PROPOSAL FOR DRAFT AMENDMENTS TO DRAFT GTR ON HEAD RESTRAINTS

Transmitted by the expert from the Netherlands

Note: The text reproduced below was prepared by the expert from the Netherlands in order to create a new definition for a Front Contact Surface Head Restraint in the gtr since. The present requirements for height of 100 mm and width of 170 mm (resp. paragraphs 5.6.1. and 5.10. of Reg.17) are not properly taken on board in the gtr, which makes that parts of the head restraint may not contribute to the support of the head during a crash.

ENCOUNTERED PROBLEM

The present definitions of minimum required head restraint height and minimum height of the front of a head restraint seem to be insufficient because certain head restraint shapes are such that a part of the head restraint will not properly function in limiting the rearward displacement of the seated occupant's head. This is clearly demonstrated by the section indicated with crosses on the head restraint in the figure below.

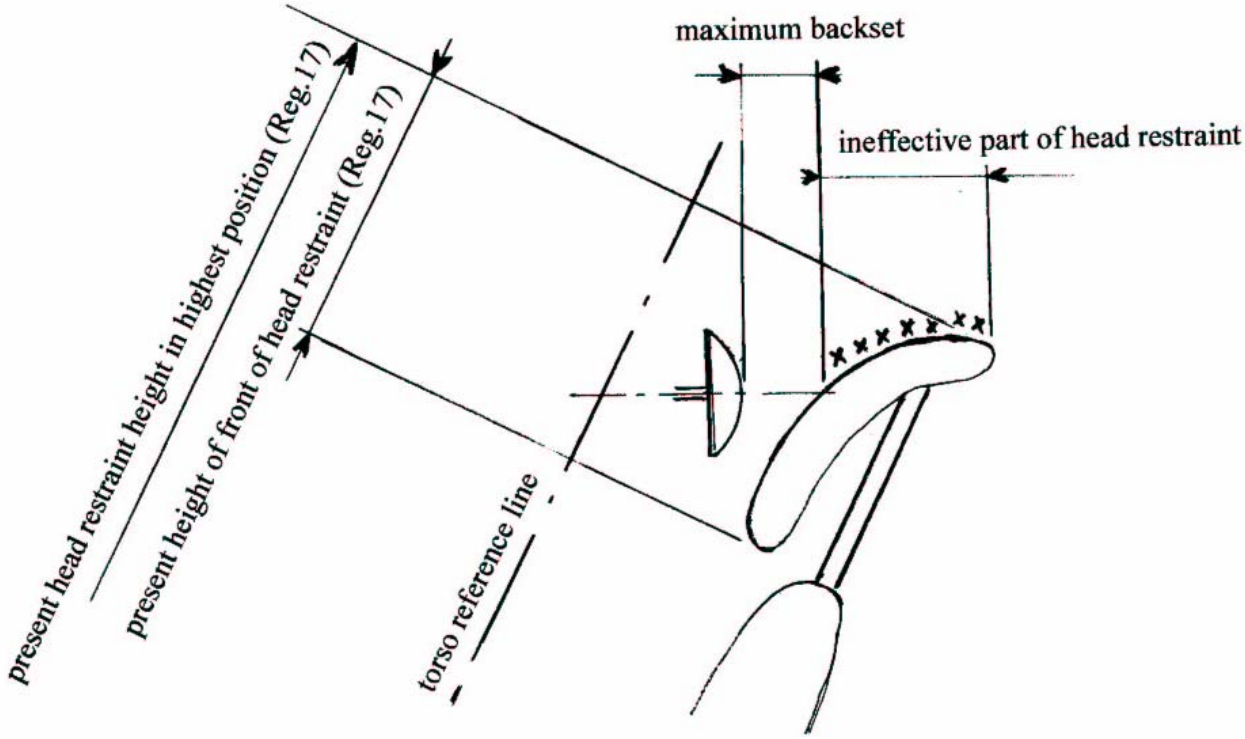

Figure – Demonstrating the ineffective part of head restraint

This problem can be solved by linking the established requirements:

- height of the front of a head restraint (100 mm),
- width of a head restraint (170 mm) and
- head restraint height relatively to the R-point,

and putting them in a new requirement called Front Contact Surface Head Restraint.

To fulfil this new requirement, head restraints shall be checked on the presence of a minimum Front Contact Surface Head Restraint (100 x 170 mm), which meets two conditions, namely: be close

enough behind the occupant's head according to maximum backset requirement ánd the top line of this Front Contact Surface (considered as the effective head restraint height, see figure 12-1) should meet the requirements for minimum height above the R-point.

