46 The protection of the occupants in the event of a frontal collision

Refer to: R94 01-S4/C1

46.1 Effective Date and Scope:

46.1.1 As for the power-driven vehicles of category M1 of a total permissible mass not exceeding or equal to 2.5 tons, the new vehicle types from 2008/1/1 and all vehicle types from 2010/1/1, shall comply with this regulation.

46.1.2 The applicants applying for low volume safety approval or vehicle-by-vehicle mat be exempt from regulation of “the protection of the occupants in the event of a frontal collision” except child-only vehicle.

46.2 The protection of the occupants in the event of a frontal collision shall according to suitable types and range of principle are as below：

46.2.1 The same vehicle category symbol.

46.2.2 The same axle set type.

46.2.3 The same brand and vehicle type series.

46.3 State of vehicle:

46.3.1 For the test, the mass of the vehicle submitted shall be the unladen kerb mass; The fuel tank shall be filled with water to mass equal to 90 % of the mass of a full as specified by the manufacturer with a tolerance of +/- 1 %.

46.3.2 The mass of the measuring apparatus shall not change each axle reference load by more than 5%, each variation not exceeding 20 kg.

46.3.3 The doors shall be closed but not locked. The gear-change lever shall be in the neutral position.

46.3.4 Front seats adjustable longitudinally shall be placed so that their "H" point is in the middle position of travel or in the nearest locking position thereto, and at the height position defined by the manufacturer (if independently adjustable for height). Head restraints adjustable for height shall be in their uppermost position. If adjustable, the seat-backs shall be adjusted so that the resulting inclination of the torso of the dummy is as close as possible to that recommended by the manufacturer for normal use or, in the

absence of any particular recommendation by the manufacturer, to 25 degrees towards the rear from the vertical. The steering wheel, if adjustable, shall be placed in the normal position indicated by the manufacturer or, failing that, midway between the limits of its range(s) of adjustment. If adjustable, the rear seats shall be placed in the rearmost position.

46.3.5 A dummy corresponding to the specifications for Hybrid III (corresponding to the principal dimensions of a fiftieth percentile male), with safety belt complying with the specifications specified in the “Standards” and safety-belt anchorages complying with the specifications specified in this “Standards” shall be installed in each of the front outboard seats.

46.4 Test methods: The vehicle shall be propelled either by its own engine or by any other propelling device. Vehicle speed at the moment of impact shall be 56 -0/ +1 km/h and the front face of the barrier (consisting of block and aluminum honeycomb) is perpendicular to the direction of travel of the test vehicle. At the moment of impact the vehicle shall no longer be subject to the action of any additional steering or propelling device. The orientation of the barrier is such that the first contact of the vehicle with the barrier is on the steering-column side. The vehicle shall overlap the barrier face by 40 % +/- 20 mm.

46.5 Specifications:

46.5.1 The performance criteria recorded on the dummies in the front outboard seats shall meet the following conditions:

46.5.1.1 The head performance criterion (HPC) shall not exceed 1000 and the resultant head acceleration shall not exceed 80 g for more than 3 ms. The latter shall be calculated cumulatively, excluding rebound movement of the head; (Values of HPC for which the time interval (t1 - t2) is greater than 36 ms are ignored for the purposes of calculating the maximum value).

