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agenda item 4.2.14.)

**PROPOSAL FOR DRAFT SUPPLEMENT 1 TO REGULATION No. 111
(Handling and stability of vehicles)**

Transmitted by the Working Party on Brakes and Running Gear (GRRF)

Note: The text reproduced below was adopted by GRRF at its fifty-fifth session, and is transmitted for consideration to WP.29 and to AC.1. It is based on the text of document TRANS/WP.29/GRRF/2003/14/Rev.1 as amended by TRANS/WP.29/GRRF/55, para. 20 and annex 4.

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Insert new paragraphs 2.7. and 2.7.1., to read:

"2.7. "Rollover threshold" means the instant when all the wheels of one side of a vehicle have lost contact with the supporting surface (tilt table platform).

2.7.1. The inclination angle of the tilt table surface is represented by the symbol " β ".

Paragraph 5.3.1.1., amend to read:

"a tilt table angle of $\beta_c = 23^\circ$ has been reached "

Annex 1,

Item 3.2., amend to read:

"3.2. tank; make, model, effective volume:"

Item 6.2., amend to read:

"6.2. mass of vehicle in running order: "

Insert a new item 8.1., to read:

"8.1. Centre of gravity height of the vehicle in running order: "

Insert a new item 11.5., to read:

"11.5. Stability enhancement engaged: yes/not/not applicable 2"

Annex 3,

Paragraph 7., amend to read:

"7 TEST PROCEDURE

7.1. This procedure consists
...
..... of stick-slip and hysteresis."

Insert new paragraphs 7.2. to 7.4., to read:

"7.2. Without prejudice to paragraph 5., if the vehicle fails to achieve the minimum tilt table angle specified in paragraph 5.3.1.1. when tested with a partially filled tank in the maximum mass condition then, subject to the agreement of the type approval authority and appropriate safety considerations being taken into account, the manufacturer or applicant may request that a further test be undertaken with alternative loading conditions as described in paragraphs 7.2.1. and 7.2.2. Where the vehicle

manufacturer or applicant chooses not to test in accordance with the alternative loading conditions in paragraphs 7.2.1. and 7.2.2., the first test result will constitute the final result.

- 7.2.1. The first alternative condition is the vehicle loaded to its maximum mass and with the tank fully or partially filled with a fluid for which the tank is designed to carry in normal use.
- 7.2.2. The second alternative condition is the vehicle loaded in excess of its normal maximum mass and with the tank fully filled with a substitute fluid.
- 7.2.3. If the tank vehicle manufacturer does not agree with overloading required for additional test, the vehicle is considered as not having passed the test.
- 7.3. In the case where the vehicle is tested in the fully filled condition, the recorded values of the test tilt table inclination angle β_f shall be corrected using the following formulae:

$$\tan \beta_p = \tan \beta_f \cdot \frac{A_T \cdot H_f}{A_f \cdot H_g} + \frac{T_T}{2H_g} \left(1 - \frac{A_T}{A_f} \right)$$

The value of β_p shall be higher than, or equal to, the minimum rollover threshold inclination angle required by this Regulation (β_c).

In the formulae:

A_T = vehicle mass in case of loading by normal fluid;

A_f = vehicle mass in case of loading by a substitute fluid.

$$A_f = A_T + V_i \cdot (\rho_f - \rho_T)$$

H_g, H_f = height of the vehicle centre of gravity in case of loading with normal fluid and a substitute fluid, respectively;

$$H_f = H_g - V_i \cdot (\rho_f - \rho_T) / C_{ST}$$

T_T = theoretical wheel track at the vehicle cross section at the centre-of-gravity point;

β_p = corrected tilt table inclination angle for the fluid which the vehicle is intended to carry;

β_f = the recorded tilt table inclination angle achieved using the substitute fluid;

V_t = effective tank volume;

$$C_{ST} = \frac{A_g}{H_g - H_l}$$

C_{ST} = vertical stiffness of suspension at the centre of gravity point;

A_g = mass of payload;

ρ_T = density of normal fluid;

ρ_f = density of the substitute fluid;

H_l = height of the centre of gravity of the vehicle in running order.

- 7.4. If, in the case of filling a tank with a substitute fluid, the total vehicle mass is less than the maximum permissible mass of a vehicle and the vehicle is intended to carry a fluid having a higher density than that of the test fluid, the recorded value of the rollover threshold inclination angle shall be corrected using the formula given in paragraph 7.2. of this annex. Alternatively, the manufacturer may arrange to provide facilities for the vehicle to be tested using the fluid which it is intended to carry, taking into account any incurred safety risks."

Annex 4,

Paragraph 7.2., amend to read:

- "7.2. In case of semi-trailers separated from tractors, kingpin effects are calculated by using the following formula:

Kingpin trace width:
$$T_K = \frac{\sum_{i=1}^n T_i}{n}$$

The kingpin roll stiffness, which is the roll stiffness of the tractor at the longitudinal position of the fifth wheel/kingpin, will be calculated by using a reference load dependent roll stiffness factor of 4 kN-m/rad:

$$C_{DRESK} = A_K \cdot 4 "$$