This concept leads to the following proposal.

PROPOSAL

in Definitions of the GTR:

3.16. Front Contact Surface Head Restraint means the surface intended to support the seated occupant's head to limit rearward displacement.

in Performance requirements of the GTR:

5.1.6. Minimum area and location of Front Contact Surface Head Restraint. When measured in accordance with Annex 12:

5.1.6.1 a Front Contact Surface Head Restraint shall have at least a minimum area with borders that coincide with the intersections of the following planes with the head restraint:

- two vertical longitudinal planes set at 85 mm on either side of the vertical median plane of the seat,
- two planes perpendicular to the torso line, 100 mm apart, of which the upper plane is located at the highest effective head restraint height. The highest effective head restraint height shall not be less than the minimum required head restraint height that counts for the concerned designated seating position.

5.1.6.2. a Front Contact Surface Head Restraint [of front outdoor seating positions] shall fulfil the backset requirements.

Annex 1, Annex 2 and Annex 3 will be replaced by one single Annex hereafter called Annex 12:

Annex 12
Test Procedure for Verifying the Front Contact Surface Head Restraint

1. Purpose. The procedure described in this Annex is used to verify whether the Front Contact Surface Head Restraint encloses the minimum area and is located as required in paragraph 5.1.6.

2. Tools and use. For the measurements a CMM (Coordinate Measuring Machine) in combination with a HRMD-probe is used. The probe is fixed in a portal construction such that it can be shifted horizontally (X-direction) and can be displaced laterally and vertically (respectively Y-direction and Z-direction).
   During determination of the X-coordinate of the head restraint surface a 10N force is applied to the probe to ensure that any trim covering material is in contact with the underlying foams, or that the separation of trim material will not provide artificially favourable measurements.
   For the measurements of backset the CMM shall touch the easy accessible rear side (the flat edge) of the probe. The difference between this X-coordinate of the flat edge and its known initial X-coordinate (see Appendix 1 of this Annex) gives the backset measure.

3. Procedure. The seat shall be adjusted such that its H-point coincides with the R-point and the seat back is set at the design seat back angle (if it is adjustable), taking account of the requirements of paragraph 4 of this Annex.
   The head restraint shall be adjusted to the highest position of use. The head restraint shall, if adjustable laterally, be adjusted to the most rearward position.

3.1. The initial position of the HRMD-probe can be calculated taking into account Annex 12 , Appendix 1.

3.2. The vertical median plane of the seat shall be located and/or drawn on the head restraint; this will be considered as the centre line of the head restraint.

3.3. Two vertical longitudinal planes set at 85 mm on either side of the centre line of the head restraint shall be used to locate and/or draw the vertical borders of the minimum area of the Front Contact Surface Head Restraint.

3.4. Establish on the centre line of the head restraint the highest point that fulfils the backset criterion, taking account of Annex 12, Appendix 1.

3.5. A plane through this established point, perpendicular to the torso reference line, shall be used to locate and/or draw a line between the vertical borders.

3.6. Check whether all points, constituting the line determined in paragraph 3.5., fulfil the backset criterion.
If not, start again with paragraph 3.4. by establishing a new point on the centre line at a lower height.
If the backset criterion is fulfilled on this line the so determined line is the upper border of the Front Contact Surface Head Restraint and is considered as the highest effective head restraint height. This height has to fulfil the minimum head restraint height above the R-point that counts for the concerned designated seating position.

3.7. A plane, below and parallel to the plane used to locate the upper border, on a distance of 100 mm (see figure 12-1), shall be used to locate and/or draw the lower border of the Front Contact Surface Head Restraint.

3.8. Determine whether all points, constituting the vertical borders and the lower border of the Front Contact Head Restraint Surface fulfil the backset criterion.

