9 November 2015

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

* Former title of the Agreement: Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

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:

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. = C1 – SRTT 14	*Ref. = C2 – SRTT 16C*	*Ref. = C1 – SRTT 14*	*Ref. = C3N – SRTT 19.5* *Ref. = C3W – SRTT 22.5*
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"

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)[2]

3.2. Traction tyre (Yes/No)[2] "

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[2], spin traction method[2] or acceleration method. [2]"

Annex 2,

Appendix 2,

Example 1, correct to read:

" ↕ a/3 **0212345 S2 0236378**"

Example 3, correct to read:

"a/3 **0212345 S2 0236378**"

Example 4, correct to read:

"a/3 **0212345 S2 0236378**"

Appendix 3,

Example 1, correct to read:

"a/3 **0236378 + 02S1**"

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 ω 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,
ω_{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 dω/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:

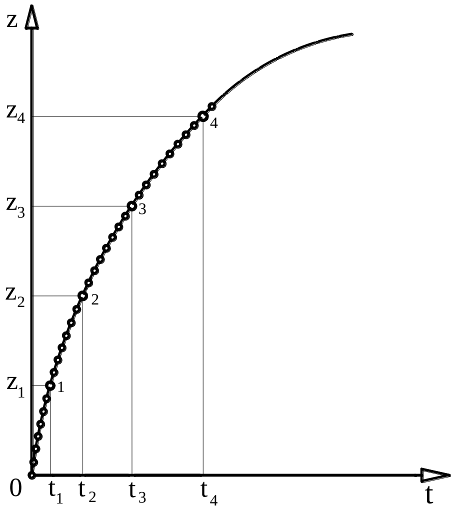
$$z = f(t_z)$$

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:

$$z_m = A \ln \frac{\cos B(T_\Sigma - t_m)}{\cos B T_\Sigma}$$

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:

$$z(t)=A\ln\frac{\cos B(T_\Sigma - t)}{\cos BT_\Sigma}$$

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 $z = f(t_z)$ 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:

ω is the angular speed in revolutions per second (s^{-1}).

For the case Un = 80 km/h; ω = 22.222/R_r (or R).

For the case Un = 60 km/h; ω = 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:

$$\sigma = \sqrt{\frac{1}{n-1}\sum_1^n \left[1-\frac{z(t)}{z}\right]^2} \times 100\%$$

4.2. Coefficient of determination

$$R^2=1-\frac{\sum_1^n [z-z(t)]^2}{\sum_1^n [z-\bar{z}]^2}$$

Where:

$$z=\frac{1}{n}\sum_{z=1}^{n}z=\frac{1}{n}(1+2+...+n)=\frac{1+n}{2}$$

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 …

…"

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[1] http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/deceleration_calculator.html.