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Working Party on Brakes and Running Gear (GRRF)
(Fifty-fourth session, 6-8 October 2003,
agenda item 6.2.)

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATIONS Nos. 30 and 54

(Pneumatic tyres and pneumatic tyres for commercial vehicles)

Transmitted by the expert from the Russian Federation

Note: The text reproduced below was prepared by the expert from the Russian Federation in order to propose concrete amendments to Regulations Nos. 30 and 54 complementing document TRANS/WP.29/GRRF/2003/10. It is based on the text of a document (informal document No. 22) distributed without a symbol at the fifty-third session (TRANS/WP.29/GRRF/52, para. 43).

Note: This document is distributed to the Experts on Brakes and Running Gear only.

A. BACKGROUND

In addition to the information contained in document TRANS/WP.29/GRRF/2003/10, transmitted by the Russian Federation about tyre rolling resistance coefficient, tables Nos. 1 and 2 comparing the standards of ISO, SAE and the Russian Federation with regard to bench measuring of rolling resistance coefficient are brought to the attention of the GRRF experts (see justification). The comparison indicates that, by this time, achieving of comparable results when different standards are used, in particular with respect to the base test at 80 km/h for car and truck tyres, has become possible. This is provided by test conditions and similar formulae of transforming to the same drum diameter and ambient temperature. It can be predicted that compatibility of the test results could be additionally increased, if tyre temperature could be measured by, for example, non-contact means of infrared emission registration. Besides that, the presented comparison indicates the possibility of a relatively fast rapprochement of positions with regard to matrixes of test parameters in such form as "load – pressure".

Consequently, the following additions to Regulations Nos. 30 and 54 are introduced:

* * *

B. PROPOSAL

B.1. Regulation No. 30:

Insert a new paragraph 4.1.16., to read:

"4.1.16. rolling resistance coefficient at a speed of 80 km/h and loaded at 80 per cent of maximal load determined in accordance with ISO 8767. The manufacturer may, if he so wishes, introduce additional data for the speeds of 50, 90, and 120 km/h determined in a similar way. If a different method of determination was used, its equivalence shall be proved."

B.2. Regulation No. 54:

Insert new paragraphs 4.1.14. to 4.1.14.3., to read:

"4.1.14. rolling resistance coefficient at load 85 per cent of maximal load determined in accordance with ISO 9948.

4.1.14.1. for tyres with load index of 122 and higher and speed categories from K to M at a speed of 80 km/h, and for tyres of speed categories from F to J at a speed of 60 km/h;

4.1.14.2. for tyres with load index 121 and lower at a speed of 80 km/h, and, if required, 120 km/h;

4.1.14.3. The manufacturer may, if he so wishes, introduce additional data for alternative combinations of load and tyre pressure as specified in the mentioned test method. If a different method of determination was used, its equivalence shall be proved."

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C. JUSTIFICATION

For further activity for the creation of the uniform regulatory document based on the experience of the parties on application of the above-mentioned standards, the Russian Federation would like to base this document on ISO standards 8767 and 9948 since they contain the most extended combination of alternative test methods. If GRRF experts could come to the decision of excluding from the list the power test method as less accurate, the Russian Federation would agree with such decision.

Regarding the other three test methods (force, torque, deceleration), it is considered appropriate to cite the preambles to standards SAE J1270 and J2452, which have been confirmed by practice of our tests:

"The main disadvantage of the **force** method is that the spindle force measured can contain a severe error caused by load misalignment and load-spindle force interaction ("crosstalk"). Elimination or compensation of these effects is necessary. A minor disadvantage is that the loaded radius of the tyre must be measured in order to convert spindle force to rolling resistance."

"The main disadvantage of the **torque** method is that parasitic losses contained in the measurement include rotational test wheel losses as well as tyre spindle losses. Hence, the parasitic losses are larger then those of the force method and can be of the same order of magnitude as the rolling resistance itself. In addition, speed-hunting oscillation in the drive motor can introduce errors."

The preamble to standard ISO 8767 can be added to the above-mentioned:

"In measuring tyre rolling resistance, it is necessary to measure small forces in the presence of a much larger force. It is, therefore, essential that equipment and instrumentation of appropriate accuracy be used."

Considering the above-mentioned, attention should be paid to reserves of improvement of the deceleration method. The major disadvantages of it, in the variant presented by ISO standards 8767 and 9948, is the necessity of determination of deceleration as a relation between a small decrease of speed and a small value of time $\Delta V / \Delta t$, which is a source of a significant portion of errors, and an unsatisfactory accuracy of measurement of the inertia moment of a drum.