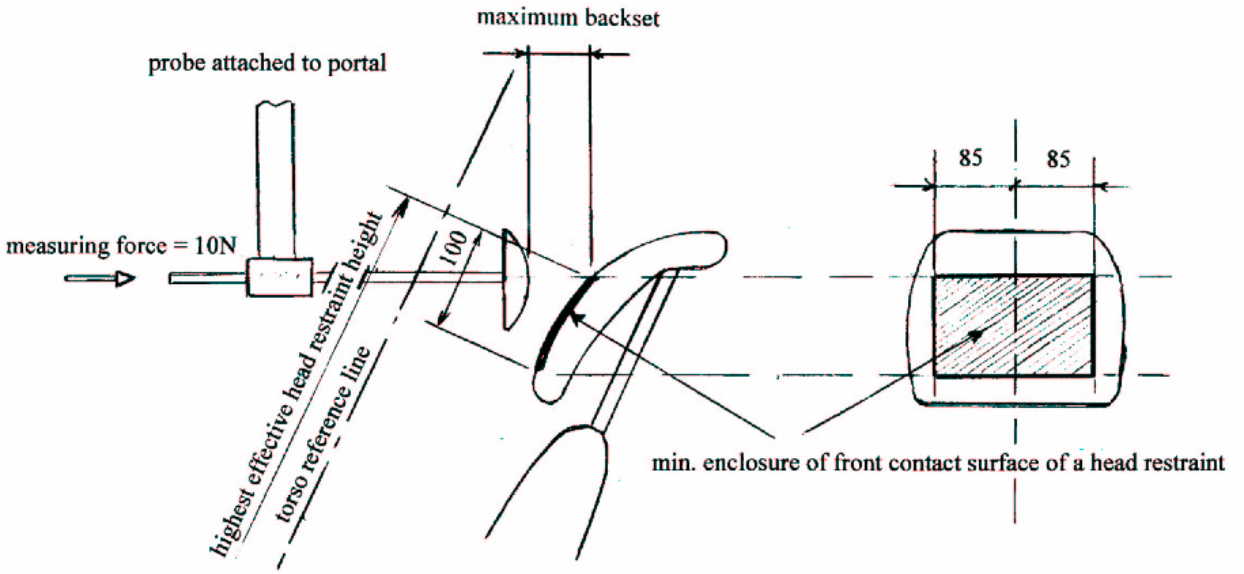

Figure 12-1: Check on compliance of Front Contact Surface Head Restraint to minimum enclosure and location

4. Relationship between the H-point and the R-point .

4.1. When the seat is positioned in accordance to the manufacturer's specifications, the H-point, as defined by its co-ordinates, shall lie within a square of 50 mm side length with horizontal and vertical sides whose diagonals intersect at the R-point, and the actual torso angle shall be within 5 degree of the design torso angle.

4.2 If these conditions are met, the R-point and the design torso angle, shall be used to demonstrate compliance with the provisions of this Annex.

4.3. If the H-point or the actual torso angle does not satisfy the requirements of paragraph 4.1., the H-point and the actual torso angle shall be determined twice more (three times in all). If the results of two of these three operations satisfy the requirements, the conditions of paragraph 4.2. shall apply.

4.4. If the results of at least two of the three operations described in paragraph 4.1. do not satisfy the requirements of paragraph 4., or if the verification cannot take place because the vehicle manufacturer has failed to supply information regarding the position of the R-point or regarding the design torso angle, the centroid of the three measured points or the average of the three measured angles shall be used and be regarded as applicable in all cases where the R-point or the design torso angle is referred to in this Annex.

Annex 12 – Appendix 1

RELATIONSHIP BETWEEN PORTAL APPARATUS EQUIPPED WITH HRMD-PROBE AND 3-D H MACHINE EQUIPPED WITH HRMD-PROBE,

The HRMD-probe is the simulation of the back of the occupant's head.
The original position of this probe is derived from the UMTRI mid-sized male (report nr. UMTRI-83-53-1, Dec.'83), and can be reached by means of a 3-D H machine that is suited to receive the HRMD (see figure 12-2).

