Agreement

Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions*

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum 116 – Regulation No. 117

Revision 3 - Amendment 3

Supplement 7 to the 02 series of amendments – Date of entry into force: 8 October 2015

Uniform provisions concerning the approval of tyres with regard to rolling sound emissions and/or to adhesion on wet surfaces and/or to rolling resistance

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2015/5.

UNITED NATIONS

Paragraph 2.16., amend to read:

"2.16. "Standard reference test tyre (SRTT)" means a tyre that is produced, controlled and stored in accordance with the ASTM (American Society for Testing and Materials) standards

(a) E1136-93 (2003) for the size P195/75R14
(b) F2872 (2011) for the size 225/75 R 16 C.
(c) F2871 (2011) for the size 245/70R19.5
(d) F2870 (2011) for the size 315/70R22.5"

Paragraph 6.4.1.1., amend to read:

"6.4.1.1. Class C1, C2 and C3 tyres

The minimum snow index value, as calculated in the procedure described in Annex 7 and compared with the SRTT shall be as follows:

<table>
<thead>
<tr>
<th>Class of tyre</th>
<th>Snow grip index (brake on snow method)</th>
<th>Snow grip index (spin traction method)</th>
<th>Snow grip index (acceleration method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>1.07</td>
<td>No</td>
<td>1.10</td>
</tr>
<tr>
<td>C2</td>
<td>No</td>
<td>1.02</td>
<td>1.10</td>
</tr>
<tr>
<td>C3</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

(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"

Annex 1,

Paragraph 3., amend to read:

"3. "Tyre class" and "category of use" of the type of tyre: ……

3.1. Snow tyre for use in severe snow conditions (Yes/No)

3.2. Traction tyre (Yes/No)"...

Insert a new paragraph 6.4., to read:

"6.4. Snow grip level of the representative tyre size, see paragraph 2.5. of Regulation No. 117, as per item 7. of the test report in the appendix to Annex 7:.......................... (Snow grip index) using the brake on snow method, spin traction method or acceleration method."

Annex 2,

Appendix 2,

Example 1, correct to read:

0212345 S2 0236378
Example 3, correct to read:

\[ \text{Example 3, correct to read:} \]

\[ \text{Example 4, correct to read:} \]

\[ \text{Appendix 3,} \]

Example 1, correct to read:

\[ \text{Example 1, correct to read:} \]

Annex 4, delete duplicated paragraphs 3.2. to 3.2.1.2.

Annex 6,

Paragraph 3.5., amend to read:

"3.5. Duration and speed.

When the deceleration method is selected, the following requirements apply:

(a) The deceleration j shall be determined in differential $d\omega/dt$ or discrete $\Delta\omega/\Delta t$ form, where $\omega$ is angular velocity, $t$ – time;

If the differential form $d\omega/dt$ is used, then the recommendations of Appendix 5 to this annex are to be applied.

(b) ..."

Paragraph 5.1.5., amend to read:

"5.1.5. Deceleration method

..."

I_T is the spindle, tyre and wheel inertia in rotation, in kilogram meter squared,

R_r is the tyre rolling radius, in metre,

$\omega_{T0}$ is the tyre angular speed, unloaded tyre, in radian per second.

...

Appendix 1,

Paragraph 7., delete the reference to the footnote 1 and footnote 1.
Insert a new Appendix 5, to read:

"Annex 6 – Appendix 5

Deceleration method: Measurements and data processing for deceleration value obtaining in differential form $d\omega/dt$

1. Record dependency "distance-time" of rotating body decelerated from peripheral with a speed range such as 82 to 78 km/h or 62 to 58 km/h dependent on tyre class (Annex 6, paragraph 3.2., table 1) in a discrete form (figure 1) for a rotating body:

$$z = f(t_z)$$

Where:

$z$ is a number of body revolutions during deceleration;
$t_z$ is end time of revolution number $z$ in seconds recorded with 6 digits after zero.

Figure 1

Note 1: The lower speed of the recording range may be reduced down to 60 km/h when test speed is 80 km/h and 40 km/h when the test speed is 60 km/h.

2. Approximate recorded dependency by continuous, monotonic, differentiable function:

2.1. Choose the value nearest to the maximum of $z$ dividable by 4 and divide it into 4 equal parts with bounds: $0, z_1(t_1), z_2(t_2), z_3(t_3), z_4(t_4)$.

2.2. Work out the system for 4 equations each of the form:

$$z_n = A \ln \frac{\cos B(T_{n-1} - t_m)}{\cos B T_n}$$
Where unknowns:

A is a dimensionless constant,

B is a constant in revolutions per second,

T Σ is a constant in seconds,

m is the number of bounds shown in figure 1.

Insert in these 4 equations the coordinates of 4-th bound above.

2.3. Take constants A, B and T Σ as the solution of the equation system of paragraph 2.2. above using iteration process and approximate measured data by formulae:

\[ z(t) = A \ln \frac{\cos B(T_Σ - t)}{\cos B T_Σ} \]

Where:

z(t) is the current continuous angular distance in number of revolutions (not only integer values);

t is time in seconds.

*Note 2:* Other approximating functions \( z = f(t) \) may be used if their adequacy is proven.

3. Calculate the deceleration \( j \) in revolutions per second squared (s^-2) by the formula:

\[ j = AB^2 \frac{\omega^2}{A} \]

Where:

\( \omega \) is the angular speed in revolutions per second (s^-1).

For the case \( Un = 80 \text{ km/h}; \omega = 22.222/R_r \) (or R).

For the case \( Un = 60 \text{ km/h}; \omega = 16.666/R_r \) (or R).

4. Estimate the quality of approximation of measured data and its accuracy by parameters:

4.1. Standard deviation in percentages:

\[ \sigma = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} \left( 1 - \frac{z_i(t)}{z} \right)^2} \times 100\% \]

4.2. Coefficient of determination

\[ R^2 = 1 - \frac{\sum_{i=1}^{n} [z - z_i(t)]^2}{\sum_{i=1}^{n} [z - \overline{z}]^2} \]
Where:

\[
\sum_{i=1}^{n} \frac{1}{x_i} \leq \frac{1}{n} \left( 1 + \frac{1}{2} + \ldots + \frac{1}{n} \right) = \frac{1 + n}{2}
\]

Note 3: The above calculations for this variant of the deceleration method for tyre rolling resistance measurement can be executed by the computer program "Deceleration Calculator" downloadable from the WP.29 website\(^1\) as well as any software which allows the calculation of nonlinear regression.

Annex 7,

*Paragraph 3.1.4.*, amend to read:

"3.1.4. Load and pressure

3.1.4.1. For C1 tyres, the vehicle load …

..."