For the improvement of the Russian standards for methods of measuring of rolling resistance, the goal was to develop the deceleration method, which could have provided for:

1. scanning of all rolling resistance coefficients within the speed range from 90 km/h or 120 km/h (maximum) to 0;

2. exclusion of necessity of measuring of speed indirectly;
3. possible measuring of rolling resistance on most drums, which are available for most domestic manufacturers, and which were not originally intended for such purpose;
4. convenient and accurate measuring of inertia moments of the drum, test bench electric motor, and a wheel with a test tyre

Such method and related equipment were developed, tested, and in 1999 were fixed by the Russian national standard of the automotive industry OST 37.001.522, presented in tables 1 and 2.

If GRRF approves such a way of further activities, the Russian Federation would envisage a consolidated document in the form of ISO 8767 and 9948 with exclusion of power method and modified deceleration method and agreed by all participants a uniform matrix "load – tyre pressure".

In conclusion, it should be noted that recently GRRF already paid attention to the subject of tyre rolling resistance. The Russian proposals with regard to the subject are the following:

1. it is well known that the tyre rolling resistance coefficient relates to the fuel consumption. The latter parameter is the major criterion of evaluation of performance of a vehicle and the entire automotive fleet with respect to ecological and economical evaluation of performance;
2. tyre rolling resistance isa new or unknown parameter for none of tyre manufacturers. It can be definitely said that every tyre and vehicle manufacturer always uses such a parameter in practice and has a clear opinion with regard to its evaluation (value of rolling resistance coefficient);
3. there is no problem in methodology of evaluation of tyre rolling resistance; the experience reflected by ISO and national standards indicates that there should be significant difficulties in development of agreed uniform method;
4. it is considered that limitation of the value of the tyre rolling resistance coefficient and even activities for such purpose will cause increase of attention from tyre manufacturers and consumers concerning tyre rolling resistance and a search for further improvement of such a criterion;
5. it is known that reserves for reduction of tyre rolling resistance coefficient exist. The rolling resistance coefficient may differ by 25-35% on tyres presented on the market.

The extended proposals of the Russian Federation may be presented to the GRRF for preliminary consideration not later than in April – May of this year, so it could be possible to conclude discussion at the next GRRF session.

Standard	Test method	Drum diameter [mm]	Test speed, km/h	Load, % of Max	Inflation pressure, kPa (base ±)	Warm-up		Temperature sensor removing [cm]
						speed, km/h	time, minute	
ISO-8767	Force, Torque, Power, Deceleration	1500-3000	80	80	- 30	80.	30	ISO-8767
			50, 90, 120	90 50	-30, +70 -30, +70			
SAE-J1269, SAE-J1270	Force, Torque, Power	1708 (most standard)	80	90 50	-50, +70 -30, +70	80	30	**SAE-J1269, SAE-J1270**
SAE J2452	Force	1219-1707	80	70	00	80	30	SAE J2452
			from 115 to 15	90 60 30	-40, +60 -40 +10			
OCT-4754 (Russian Federation)	Force	1592, 1707, 2000	80	80	+10 ÷ +40	80	60	OCT-4754 (Russian Federation)
OCT- 37.001.522 (Russian Federation)	Deceleration	1592, 1707, 2000	from max to zero	80	-30	80	to stable temp.	OCT- 37.001.522 (Russian Federation)

Table 1. Passenger car tyres – Methods of measuring rolling resistance.
Comparison of test conditions

Standard	Test method	Drum diameter [m]	Test speed, km/h	Load, % of Max	Inflation pressure, % of max	Warm-up		Temperature sensor removing [cm]
						speed, km/h	time, minute	
ISO-9948	Force, Torque, Power, Deceleration	1.700-3.000	80 60[1)]	85 100 75 50 25	100 100,95 70 120 70	80.	90 30 1/	ISO-9948
SAE-J1269, SAE-J1270	Force, Torque, Power	1708 (most standard)	80	100 75 50 25	100,95 70 120 70	80	90 30	**SAE-J1269, SAE-J1270**
OCT-5513 (Russian Federation)	Force	1.592, 1.707, 2.000	80 60[1)]	85	100	80 60[1)]	60	OCT-5513 (Russian Federation)
OCT- 37.001.522 (Russian Federation)	Deceleration	1.592, 1.707, 2.000	from max to zero	85	100	80 60[1)]	to stable temp.	OCT- 37.001.522 (Russian Federation)

Table 2. Truck and bus tyres – Methods of measuring rolling resistance.
Comparison of test conditions

1/ For tyres for speed category F to J