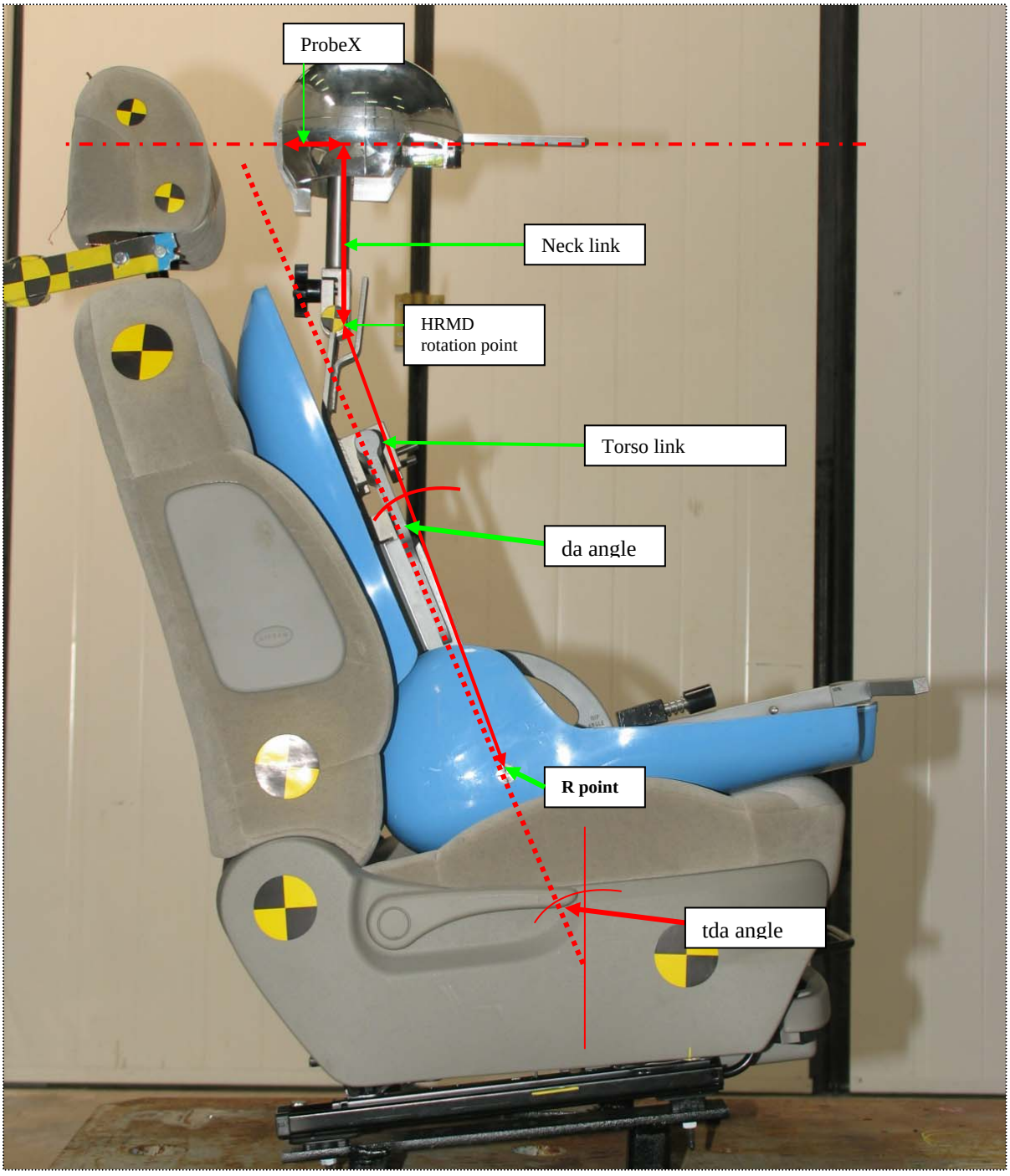

Figure 12-2 Dimensions needed from an HRMD and SAE to calculate the position of the rear flat part of HRMD

Because of restrictions bound to the use of the 3-D H machine, this procedure can cause difficulties.
The portal apparatus equipped with the HRMD-probe (see figure 12-3, shown with HRMD-probe shifted against the head restraint) in combination with a Coordinate Measuring Machine (CMM) excludes the above mentioned difficulties.

Figure 12-3

The spherical side of the HRMD-probe in its initial position simulates the back of the head of the UMTRI mid-size male sitting in an automotive posture. This position is dependent upon the design angle of the seat and will be calculated (see below).
The difference between the HRMD-probe in its initial position and the position with the HRMD-probe shifted against the head restraint (measured) will give the backset.
[For ease of accessibility the rear side of the HRMD-probe (the flat edge) will be touched with the CMM in both positions. The difference between these two X-coordinates is the backset.]

<u>Calculation of the X-coordinate of the flat edge of the HRMD-probe in its initial position:</u>
Constant values:
Torso Link = 505.5 mm, is the connecting link between R-point and HRMD-point
Neck Link = 205 mm, is the vertical link between HRMD-point and centre of head
da angle = 1.9 degrees, is the angle between Torso Link and design torso line
Probe X = 60.5 mm, is the horizontal distance between Neck Link and the flat edge of the proposed HRMD-probe
Values depending of manufacturer's specifications:
R-point = accepted from manufacturer taking account of paragraph 4 of Annex 12, and the X-coordinate of the R-point is taken as zero.
tda angle = design torso angle accepted from manufacturer taking account of paragraph 4 of Annex12

Formula:

$$X\ coordinate\ \ flat\ \ edge = 505.5 * \left| SIN\ (torso\ design\ angle - 1.9) \right| + 60.5$$