

**DRAFT CORRIGENDUM TO SUPPLEMENT __ TO THE 04 SERIES
OF AMENDMENTS TO REGULATION No. 16 (Safety belts)**

A. PROPOSAL

Paragraph 7.6.2.2., amend to read:

"7.6.2.2. A suitable apparatus for the tests specified in paragraph 7.6.2.1. above is described in Annex 4 to this Regulation. The design of any such test apparatus shall ensure that the required acceleration is given before the webbing is withdrawn out of the retractor by more than 5 mm and that the withdrawal takes place at an average rate of increase of acceleration of at least **55 g/s ^{4/} and not more than 150 g/s ^{4/} in testing sensitivity for strap movement and of at least 25 g/s ^{4/} and not more than 150 g/s ^{4/} in testing sensitivity for vehicle deceleration . ^{4/}."**

B. JUSTIFICATION

The shown proposal is addressing an ambiguity of ECE-R16 section 7.6.2.2 which should be resolved. The section 7.6.2.2 of the European regulation ECE-R16 for the approval of safety-belts defines one aspect of the test conditions that shall be applied during acceleration tests. In those tests a retractor as part of a safety belt system is checked for conformity with the regulations in section 6. The two relevant test procedures are for testing sensitivity for strap movement and testing sensitivity for vehicle deceleration. In both an acceleration profile is applied on either the retractor with fixed strap or on the strap with a fixed retractor. The general conditions for the acceleration profile are regulated in respective section in question (7.6.2.2):

The section combines two aspects:

- An average acceleration onset between 25-150 g/s should be used to reach the test acceleration.
- The test acceleration must be reached before 5mm webbing extraction.

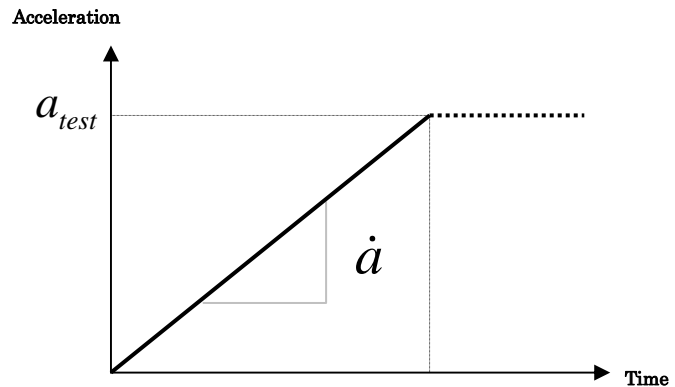
^{4/} g = 9.81 m/s²

However, the two requirements can not be seen independent from each other. An average onset rate (constant) leads to the following webbing extraction:

$$s(t) = \iint \dot{a}(t) dt = \iint c dt = \frac{1}{6} ct^3 = \frac{1}{6} \dot{a} t^3$$

$$a_{test} = \int \dot{a}(t) dt = \int c dt = ct = \dot{a} t$$

$$\Rightarrow s(a_{test}, \dot{a}) = \frac{1}{6} \frac{a_{test}^3}{\dot{a}^2}$$



By applying the lower threshold of 25g/s and a test acceleration of 2.0g, which is the upper limit of the available locking range for webbing sensitive locking (0.8 – 2.0g see section 6.2.5.3.1.2 and 6.2.5.3.2), the resulting webbing extraction leads to $s = 20,9\text{mm}$ and to a violation of the requested 5mm.

In order to fully comply with the requested maximum 5mm in testing the sensitivity for strap movement the minimum average onset rate yields

$$\dot{a} > 51\text{g/s}.$$

For further clarification Figure 1 shows the resulting strap extraction as a function of the test acceleration for different onset rates.

The recommendation is to clarify the section 7.6.2.2 by differentiation into requirements for tests on the sensitivity for strap movement (upper limit 2.0g) and for tests on sensitivity for vehicle deceleration (upper limit 0.45g):

For the tests on the sensitivity on vehicle deceleration a range of 25-150g/s is still reasonable and a violation of the 5mm rule is not possible.

For the tests on the sensitivity tests on strap movement an onset rate range of 55-150g/s is recommended to avoid conflicts.

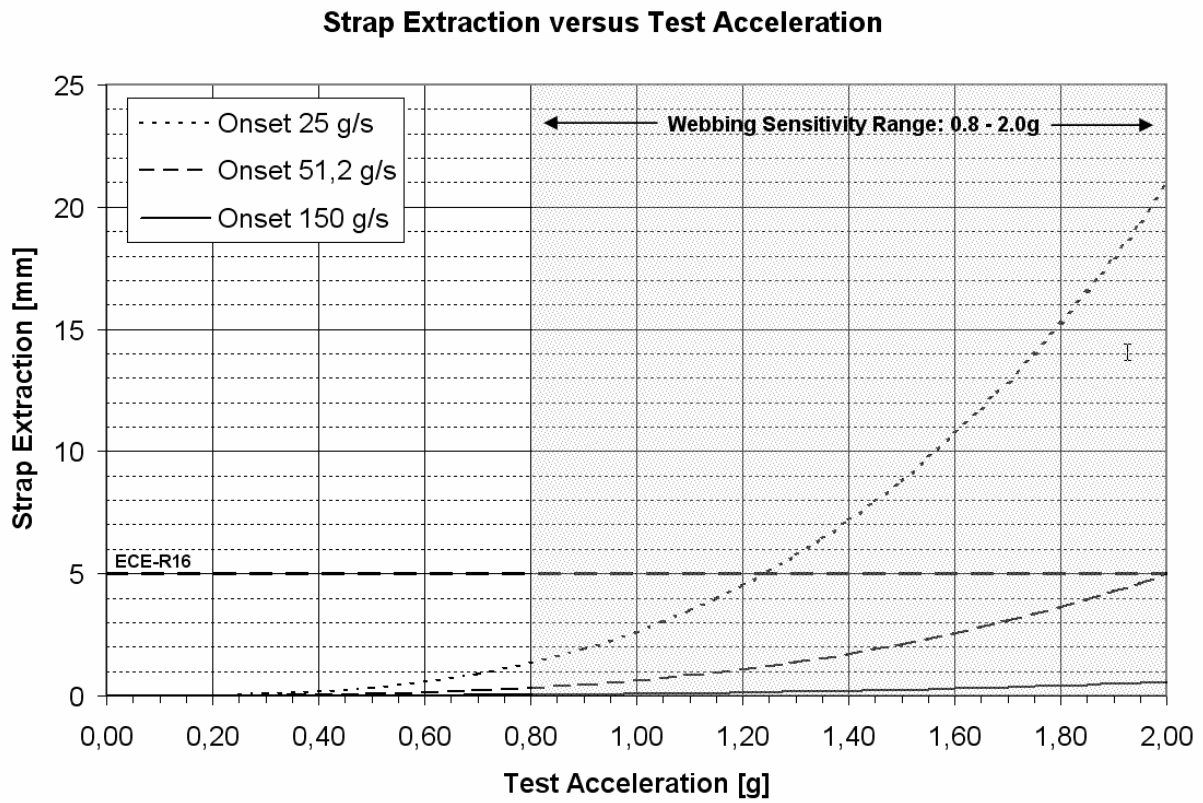


Figure 1: Strap extraction when test acceleration has been reached after acceleration onset phase.