyres to be tested, ensuring that the F_r values also cover the range for the tyres to be tested.

The number of alignment tyres shall be equal to at least five, i.e. there shall be:

- (a) at least five alignment tyres for Class C1 and C2 tyres, and

- (b) at least five alignment tyres for Class C3 tyres.
- 4.2. Each alignment tyre shall be checked prior to use and replaced when:
- (a) it shows a condition which makes it unusable for further tests, and/or
 - (b) there are deviations of C_r for alignment tyre measurement greater than 1.5 per cent relative to earlier measurements after correction for any machine drift.

5. Alignment procedure

- 5.1. Alignment procedure for [Technical Services]/[test laboratories] participating to the inter-laboratory comparison (paragraph 1.2. of Annex 8)

Each [Technical Service]/[test laboratory] “i” shall correlate its measurements with the assigned values as defined in paragraph 5 of Annex 8 of this Regulation.

5.2. Alignment of candidate machine:

- (a) Each time an alignment tyre is measured, the tyre/wheel assembly shall be removed from the machine and the entire test procedure specified in paragraph 4 of Annex 6 shall be followed again. This requirement applies to both the [Technical Service]/[test laboratory] and the candidate laboratory.
- (b) The [Technical Service]/[test laboratory] shall measure each alignment tyre three times in accordance with paragraph 4 of Annex 6 and applying the conditions in paragraph 3 of Annex 6, and provides the individual values corrected for a temperature of 25°C and a drum diameter of 2 m, the mean value and standard deviation established from the 3 measurements for each tyre.
- (c) The candidate machine shall measure each alignment tyre three times in accordance with paragraph 4 of Annex 6 and applying the conditions in paragraph 3 of Annex 6, with a measurement standard deviation for each tyre of:
 - (i) not greater than 0.075 N/kN for Class C1 and C2 tyres, and
 - (ii) not greater than 0.06 N/kN for Class C3 tyres.

If this measurement standard deviation exceeds this criterion with 3 measurements, then the number of measurement repetitions shall be increased to meet the criterion:

$$n = (\sigma_m/\gamma)^2$$

where:

$\gamma = 0.043$ N/kN for Class C1 and C2 tyres, and

$\gamma = 0.035$ N/kN for Class C3 tyres.

- (d) The alignment shall be performed by the candidate laboratory and shall be a linear regression technique, A and B, given in the equation:

$$C_{r_TS_i} = A2 \times C_{r_CM} + B2$$

where:

$C_{r_TS_i}$ is the measured value of the rolling resistance coefficient by [Technical Service]/[test laboratory] including temperature and drum diameter influences.

C_{r_CM} is the measured value of the rolling resistance coefficient by the candidate laboratory including temperature and drum diameter influences.

The measurement standard deviation estimate σ_m will also be given.

- 5.3. The alignment process shall be repeated at least every second year and always after any significant machine change or any drift in machine control tyre monitoring data.”

II. Justification

Paragraph 3.2.1.

1. Clarification is necessary with respect to the information required to be submitted in the application for approval.

Paragraph 6.4.(b)

2. It is proposed to remove the reference to a “maximum” traction force in paragraph 6.4. (b), as the American Society for Testing and Materials (ASTM) test method uses the average traction force in the traction test.

Paragraph 6.4.(c) and Annex 7, paragraph 1.4.

3. There is not yet any established test procedure associated with this test method, or any performance criteria specified in paragraph 6.4.1.1. Therefore, references to the acceleration test procedure are to be eliminated from the document for the time being. However, a footnote has been inserted to note the fact that such a procedure is under development. It is intended to introduce this as an alternative procedure in a further amendment to this Regulation.

Paragraph 6.4.1.

4. The term “design” is not relevant.

Paragraph 6.5.1.

5. To introduce a possible amendment to use a test method as an alternative applicable at a further stage in addition to the geometrical requirements.

Paragraphs 12.1. to 12.3.

6. Editorial amendments to refer to the wet grip requirements of paragraph 6.2.1. rather than paragraph 6.2.

Annex 7, paragraphs 2. to 2.2.

7. The standard ASTM standard F1805-06 describes several kinds of snow. Therefore, the type of snow used has to be defined, as well as the related compaction index value. Editorial amendments to refer to the wet grip requirements of paragraph 6.2.1. rather than paragraph 6.2.

Annex 7, paragraph 3.1.1.

8. The range 75 to 85 shall be the unique range retained to avoid any confusion.

Annexes 8 and 9

9. The original aim of these Annexes was to permit an accurate system of inter-laboratory comparison in order to assist Contracting Parties to carry out market surveillance. At the 151st session of the World Forum WP.29 in June 2010, it was agreed that these two Annexes should not be part of this Regulation, but should nevertheless be agreed upon by GRB and reproduced in the report of GRB in order to provide a reference document for inter-laboratory comparison procedures for measuring tyre rolling resistance. For the purposes of discussion within GRB, the terms “Annex 8” and “Annex 9” will continue to be used throughout this document for ease of reference.

10. The aim of Annex 8 is to describe and to define the test conditions for the inter-laboratory comparison.

11. Annex 9 defines first in paragraph 5.1., the alignment procedure for the Technical Services or test laboratory (as introduced paragraph 1.2. of Annex 8) for the alignment to the assigned values. Paragraph 5.2. gives the procedure for a candidate machine and the calculation for the correction. Annex 9 also gives the procedures to establish the assigned values in order to permit a candidate laboratory to correct its own measurements for the purpose of market surveillance.

12. One issue discussed but not resolved during the informal group meeting was whether the Technical Services or just the test laboratories should be involved in the inter-laboratory procedure. This document contains the term [Technical Service]/[test laboratory] in several places to allow GRB to decide on this point.