46.5.1.2 The neck injury criteria:

46.5.1.2.1 The neck injury criteria (NIC) shall not exceed the values shown in Fig. 1 and 2;

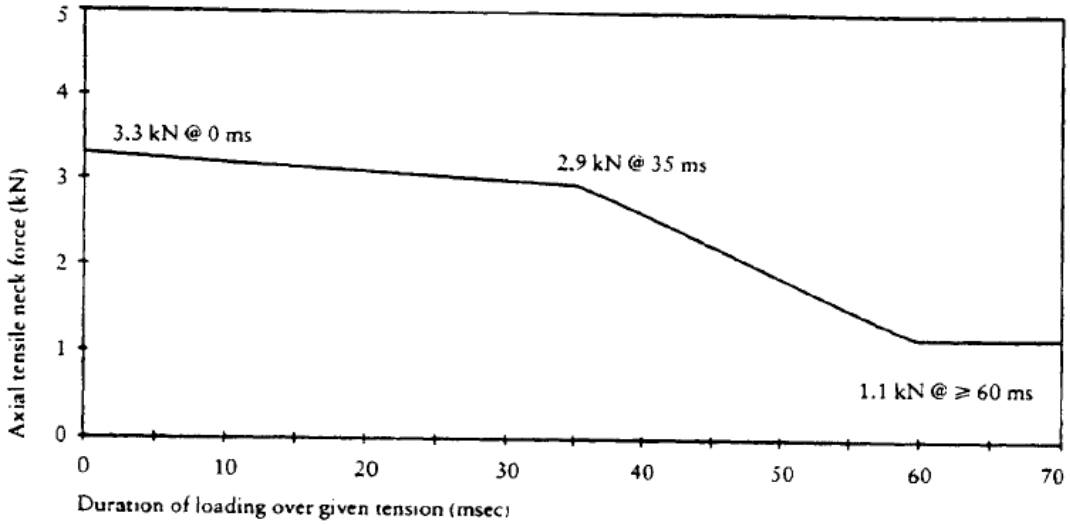


Fig 1. Neck Tension criterion

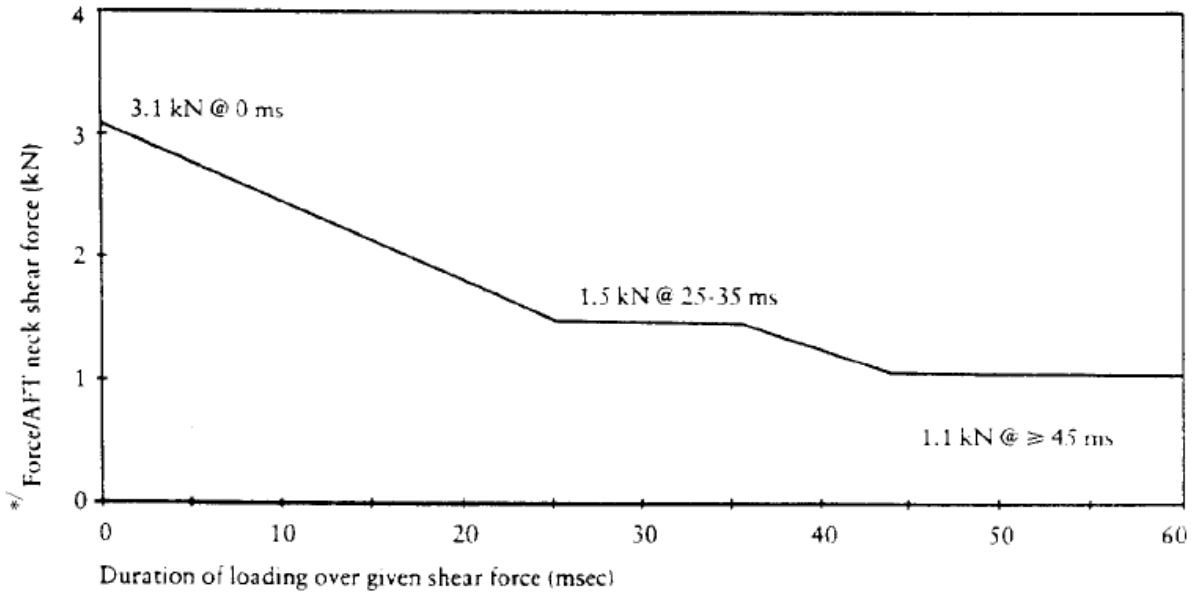


Fig 2. Neck Shear criterion

46.5.1.2.2 The neck bending moment about the y axis shall not exceed 57 Nm in extension.

46.5.1.3 The thorax injury criterion:

46.5.1.3.1 The thorax compression criterion (ThCC) shall not exceed 50 mm.

46.5.1.3.2 The viscous criterion (V*C) for thorax shall not exceed 1.0 m/s.

46.5.1.4 The femur force criterion (FFC) shall not exceed the force-time performance criterion shown in Fig. 3.

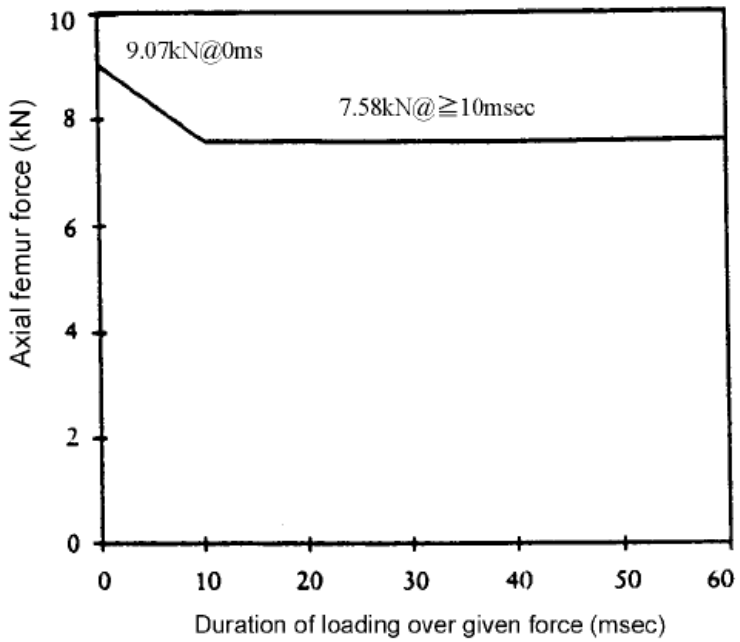


Fig 3. Femur force criterion

46.5.1.5 Tibia injury criterion:

46.5.1.5.1 The tibia compression force criterion (TCFC) shall not exceed 8 kN.

46.5.1.5.2 The tibia index (TI), measured at the top and bottom of each tibia, shall not exceed 1.3 at either location.

46.5.1.6 The movement of the sliding knee joints shall not exceed 15 mm.

46.5.2 During the test no door shall open.

46.5.3 During the test no locking of the locking systems of the front doors shall occur.

46.5.4 After the impact, it shall be possible:

46.5.4.1 Without the use of tools, except for those necessary to support the weight of the dumm:

46.5.4.1.1 To open at least one door, if there is one, per row of seats and, where there is no such door, to move the seats or tilt their backrests as necessary to allow the evacuation of all the occupants; this is, however, only applicable to vehicles having a roof of rigid construction;

46.5.4.1.2 To release the dummies from their restraint system which, if locked, shall be capable of being released by a maximum force of 60 N on the centre of the release control;

46.5.4.1.3 To remove the dummies from the vehicle without adjustment of the seats.

46.5.4.2 Residual steering wheel displacement, measured at the centre of the steering wheel hub, shall not exceed 80 mm in the upwards vertical direction and 100 mm in the rearward horizontal direction.

46.5.4.3 If there is continuous leakage of liquid from the fuel-feed installation after the collision, the rate of leakage shall not exceed 30 g/min; if the liquid from the fuel-feed system mixes with liquids from the other systems and the various liquids cannot easily be separated and identified, all the liquids collected shall be taken into account in evaluating the continuous leakage.